



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

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SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND 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 Double Girder overhead EOT Crane of following capacities to be provided for 400kV, 220kV & 132kV Gas Insulated Substation Building of 400/ 220/ 132 kV GIS SUBSTATION AT RASRA, BALLIA

Sl. no.	Area	Type	Selected Capacity (tons)	Qty (Set)
1	400 KV GIS Building	Double Girder EOT	10 T	1
2	220 KV GIS Building	Double Girder EOT	6 T	1
3	132 KV GIS Building	Double Girder EOT	6 T	1

- Detailed design of all the equipment and equipment system(s).
- Complete manufacturing including shop testing.
- Providing engineering data, drawings, and O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.
- Packing and transportation from the manufacturer's works to the site including customs clearance/port clearance, if required.
- Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
- 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. Customer specification in annexure to section – 2 shall also be followed in conjunction to all the sections of this specification.
- 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.

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- 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.*
- 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’ appearing in this specification shall refer to UP POWER TRANSMISSION CORPORATION LTD. (UPPTCL), the term ‘Purchaser’ shall refer to BHEL and the term ‘Contractor’ shall refer to the successful Bidder.**

2.0 Scope

Double Girder EOT is envisaged for GIS (Gas Insulated Substation) Buildings of 400kV, 220kV & 132kV.

Double girder Electrically Operated Travelling Crane or EOT Crane with Variable Voltage Variable Frequency i.e. VVVF Drive in all three controls of Hoisting, CT & LT suitable for erection of various equipment in GIS Hall Buildings and tools & tackles shall be provided.

Crane shall be designed on the following main technical parameters:

S.N.	Description	Technical Particulars		
	Areas	400kV GIS Hall	220kV GIS Hall	132kV GIS Hall
1.	GENERAL	Double Girder EOT Crane	Double Girder EOT Crane	Double Girder EOT Crane
3.	Capacity (SWC)	10 T	6 T	6 T
4.	Span	14.5 m	12 m	11 m
5.1	Lift	9.0 m	7.5 m	6.5 m
5.2	Bay Length*	47 m	48 m	33 m
6.	Crane structure	Double Girder		
7.	PAINTING	As per Annexure-I of this spec.		
8.	Control for Hoisting, CT and LT operations	Thru' VVVF drives		



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9.	Speed Control	Thru' VVVF drive
10.	Design Temperature	50 degC

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

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.

2.1 SCOPE OF SUPPLY AND SERVICES

The requirements mentioned in this clause are indicative only and the exact requirements shall be worked out during detailed engineering after award of contract. 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.

A. SUPPLIES

Equipment and services to be furnished by the bidder for the Double 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, unloading.
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



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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 -165 and ASTM 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



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- 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.
- 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:

- a) All the tests as mentioned above, with actual hook and wire rope
- b) Speed test at rated load for hoisting / CT and LT mechanism
- c) Brake test and working of both electric hoist
- d) 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.

2.2 Drawing / design document for submission.

A. For Approval

- a) G.A. drawing showing clearances, assembly, cross section details, materials of construction, lifts and hook approach.
- b) Hoist assembly.



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- c) DSL fixing arrangement and supports
- d) Motors HP/KW calculations, brake selection calculation, cable sizing calculations, voltages drop calculation etc.
- e) Gantry Rail fixing Arrangement with accessories. (If applicable)
- f) Write up on the crane control.
- g) Wire rope selection, gearbox selection, rope drum selection and wheel size selection calculation
- h) Electrical wiring diagram and control scheme
- i) Quality Plan.
- j) Test certificates and reports on various shop tests.
- k) Field quality plans.
- l) O.M. Manuals
- m) Technical data sheet of all equipment / components

B. For Reference

- a) Hook block assy. And gear box drawings.
- b) Rope drum assy. drg.
- c) Cross conductor on bridge.
- d) Crane lubrication arrangement
- e) LT & CT wheel Assembly drawing
- f) Manufacturers catalog
- g) Motor characteristics curves.
- h) Structural Calculation
- i) Detailed erection drawing (as erection shall be carried by customer himself complete erection procedure, literature and necessary erection drawing shall be provided).

3.0.0 Design Features & requirements

CODES AND STANDARDS.

- IS: 807: Code of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of Cranes and Hoists.
- IS: 3177 - Code of Practice for Design of Overhead Traveling Cranes and Gantry Cranes other than Steel Works Cranes.
- IS: 2266 - Steel Wire Ropes for General Engineering Purposes.
- IS: 3443 - Crane Rail Sections.
- IS: 5749 - Forged Ramshorn Hooks.
- IS: 816 - Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
- IS: 1323 - Code of Practice for Oxy-Acetylene Welding for Structural Work in Mild Steel.
- IS: 9595 - Recommendations for metal arc welding of carbon & carbon - Manganese steel.
- IS: 15560 - Point Hook with Shank up to 160 tones - Specification

3.1.0 DESIGN REQUIREMENT

- 3.2.0 EOT cranes classification conforming to M5 for Mechanical and Electrical as per IS: 3177– (latest edition) will be designed (structural design as per IS 807 - 2006), manufactured, inspected, shop



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tested, erected, site tested and commissioned to well established engineering practices, safety codes and other relevant codes and standards.

3.3.0 Ambient Temperature

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

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

3.5.0 DNV/Lloyd/EIL/BHEL or other Customer approved qualified welders will carry out welding.

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

4.0.0 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. Hooks shall be as per IS 15560.

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 ***Two individual bridge girders in the plate welded box type construction will be fabricated from tested steel plates.***

4.5.0 ***Jacking Pads will be provided on the structural frames of trolley end carriage, for removal of wheels.***

4.6.0 ***PVC shrouded conductor (Cu) bus bar type DSL will be with suitable guards and service cage for maintenance of DSL will be provided.***

4.7.0 ***Wheelbase for end carriage will be as per IS: 807 (latest edition).***

4.8.0 Minimum thickness of Metal

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

4.9.0 Suitable brake shall be provided for each motion. The capacity of hoisting motion brake shall be 150% of torque transmitted to the brake drum with full load and that of cross travel and long travel to be 125% of motor rated torque before de-rating. Electromagnetic brakes will be provided as per the details given in data sheet for each motion.

4.10.0 All drive motors will be of crane duty conforming to IS: 325 and IS: 3177. The motor shall be suitable for 300 starts / hr. and 40% CDF. 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

4.11.0 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.



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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.

The receiver unit along with I/O interface unit should be able to bear the vibrations and shocks encountered in normal usage of EOT crane. The system should have very fast response time.

4.12.0 No cast iron parts will be used on the crane except for electrical motors and gearbox castings. Similarly, no wood or other combustible material will be used in any part of the crane

4.13.0 *Maintenance platform throughout the span of the crane, along with bridge girders shall be provided. Maintenance platform with hand railing shall be provided for easy, simple and safe maintenance of the Crane extended partially or totally along the girder.*

4.14.0 *Crane shall be complete with trolley, tracks, wheels, axles, drive mechanism, hoisting drum brakes, horns, warning lights limit switches etc.*

4.15.0 *Bridge and trolley frame will be fabricated from steel plates/members. Mounting will be designed to facilitate easy removal of the wheels, bearings and journals.*

5.0.0 **DEFLECTION AND CAMBER:** *The total maximum vertical deflection for the girders for the safe weight of working load plus the weight of crab in central position (without taking in to consideration the impact factor) will not exceed limit of Span/1000. The girders shall be cambered to an amount approximately equal to the dead load deflection plus one-half the live load deflection.*

5.1.0 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.

5.2.0 The cranes shall be designed to operate at 100% of rated load. The overload testing of the crane shall be at 125% of rated load.



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5.3.0 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.

6.0.0 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.

Functional Guarantee (at site)

- ☐ Load test as per IS 3177(Latest edition)
- ☐ Overload test as per IS 3177(Latest edition)
- ☐ Limiting deflection check of bridge girder as per IS 3177 (latest edition)

6.1.0 Technical Data Sheet of Double Girder cranes shall be as follows and bidder should meet all the parameters mentioned below:

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.	
1.1.0		Number of cranes and capacity	As per requirement in clause 1.0.0	
1.2.0		Crane classification	M5 for Mechanical, Structural & 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	*(vendor data)	
	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	As per requirement given in table under clause 2.0	
1.6.0		Operation from	Electrical-from floor by means of pendent push button station/controller suspended from junction box 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	1.0	20% of main speed (thru' VVVF AC drives)



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	b.	Trolley travel (CT)	12	10% of main speed (thru' VVVF AC drives)
	c.	Longitudinal bridge travel (LT)	25	10% of main speed (thru' VVVF AC drives)
2.2.0		Acceleration values	LT motion (bridge travel)	CT motion (trolley travel)
			As per IS: 3177	As per IS: 3177
2.3.0		Lift in Metres	As per requirement given in table under clause 2.0	
	a.	Main Hoist	As per requirement given in table under clause 2.0	
2.4.0		Hook Approaches		
	a.	Main hook (DSL end)	To suit the layout requirement.	
	b.	Main hook (Other end)		
2.5.0		Hand rail pipes	32 mm NB Medium class of IS: 1239 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1750 mm with provision of kick plate (100 mm high and 6mm thick)	
3.0.0		COMPONENT DETAILS		
3.1.0		Trolley		
	a.	Type	Fabricated/ Fusion welded	
	b.	Material	MS. IS: 2062 Gr. A or B	
3.2.0		Rope drums		
	a.	Material	Rolled steel, welded construction / Seamless pipe as per ASTM A106 / 53 GR A / B	
	b.	Flange / flangeless	Flanged/Flange less	
	c.	Numbers provided	One	
	d.	Type of grooves	Machined grooved identical Right hand and Left hand	
3.3.0		Rope details		
	a.	Construction	Extra flexible plough steel, 6 x 36 construction	
	b.	Standard conforming to	IS: 2266	
	d.	Factor of safety	6.06	
	e.	Type of core	Steel/Fibre core	
3.4.0		Sheaves details		
	a.	Material	Fe 410 WA IS: 2062 Gr. A or B / CS Gr. 280-520 IS: 1030 Design as per IS: 3177- 1999	
	b.	Diameter of Equivalent sheaves in mm on Root	Should not be less than 62% of calculated main sheave diameter.	
	c.	Type of guards provided	Fabricated from rolled steel plate	



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3.5.0		Coupling & Shafting			
3.5.1	A.	<i>Coupling details (between motor and gear box)</i>	<i>Main Hoist</i>	<i>Cross Travel</i>	<i>Long Travel</i>
	a.	<i>Type</i>	<i>Flexible shock absorbing coupling excepting pin bush type</i>		
	b.	<i>Guards and Enclosures</i>	<i>Provided</i>		
	B.	<i>Coupling details (gear box and wheels)</i>	<i>Cross Travel</i>	<i>Long Travel</i>	
	a.	<i>Type</i>	<i>Flexible geared type</i>		
	b.	<i>Guards and Enclosures</i>	<i>Provided</i>		
	C.	<i>Coupling details (gear box and rope drum)</i>	<i>Main Hoist</i>		
	a.	<i>Type</i>	<i>One of the following arrangements will be adopted for connecting the rope drum with the gear- box.</i> <i>1. Flexible joint, incorporating flexible geared coupling housed within the drum.</i> <i>2. Fully flexible geared coupling between the drum & gearbox.</i>		
	b.	<i>Guards and Enclosures</i>	<i>Provided</i>		
3.5.2	A.	<i>Shafting (Output)</i>			
	a.	<i>Factor of Safety</i>	<i>As per IS : 3177 (latest edition)</i>		
	b.	<i>Arrangement of Lubrication</i>	<i>Grease cups/ Nipples</i>		
	c.	<i>Type of Lubricant</i>	<i>Grease</i>		
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/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177 (latest edition) Gears to be hardened, tempered & heat treated as per IS 4460		
	g.	Casings	Fabricated Fe 410w IS: 2062 Gr A/B & stress relieved		



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	h.	Type of Bearing	Antifriction Ball/ roller	
3.6.2		Travel Motions	CT	LT
	a.	Type of mounting gear box	Horizontal / Vertical	
	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/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177 (latest edition)	
	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 rolled / cast steel	
	c.	Type	Double flanged	
	d.	Numbers provided	As per manufacturer's standard.	
	e.	Hardness	300-350BHN	
	f.	Arrangement of lubrication	Grease	
	g.	Specification conforming to	IS: 3177 (latest edition)	
	h.	Bearing type	Anti-friction deep groove ball bearing	
3.8.0		Lifting hooks	Main Hoist (MH)	
	a.	Type	Ramshorn, shank with safety latch swivelling type as per latest edition of IS: 5749	
	b.	Safe lifting capacity	*	
	c.	Material	Class II of 1875 :1992 (re affirmed 2004) for hooks conforming to IS : 5749 For loads up to and including 50 t, Shank type plain hooks shall be provided, For loads of 50 t and over, hooks of Rams horn type shall be provided.	
	d.	Standard conforming to	IS: 15560	
	e.	Hook can swivel	Yes	
	f.	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 the rated speed.	
	b.	Numbers provided	4	4



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3.10.0		Brakes					
3.10.1		Hoist Motions					
	a	Type of brake (AC / DC / thruster)	AC Electro-Hydraulic Thruster operated + DC electro magnetic				
	b.	Number provided per motor	1+1 (per motor)				
	c.	Braking capacity (% of full load torque)	150%				
3.10.2		Travel Motions	CT		LT		
	a.	Type of brake (AC/ DC/ thrustor)	AC Electro-Hydraulic Thruster operated + DCEM brake				
	b.	Number provided per motor	1+1 (per motor)		1+1 (per motor)		
	c.	Braking capacity (% of full load torque)	125%		125%		
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 / 1000 (maximum)				
	c.	Type of connection to end carriage	By fitted bolts				
		Rails-Bridge girder					
		Type / section	Rails sections as per IS: 3443. Joints shall be end clamped.				
		Standard conforming to	IS: 3443				
		Material	50C12 or 55C11				
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 + 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	40 % 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	One		
	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	40 % CDF / S-4		
	h.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited class B.		
	i.	Number of starts/ hour	150 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	
	b.	Number provided	1+1	1	1
	c.	Material of contacts	Double break Silver Cadmium		



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	d.	Control voltage / Enclosure	110V / IP-55	
	e.	Emergency switch	4 corner switch to be provided at all four corners to act as emergency switch	
3.16.0		Power conductors (DSL)		
	a.	Type	LT: PVC shrouded conductor (Cu) bus bar. CT : Flexible trailing cable mounting on retracting support (Festoon type) EPR insulated type	
	b.	Size	Shall be sized with a margin of 20% over load requirement. Voltage drop at motor terminal shall be limited to 3% at extreme positions of cranes. Protective cover over DSL shall be provided.	
	c.	Length	Suitable for entire bay length.	
3.17.0		Control Panel		
	a.	Material & size	Fabricated from sheet steel, minimum 2 mm thick.	
	b.	Degree of protection	IP 54	
	c.	Numbers and location	One each for MH, CT and LT located on bridge platform	
	d.	Illumination	Internal illumination with florescent lamp	
3.18.0		Control for Hoisting operations		
	a.	Speed control	Thru' VVVF with 6 pulse design	
	b.	Starting torque of VVVF	Up to 400% without encoder.	
	c.	Starting current	Less than 150 % of rated torque.	
	d.	Temperature	VVVF system shall be capable of withstanding up to 50 ° C without de rating.	
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	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		Transformer		
	a.	Quantity	2 x 100 % for control	



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	b.	Voltage Rating	Control 415/240V
3.23.0		Contactors	AC 4 duty for reversing application. AC 3 duty for non-reversing application
3.24.0		Switches	AC 23 for motor application, AC 22 for other application.
3.25.0		Illumination	
	a.	Over Bridge	2 nos. 60 W Bulk-head fittings with incandescent lambs and 4 nos. 24V – 5A – 3 pin industrial socket
	b.	Under bridge	2 nos. 250 W HPSV lamps
	c.	For inspection of crane components	One (1) portable 40W hand lamp with min. half span length flexible cable for inspection of crane components
	d.	Hand lamp socket and hand tool sockets	Hand lamp socket outlets (2 pin, 10A, 24V) and power socket outlets (3 pin, 20A, 240V) shall be provided for use of hand tools along with switches.
3.26.0	a.	Type of platform required on the bridge.	Chequered plate platform 6 mm thick as per IS :3502
	b.	Length	Full span length at both sides
3.27.0	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.
	c.	Main Isolating switch	Main isolating switch at Middle of the bay length (1.5M above operating floor)
3.28.0		Painting & Color Coding	As per <i>Annexure I</i> below
3.29.0		Fire Extinguisher	
	a.	Type and size	4.5 kg , CO2 type
	b.	Numbers & Location	One no. on bridge
3.30.0		Runway Rail	Minimum 50mm Square Bar or of suitable size and material (whichever is higher) as per relevant IS

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

6.2.0 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-A. Vendor shall



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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.

6.3.0 Functional Guarantee (at site):-

- A. Load test as per IS 3177(Latest edition)
- B. Overload test as per IS 3177(Latest edition)
- C. Limiting deflection check of bridge girder as per IS 3177 (latest edition)
- D. The successful bidder shall furnish their recommended procedure for carrying out the Erection and Commissioning, to be done by the customer.

6.4.0 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

6.5.0 Various Heads to be quoted

Sl. No.	Item Description	Unit	Quantity	Total Ex-works	Total ETC
1.	10 Ton Double Girder EOT Crane for 400 kV GIS Building as per technical specification	Set	01		
2.	6 Ton Double Girder EOT Crane for 220 kV GIS Building as per technical specification	Set	01		
3.	6 Ton Double Girder EOT Crane for 132 kV GIS Building as per technical specification	Set	01		

6.6.0 Drawing / design document for submission

A. For Approval

- a) G.A. drawing showing clearances, assembly, cross section details, materials of construction, lifts and hook approach.
- b) Hoist assembly.
- c) DSL fixing arrangement and supports
- d) Motors HP/KW calculations, brake selection calculation, cable sizing calculations, voltages drop calculation
- e) Gantry Rail fixing Arrangement with accessories. (If applicable)
- f) Write up on the crane control.



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- g) Wire rope selection, gearbox selection, rope drum selection and wheel size selection calculation
- h) Electrical wiring diagram and control scheme
- i) Quality Plan.
- j) Test certificates and reports on various shop tests.
- k) Field quality plans.
- l) O.M. Manuals
- m) Technical data sheet of all equipment / components
- n) Write-up and detailed schematic for centralized lubrication system

B. For Reference

- a) Hook block assy. & gear box drawings.
- b) Cross conductor on bridge.
- c) Crane lubrication arrangement
- d) LT & CT wheel Assembly drawing
- e) Manufacturers catalogue
- f) Motor characteristics curves.
- g) Structural Calculation



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Annexure I PAINTING SPECIFICATION

A) Structural

Surface preparation: Blasting according to SIS 055900 grade Sa 2^{1/2}

Primer : Two (2) layers of primer paint shall be Zinc Silicate, Total dry film thickness 120 µm (60 µm per coat).
Intermediate : Two intermediate MIO epoxy paint, DFT per coat 90 µm (Total 180 µm)
Finish Coat : One finishing coat of polyurethane coating DFT 30 µm.
Total DFT : 330µm

B) Mechanical Components & Motors

Surface preparation : Blasting according to SIS 055900 grade Sa 2^{1/2}

Primer : Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75 µm.
Finish Coat : Two (2) layers finishing coats chlorinated rubber at 30-40µm DFT each coat.
Total DFT : 135 - 155µm

C) Electrical /Control Panel

Surface preparation : Seven tank process

Primer : Two (2) layers of Zinc rich primer paint, total dry film thickness 75 µm
Finish Coat : Two (2) layers finishing coats chlorinated rubber at 30-40µm DFT each coat.
Total DFT : 135 - 155µm

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 540 as per IS-5	
3	Motors	Light grey 631as per IS-5	
4	Control Panels	Light Grey 631 of IS-5 / 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 / ABB / AEI & GEC
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 /



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		ELECTROMAC INDUSTRIES
21	PUSH BUTTONS	SIEMENS / L&T / BCH
22	LIMIT SWITCHES	SPEED-O-CONTROL / ELECTROMAG/SIEMENS/SCHNEIDER
23	MASTER CONTROLLER	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 / SCHNEIDER
35	SHROUDED DSL	SUSHEEL / STROMAG

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ANNEXURE-III

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

Objective: To demonstrate final No load / Load / Overload / Deflection / Functional tests of assembled Crane for the purpose of acceptance.

Basic Assumptions / Inputs for testing at Works:

- Actual job hook shall be used for Load / Overload tests for hoisting. However load / overload test for cross travel shall be done with hook block (without hook).
- Standard wire ropes (Equivalent to actual rope) shall be used for load / overload testing.
- Shop cables shall be used for temporary connection for the purpose of showing various functional tests at shop.
- Interlock and limit switch operation check will be shown without load for hoisting and CT motion.

Procedure for Load / Overload testing:

- The cranes shall be tested for NO load and load test at works generally in conformance with the IS – 3177 (1999). Specifically with respect to the load / overload testing of crane, the following tests as per the outlined procedures shall be done at works.
- Deflection of the girder will be measured at SWL when the trolley with load is at the middle of the girder.
- No load and full load current of the motors will be measured to verify whether it is as per the approved data sheet of the motor. Resistors in the circuit will be checked for any overheating of the element.

Hoisting & Cross Travel motions:

- The load will be gradually raised to 125 percent of the rated capacity (SWL) with actual hook. The load will be lifted upward to about 1meter height above its support and stop again. Check for any undue drift in the load. If load drifts, check the adjustment of brakes and repeat the above procedure. Then lower the load to rest on support/ground.



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SECTION - 2

CUSTOMER SPECIFICATION

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

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ELECTRIC OVERHEAD TRAVELLING (EOT) CRANE

ELECTRIC OVERHEAD TRAVELLING (EOT) CRANE

CONTENTS

Clause No.	Description
1.1	Scope
1.2	Codes and standards
1.3	General
1.4	Construction Features
1.5	Cables & Wiring
1.6	Structure
1.7	Crane Rails
1.8	Crane Bridge
1.9	Electrical Parts
1.10	Motors
1.11	Gear Boxes
1.12	Brakes
1.13	Limit Switches
1.14	Push Button Control Station
1.15	Overload Relays
1.16	Switchgear
1.17	Circuit Breaker Cabinets
1.18	Maintenance Platform with Hand Railing
1.19	Normal speed creep speed
1.20	Tools

1.0 Electric Overhead Travelling (EOT) Crane

1.1 Scope

This specification includes the supply of all materials and works for a crane with all operating machinery, structural steel, control equipment including cables and all other parts and accessories required for proper and safe operation.

1.2 Codes and standards

The cranes shall comply with the requirements and standards of latest versions of following relevant IS / IEC standards

IS 807 : 2006 - Design, Erection and testing (Structural Portion) of Cranes and Hoists - Code of Practice (Second Revision)

IS 3177 : 1999 - Code of Practice for Electric Overhead Traveling Cranes and Gantry Cranes other than Steel Work Cranes (Second Revision) This code covers mechanical, electrical, inspection and testing requirements relating to the design, manufacturing and erection of electric overhead traveling cranes, portal and semi - portal cranes, single girder, double girder or mono-box type.

IS 13834 : Part 1 : 1994 - Cranes - Classification Part 1 General

IS 13870 : Part 1 : 1993 - Cranes and lifting appliances - Selection of wire ropes Part 1 General

1.3 GENERAL

The crane shall be complete, including, crab, hoisting machinery with motor and brakes, all lubricating devices, ropes, sheaves, hooks, flood lights, control apparatus including switchgear, runway rails, push-button controls, interlocks, limit switches, governors, protecting and alarm devices and all electric connections (cables and live rails including insulators) between all parts supplied.

All the required materials, labour, tools, staging materials and consumables for completing the work shall be supplied.

The travelling crane shall be used for erection work as well as for normal maintenance, repair and overhaul purposes.

1.4 Construction Features

The design of the travelling crane has to guarantee fail-safe and satisfactory operation and has to be easy to access for service, inspection and repair. Full guarantee for all parts and services after commissioning shall be given. Any defects arising in any parts and services after commissioning shall be rectified free of cost.

A safety factor of 2.0 times of the maximum load to be lifted inclusive of the weight of the lifting beam is to be taken into account for all stress calculations to allow shock loading. However the Crane lifting capacity shall be adequate to handle at least two times the maximum weight of the heaviest package of GIS but shall not be less than 10 tonnes (for 400kV) and 6 tonnes (for 220kV & 132kV) with micro switch arrangement.

The span of the crane shall be fixed in such a way that the travel and lift of the main and auxiliary hooks of the crane as well as the hook limits shall be adequate for the assembly and disassembly of the main equipment. The lift above the service bay (upper limit) shall be adequate to hoist and carry the equipments to assemble and disassemble. The lift below the service bay (lower limit) shall be fixed in such a way as necessary for assembly and disassembly of the equipments.

The provision of radio remote control and variable voltage variable frequency (VVVF) drive for various crane motions for the purpose of precision speed control shall be made available for the cranes.

The radio remote control equipment, wherever provided shall conform to all applicable Government Rules and Regulations. The frequency of operation shall be in the requisite frequency band as per relevant standards.

Adequate guards shall be provided to protect personnel from accidents caused by moving mechanism, live terminals, live conductors, etc.

The guards shall be removable for inspection and maintenance without disturbing any other part of the plant.

The Contractor shall supply suitable nameplates, giving details of the lifting capacity of the travelling crane. These nameplates shall be clearly visible to anyone who may use the cranes. The nameplates shall be inscribed in English Language.

4(four) sets of layout drawing and operation and maintenance manual of the crane shall be given after commissioning.

Operating machinery and other exposed parts shall be suitably housed so that the exterior of the travelling crane will consist of smooth surface and pleasing lines.

Electric/ Electronic soft start modules electrically coupled to the long travel drives shall be provided to achieve jerk free, cushioned and smooth starts.

1.5 CABLES & WIRING

The cables laid from control panel to girder end junction box, DSL to Main switch to Protection panel shall be 1100V grade armoured PVC copper cables conforming to IS 1554 with latest amendments. The trailing cables laid on Coburn track (Cross conductor system with Coburn track) shall suitably rated for 1100V grade bare copper flexible cables confirming to relevant IS standards. The end termination of all cables shall be with copper lugs, pins, glands etc. and shall be ferruled with numbers. The

details including cable size calculations, make of the cables, lay out drawings etc. shall be submitted for prior approval. Separate control panel shall be provided for protective circuit, Hoist, LT & CT.

1.6 Structure

The minimum plate thickness for the steel construction shall be 7 mm, unless otherwise demonstrated suitable by the Contractor.

1.7 Crane Rails

Travelling crane rails shall be provided by the Contractor. Joints between rails on opposite runway girders for the cranes shall be staggered with respect to each other and to the wheelbase of the cranes. All joints of rails shall be welded. Rail joints shall not be located over the runway girder splices. Provision for rail expansion shall be made at the end stop locations only.

Guiding of rails on the girders should be carried out with rail clamps to distance adjustment. Welded clips are not allowed.

End stops shall be designed and located to limit the maximum crane travel. The end stops shall be capable of stopping the travelling crane fully loaded and travelling at the rated speed.

1.8 Crane Bridge

The travelling crane bridge shall consist of two girders rigidly attached to the end trucks. Gusset plates shall keep the crane in alignment.

Welded joints shall be used for the main structure of the crane, bolted joints shall be avoided whenever possible.

- In load bearing members, if a bolted joint is necessary, black bolts shall not be used.
- The strength of welded joints or joints made by friction grip bolts in structural members shall not be less than the net strength of the member. Friction grip bolts shall comply with BS 3139 and shall be fitted in accordance with the recommendations of BS 3294.
- The calculated strength of other bolted joints in structural members shall be not less than the net strength of the member plus 25 per cent. The calculated stress in screws, bolts and welds shall not exceed the appropriate permissible stress given in BS 2573.

The travelling crane girders shall be welded in structural steel box sections, with wide flange beams, standard "I" beams or reinforced beams. Girders must be symmetrical and line-of-sight must be considered along with girder design, as well as suspended crane supports. Trellis girder shall be prohibited.

The girders shall be designed to withstand all vertical loads and horizontal forces that may arise under service conditions. The vertical deflection of the girders, caused by

the safe working load and the weight of the crab in the central position shall not exceed 1/1000 of the span.

The larger of the following load combinations shall control the design of the girders:

- The sum of the maximum stresses due the dead load, the weight of the trolley, the rated load, and the impact allowance.
- The sum of the maximum stresses due to the dead load, the weight of the trolley, the rated load, and an allowance for the lateral load due to acceleration and deceleration of the travelling crane.

The bridge girders shall be security braced to the end carriages to prevent cross racking. It must be impossible for the travelling crane to fall from the gantry in the event of derailment. The carriages shall be of the bogie type and shall be equipped on each end with spring buffers (bumpers).

1.9 Electrical Parts

The travelling crane and hoists shall be so designed that adequate access for maintenance of the electrical control and operating gears is provided with suitable access facilities to enable removal of parts for maintenance and repair.

The power supply shall be provided via adequately protected contact wires along the crane track and a suspended cable on the crane girders.

The supply to the contact wires shall be via a manually operated load break isolating switch mounted at a convenient height above floor level, the switch being capable at being locked in the open position. Red indicating lights shall be arranged at collector level to show when the isolator is closed.

Motors shall be provided with quick action brakes; controllers, resistors, magnetic contractors and overload protection switches. Heavy dust and splash-proof limit switches shall be provided to prevent over hoisting, over transversal and over travelling motions.

1.10 Motors

All motors shall preferably be heavy duty squirrel cage induction motors type specifically designed and built for hoists and cranes services. Slip ring induction motors will also be acceptable if heavy duty cranes are required as per design requirement.

Motors shall be equipped with sealed antifriction, grease lubricated bearings, with provision for grease renewal.

Motors shall have tapered shaft extension on the brake end for easy removal of the brake wheel.

The motors shall be of reputed make like ABB, Siemens, AEI, and GEC only. Conforming to appropriate code of standard. The crane to be supplied shall be of reputed make and it shall be got approved.

1.11 Gear Boxes

The gear boxes shall be provided with precision flat helical/ spur gear units in light alloy housings with case-hardened gears, high-grade surface treatment and permanent oil/ grease lubrication. All the couplings shall be of spring grid/ gear type couplings

1.12 Brakes

The brakes shall preferably of Single/ Dual-disc electromagnetic DC brakes featuring automatic braking on power failure or Electro hydraulic thruster operated type.

1.13 Limit Switches

Limit switches shall be provided to control the upper limits of travel of all hoist motors and at each end of travel for the bridge and trolley and also to prevent over hoisting and over lowering of hook. Switches shall be of the totally enclosed safety type operated by the hooks or hook blocks.

1.14 Push Button Control Station

The push button control station shall be suspended by means of flexible galvanised wire rope and connected to the crane control panel by means of flexible multicore cable. The arrangement shall permit movement of the control station along the entire length of the bridge at all levels of operation.

The push button control station shall have an extra light, handy, easy to operate, cast aluminium fabricated housing and shall have mechanical protection class of IP 44. The control station shall contain besides all necessary individual push buttons for controlling operation of all crane motors, an emergency push button of the lockable type. This shall function as a master switch to cut off all power supply to the crane control panel, by switching off the master magnetic contactor.

1.15 Overload Relays

Each motor shall be protected by overload relays adjustable for values between 150 and 300 per cent of the full load motor current.

1.16 Switchgear

The power supply from the main collectors shall be controlled by means of a 3-phase, manually operated circuit breaker, and a 3-pole master magnetic contactor provided with under-voltage and phase reversal protection.

The operating coil of the contractor shall be wired in series with the auxiliary contacts of the adjustable, instantaneous relays in the circuit of each hoist and each travel motor, and in the circuits of all limit switches.

The circuits shall be so arranged that, on the functioning of an overload relay or the tripping of the limit switch, the flow of power to the crane will be interrupted.

1.17 Circuit Breaker Cabinets

The main circuit breaker, lighting supply circuit breaker, master contractor, relays and protective devices shall be enclosed in a suitable steel cabinet with hinged doors. The main circuit breaker shall be so arranged that it can be operated without opening the cabinet door and that it can be locked in the open position.

1.18 Maintenance Platform with Hand Railing

Maintenance platform with hand railing shall be provided for easy, simple and safe maintenance of the Crane extended partially or totally along the girder.

1.19 Normal speed creep speed

- (i) Main hoist 1m / min (Normal speed) 0.2m / min (Creep speed)
- (ii) Cross travel 12m / min
- (iii) Bridge long travel 25m / min

1.20 Tools

One steel toolbox shall be provided, containing complete set of ordinary and special tools needed for overhauling and repair of cranes furnished. General list of such tools shall be indicated in Tenderer's offer, and shall be detailed and submitted by the Contractor to the Engineer for checking and approval.

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SECTION - 3

PROJECT DETAILS GENERAL TECHNICAL REQUIREMENTS

SITE INFORMATION

S. N.	Particular	Details
a)	Owner	UPPTCL
b)	Customer	UPPTCL
c)	Project Title	400/220/132 kV GIS at Rasra, Ballia
d)	Location	Uttar Pradesh
e)	Transport Facilities	Nearest rail head - Ballia
SITE CONDITIONS		
a)	Max. Ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient emp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000meter
j)	Pollution Severity	High Pollution level
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS / IEC-62271-300 but not less than 0.3g horizontal
WIND DATA		
	Wind load	195kg/sqm
	Average No. of thunderstorm days per annum	As per IS

1. GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

- 1.1** Equipments furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories specified &/or normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications.

Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost All similar standard components/ parts of similar standard equipment provided, shall be inter-changeable with one another.



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- 1.2** The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

2. SYSTEM PARTICULARS

	Rated System voltage	420 kV, 245kV, 145kV, 36kV
	System frequency	50 Hz, This may vary by $\pm 5\%$
	Number of phases	Three
	Neutral	Effectively Earthed
	Auxiliary power supply:-	
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:	
(a)	Power device (Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.
(b)	Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.
(c)	DC alarm, Control and Protective Devices from sub-station batteries as under	2 wire ungrounded DC supplies (i) 400 kV S/S : 220V DC (ii) 220/132kV S/S : 110V DC (iii) Communication : 48 V DC The above supply voltage is subject to variation as follows: All devices must be suitable for a continuous operation over the entire range of voltage variations : (i) AC Voltage may vary by $\pm 10\%$. Frequency by $\pm 5\%$ Combined Voltage & frequency by $\pm 10\%$. (ii) DC a) 220 V may vary between 187 & 242 V b) 110 V may vary between 93 & 121 V c) 48 V may vary between 41 & 53 V



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3. System parameters

Sl. No.	Description of Parameters	400 kV System	220 kV System	132 kV System	33 kV System
1	Nominal system voltage	400kV	220kV	132kV	33kV
2	Maximum operating voltage of the system(rms)	420kV	245kV	145kV	36kV
3	Rated frequency	50Hz	50Hz	50Hz	50Hz
4	No. of phase	3	3	3	3
5	Rated short time current	50 kA for 3 Sec.	40 kA for 3 SEC	40 kA for 3 SEC	25 kA for 3 SEC
6	Dry and wet one minute power frequency withstand voltage	680 kV	460 kV	275 kV	95 kV
7	Dry and wet impulse withstand voltage positive and negative	1550 kVp	1050 kVp	650 kVp	250 kVp
8	Corona extinction voltage	320 kV	156 kV	105 kV	-
9	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, 320kV rms for 400kV system and 156kV rms for 220kV system & 92kV rms for 132kV system	1000 microvolt	1000 microvolt	500 microvolt	-
10	Minimum total creepage	25mm/kV (10500 mm)	25mm/kV (6125 mm)	25mm/kV (3625 mm)	25mm/kV (1300 mm)
11	Min. clearances				
	i. Phase to phase	4000mm (for Conductor-conductor)	2100 mm	1300 mm	320 mm
		4200mm (for rod - Conductor)			
	ii. Phase to earth	3500 mm	2100 mm	1300 mm	320 mm
	iii) Sectional clearances	6500 mm	5000 mm	4000 mm	3000 mm
12.	System neutral earthing	Effectively Earthed			

4. SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

- 4.1** All equipments shall perform satisfactorily under various electrical, electromechanical and meteorological conditions of the installation site.
- 4.2** All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment.
- 4.3** The Bidder shall design the various forces which the terminal connectors of the



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equipment are required to withstand.

4.4 All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing.

4.5 To facilitate erection of equipment, all items to be assembled at site shall be "matchmarked".

5. STANDARDS

5.1 **Except** as modified by this Bid specification, all material and equipment shall conform to the requirement of the latest editions of relevant ISS/ IEC and other applicable standards. The equipments/ works shall be designed, engineered, manufactured, built, tested and commissioned shall be carried out in accordance with the Acts, Rules, Laws and Regulations in force in India.

5.2 In addition to meeting the specific requirements called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards which shall form an integral part of the specification. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

5.3 In the event of the Bidder offering equipment conforming to standards other than ISS/IES standards, which ensure equivalent or better performance than that specified in the standards, the salient point of comparison between the standards adopted and relevant ISS/ IEC standards shall be indicated clearly in the proposal, along with English language version of such standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's approval.

5.4 The standards mentioned in the respective equipment specifications are not mutually exclusive or complete in themselves. The equipment &/or work shall also conform to any other applicable standard, even if not specifically mentioned in these specifications.

5.5 Should the Bidder wish to depart from the provisions of the specifications, either on accounts of manufacturing practices or for any other reason, he shall clearly mention the departure and submit complete justification supported by information, drawings etc. as will enable to assess the suitability of equipment(s) offered. In the event of the Bidder's specifications, drawings, forms and tables etc. being found to disagree with the requirement of the Bid specifications at any stage, Bid specifications shall be binding, unless the departures have been duly approved in writing by the purchaser.

5.6 REFERENCE OF STANDARDS

Reference	Abbreviation	Name and Address
BS	British Standards,	British Standards Institution, 101, Pentonville Road, N-19-ND UK



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ISO	International Organization For Standardization,	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelprup, DENMARK
NEMA	National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A
BS	British Standards,	British Standards Institution, 101, Pentonville Road, N-19-ND UK
ISO	International Organization For Standardization,	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelprup, DENMARK
NEMA	National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A

6. ENGINEERING DATA AND DRAWINGS

6.1 SUBMISSION AND APPROVAL OF DRAWINGS/ DOCUMENTS

- 6.1.1 The Bidder shall follow a well-defined coding system for proper and quick identification of all systems/ sub-systems/ equipments/ assemblies/ sub-assemblies/ accessories/ other plant material/ spare parts/ special tools and plants and drawings for the execution of the plant and later for its operation and maintenance.

Copies of coding documents defining the above shall be supplied along with drawings to understand the system.

- 6.1.2 All drawings submitted by the Bidder shall be in sufficient details to indicate the type, size arrangement, weight of each component, details for packing and shipment, the external connections, fixing arrangements, dimensions required for installation arrangement, dimensions required for installation and interconnections with other equipment and other information specifically, as called for in the drawing schedules. All the equipments tapping points etc. shall be numbered according to pre-determined scheme/ system which shall be subject to approval of Purchaser.
- 6.1.3 Each drawing shall be clearly marked with the name of the Purchaser, unit designation, UPPTCL's Contract No. 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 drawings shall be in English. All the dimensions should be in metric units.
- 6.1.4 If any dimension figures on a drawing or a plan differs from those obtained by scaling the drawing or plan, the dimensions as mentioned in figures on the drawing or plan shall be taken as correct.

6.2 Submission and distribution of drawings/ documents

All the drawings which do not require approval shall be submitted along with reproducible in required number and those requiring approval shall be initially

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submitted for comments/ approval before submitting along with reproducible as per "Document Distribution Schedule".

6.3 APPROVAL OF DRAWINGS

6.3.1 The Purchaser shall return to the Bidder one set of drawings, plans and technical data requiring approval after marking them with their comments/ corrections, if any, either (a) marked 'Approved' or (b) marked 'Approved subject to incorporation of comments' or (c) marked 'Not Approved' with comments requiring resubmission of drawings etc. in 14 days or (d) marked 'Approval not required', where drawing is for information only. In case of (a) no further revision of drawings will be required. In case of (b) Bidder can proceed with the work but will resubmit the drawings incorporating the corrections as per comments only within fourteen (14) days. In case of (c) Bidder can proceed with the work only after resubmitting the drawings within fourteen (14) days and getting approval under (a) or (b) categories above. In case of (d) the Bidder drawing is deemed to have been received only for information purpose.

6.3.2 The Purchaser shall have the right to ask the Bidder to make any change in the design/ drawing which may be necessary to make equipment conform to the provisions and intent of the contract, without any extra cost to the Purchaser.

The drawings submitted shall be re-viewed by the Purchaser and shall be modified by the

Bidder as required. The Bidder shall incorporate such modifications and/or corrections and submit the final drawings for approval/ reference.

6.3.3 No deviation from the approved drawings shall be permitted without the written approval of the Engineer.

6.3.4 The review of drawings/ data by the Purchaser will cover only general conformance of the data of the specifications and document, interfaces with the equipment provided under the specifications, external connections and the dimensions which might affect substation layout.

This review by the Purchaser may not indicate thorough review of all dimensions, quantities and details of the equipment, wiring, materials, any devices or items indicated or the accuracy of the information submitted. This review and/ or approval by the purchaser shall not be considered by the Bidder, as limiting any of his responsibilities specified under these specifications and documents.

Approval/ comments conveyed as above shall neither relieve the Bidder of his contractual obligations and his responsibilities for correctness of dimensions, material of construction, quantities, design details, assembly fits, performance particulars,



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guarantees and conformity of the supplies with the specifications, schemes, systems and statutory laws, nor does it limit the Purchasers right under the contract.

- 6.3.5 Should any minor revision be made after 'approval', at the time of erection/ commissioning the Bidder shall redistribute prints and reproducible, clearly certifying the changes incorporated in the drawing and marking it in a block. Every revision shall be marked by a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.
- 6.3.6 The Bidder shall be responsible for and shall pay for any alterations of the work due to any discrepancies, errors and omissions in the drawings or other particulars supplied by him, whether such drawings or particulars have been approved by Engineer or not.

No extension of delivery periods shall be granted on this account.

6.3.7 As- build drawings

Drawings of all equipments as detailed in technical specifications of respective equipments necessarily including schematic drawings and terminal block drawings wherever applicable whether mentioned in respective technical specifications or not.

7. NAME PLATE, MARKING OF PARTS, LABELS

- 7.1 All equipment shall have metal name plates fixed in suitable position with full particulars engraved legibly thereon and not painted.
- 7.2 Each main and auxiliary item of plant is to have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which is to be engraved identifying manufacturer's name, equipment type or serial number, rating together with details of the loading/ operating conditions under which the item or plant in question has been designed to operate and such diagram plates as may be required by the Engineer.
- 7.3 Each item of plant is to be provided with a name plate or label designating the service of the particular equipment. These inscriptions are to be approved by the Engineer or as detailed in the appropriate sections of the technical specifications.
- 7.4 Such name plates or labels are to be white non hygroscopic material with engraved block lettering or, alternatively, in the case of indoor equipments of transparent plastic material with suitably colored lettering engraved on the back
- 7.5 Each bay module in GIS room will have a clear marking showing the name of bay, identification, name and rating plate marking for each individual equipment like circuit breaker, disconnectors grounding switches, current transformer, voltage transformers and bushings etc. as per relevant IEC to facilitate identification during routine operation/ maintenance.
- 7.6 All such name plates, instruction plates, lubrication charts etc. shall be bilingual with Hindi inscription first followed by English. Provisions shall be made to fit in name plates, lubrication/ connection diagram plates etc.



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7.7 In order to facilitate identification, the parts of the equipment shall be suitably marked.

8. INSTRUCTION MANUALS

8.1 The Bidder shall submit to the Engineer 'Descriptive Manuals', i.e. system design concept, detailed catalogues of equipment and typical equipment instructions for this project, for all major systems and equipment, covered under this contract along with dispatch of equipment.

These initial copies of descriptive manuals shall be in sufficient details, bringing out detailed internal construction, characteristics, performance parameters, principles of operation, maintenance requirements, replacement and renewals needed, erection and overhauling procedure, testing and operation procedure etc. for various equipment.

8.2 The integrated instruction manuals, fully defining the interfaces between various systems and complete in all respects shall be submitted by the Bidder one month before scheduled date of commissioning. The instruction manuals shall contain full details of designation and drawings of all the equipment furnished, the erection procedure, testing procedure, operation and maintenance procedure of the equipment, single line diagrams, and schematics. After the commissioning and initial operation of the plant, modifications/ additions/ changes, wherever required shall be incorporated in the instruction manuals and drawings shall be submitted by the Bidder to the Purchaser.

8.3 The manuals shall be specific to the equipment supplied and not of general nature.

9. DOCUMENTS AND ERECTION DRAWINGS

The Bidder shall submit within a reasonable time but at least four (4) weeks before dispatch of equipment (as per distribution schedule) the following drawings/ documents and instruction manuals etc. to the consignee and the Engineer.

- I. List of item-wise equipment as proposed to be dispatched by the Bidder.
- II. Erection drawings along with reproducible prints of each drawings.
- III. Instruction books for proper handling/ checking of material on receipt at site/storage, erection and assembly of all equipment and necessary instruction for checking and recording proper assembly of the plant.
- IV. Instruction sheets for proper balancing, alignment, adjustment, checking and calibrations as may be necessary.
- V. Descriptive literature and drawings to illustrate the working principals, methods of Assembly and dismantling of plants and equipment.
- VI. Testing/commissioning format for recording data during erection/testing/ commissioning and trial run. These formats/data sheets shall clearly indicate the results obtained during shop tests and permissible deviations.

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10. QUALITY CONTROL PROGRAMME

To ensure that the equipment construction work and the services covered under this job are in accordance with the specifications and conform to the high standard of workmanship. It is obligatory on the part of the Bidder to adopt a suitable quality control program. Such a program shall include suitable hold point for check for major equipments during manufacture at supplier's work, during erection at site and during the construction stage such that material checks for attaining proper strength and dimensional checks for attaining close tolerances required for equipment installation can be obtained.

In order to attain the above objectives, the Bidder shall draw out a plan listing all quality control checks in detail, including all hold points at which the quality checks shall be applied, also specifically mentioning those hold points where the Purchaser shall also participate in the quality check to assure him of the quality of the products supplied. Such a program shall be outlined by the Bidder for the acceptance by the Purchaser. The Bidder shall furnish detailed information regarding his quality control program and its strict implementation. Following information shall be included in the proposal along with others regarding quality control program:

- I. The quality control organizations and the proposal of its implementation.
- II. The system for controlling drawings and documents for correctness.
- III. The system of quality control for raw materials, process control and maintaining tolerances during manufacturing, assembly and fabrication.
- IV. Quality control during purchase of components, sub-systems and assemblies.
- V. Methods for ensuring selection of proper vendors/ sub-vendors.
- VI. Inspection of testing at shop after assembly.
- VII. Control of accuracy during calibration of measuring and testing equipments.
- VIII. Preservation and quality control during the transit.
- IX. Procedure for inspection before erection and quality control during erection.
- X. System for storage and delivery.

Bidder shall be wholly responsible for the quality control and quality assurance for the manufacture, supply, erection, testing and commissioning etc.

During inspection, destructive testing and non- destructive test evaluation shall be done wherever applicable, in presence of Purchaser's representative in accordance with established norms. Directions of Purchaser shall be rigorously followed.

11. INSPECTION&TESTING

- 11.1** The Purchaser reserves the right to inspect any machinery and material to ensure that approved Q.A.P. is being strictly implemented by the Bidder or his Sub Bidder/ Supplier under this contract and to reject any item found defective in workmanship or design or otherwise unsuitable for the use and purpose intended or which is not in accordance



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with the intent of this contract. The Bidder should on demand by the Purchaser, rectify or replace such defective or unsuitable equipment, or the Purchaser may at the Bidder's expense, rectify or replace such defective or unsuitable equipment whether before or after supply.

- 11.2** The Bidder shall advise the Purchaser at least 4 weeks in advance as to when the equipment will be ready for stage/ final inspection at the Bidder's works or at his Sub-Bidder's works.

12. PACKING

- 12.1** All 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.

While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.

- 12.2** The Bidder shall include and provide for security protection and packing the plant so as to avoid loss or damage during transport by any mode.

- 12.3** All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the engineer.

- 12.4** The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.

- 12.5** Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.

- 12.6** Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing and the quantity of each part, drawing number and tag numbers.



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12.7 All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.

12.8 Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.

12.9 Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

13. DESPATCH OF EQUIPMENT

13.1 Detailed dispatch instructions will be intimated to the Bidder. All materials shall be dispatched by road.

13.2 The Bidder shall intimate, at least thirty (30) days in advance to the consignee as well as the concerned Superintending Engineer at site, the probable date when the equipment will be ready for dispatch from the works. Notification of delivery or dispatch in regard to each and every consignment shall be made to the Purchaser immediately after dispatch or delivery. The supplier shall further supply to the consignee a priced invoice and packing account of all stores delivered or dispatched by him. All packages, containers, bundles and loose materials forming parts of each and every consignment shall be described fully in the packing account, and full details of the contents of packages and quantity of material shall be given to enable the consignee to check the stores on arrival at destination.

13.3 A list in duplicate containing details of equipment for verification at site shall also be placed inside each package and shall correspond with the advice note. One additional copy of each of the package lists shall also be sent to the consignee.

14. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.



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The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 5(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

14.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective chapters and shall be included in the Contractor's quality assurance programme.

14.2 Commissioning Tests

- 14.2.1 The available instrumentation and control equipment will to be used during such tests and the Purchaser will calibrate, all such measuring equipment and devices as far as practicable.
- 14.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- 14.2.3 The specific tests requirement on equipment have been brought out in the respective chapters of the technical specification.
- 14.2.4 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by POWERGRID on production of requisite documents.

15. MATERIAL WORKMANSHIP

15.1 General Requirement

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is understood that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of



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safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits.

Suitable guards shall be provided for the protection of personnel on all exposed rotating and/ or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Bidder shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Bidder shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Bidder has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.



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A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, of so required.

15.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

15.3 Space Heaters

The heaters shall be suitable for continuous operation at 240V AC supply. On-off switch and fuse shall be provided for the heater.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulator wire or other component in the compartments.

15.4 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.



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15.5 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

- a) Installed out door: IP- 55
- b) Installed indoor in air conditioned area: IP-31
- c) Installed in covered area: IP-52
- d) Installed indoor in non-air conditioned area where possibility of entry of water is limited: IP-41.
- e) For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part-I) / IEC-60947(Part-I) / IS 12063 / IEC-60529. Type test report for degree of protection test, shall be submitted for approval.

15.6 RATING PLATES, NAME PLATES AND LABELS

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instructions plates, rating plates CB, CT, VT, SA, Isolators and Relay & Protection panels equipments shall be bilingual with Hindi inscription first followed by English.

Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

15.7 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment, covered under the scope of the specifications, into successful operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

16. Surface finish

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.



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All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

All external painting shall be as per shade No. 631 of IS: 5.

17. HOT DIP GALVANISING

All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS: 2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electrogalvanized.

Minimum weight of zinc coating shall be 610 gm/ sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items lower than 6mm thickness, requirement of coating shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

The galvanized surfaces shall have a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization. Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

18. PAINTING

18.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 “Code of practice for phosphating iron and sheet”. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

18.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc



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chromate primer. The first coat may be “flash dried” while the second coat shall be stoved.

18.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

18.4 The exterior and interior colour of the paint in case of new substations shall preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards/panels/junction boxes is also acceptable. The exterior colour for panels shall be matching with the existing panels in case of extension of a substation. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

18.5 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The Bidder shall propose a colour scheme for those equipments/ items for which the colour scheme has not been specified in the specification. For the approval of purchaser. The decision of Purchaser shall be final. The scheme shall include.

- Finishing colour of Indoor equipment.
- Finishing colour of Outdoor equipment.
- Finish colour of all cubicles.
- Finishing colour of various auxiliary system equipment including piping
- Finishing colour of various building items.
- All steel structures, plates etc. shall be painted with non-corrosive paint with a suitable primer.

It may be noted that normally all electrical equipments in switchyard are painted with shade 631 of IS-5. The indoor cubicles, GIS enclosures and other miscellaneous items, the colour scheme shall be approved by the Purchaser during detailed engineering.

For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting.

19. TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all ordinary & special tools and tackles needed for overhauling and repair of cranes & maintenance of the equipment. The list of these tools and tackles shall be finalized during detailed engineering with customer. However, these tools and tackles shall be separately, packed and brought on to Site.



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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

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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	Date	Order	
						Of order	of supply	value

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

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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-----

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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 Specific ation	Details of test	Lab in which to be conducted
		A. Type Tests	
		1.	
		2.	
		B. Routine Tests	
		1.	
		2.	
		C. Site Tests	
		1.	
		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

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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-----

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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 –7

ENCLOSURES TO SPECIFICATION

DRAWINGS

1. *Architecture Drg- for 400KV GIS Buildings*
2. *Architecture Drg- for 220KV GIS Buildings*
3. *Architecture Drg- for 132KV GIS Buildings*