BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TITLE	Technical Specification for EOT Crane (400KV-Gas Insulated Switchyard Area)						
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CUSTOMER	PATRATU VIDUT UTPADAN NIGAM LTD. (PVUNL)
CONSULTANT	NTPC LTD.
PROJECT	3X800 MW PATRATU SUPER THERMAL POWER PROJECTS EXPANSION PHASE-I (3X800MW) - 400 KV GIS

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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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 One Set Double** Girder EOT Crane of 10T capacity to be provided for 400 kV Gas Insulated Substation Building of **3X800MW PATRATU SUPER THERMAL POWER PROJECTS EXPANSION PHASE-I -400 KV GIS**

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

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

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

1.0.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

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

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

1.0.5 **Deviation:** There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-4 towards confirmation. Except for these deviations/ variations covered under Deviation Schedules which are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the Bidder to fully meet the intent and the requirements of the specification within the quoted price.

Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.

1.0.6 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.

1.0.7 It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.

1.0.8 **The term** ‘Owner/Client’ **appearing in this specification shall refer to PATRATU VIDUT UTPADAN NIGAM LTD. (PVUNL), the term** ‘Consultant’ **shall refer to NTPC LTD.**, **the term** ‘Purchaser’ **shall refer to** BHEL **and the term** ‘Contractor’ **shall refer to the** successful Bidder**.**

This system shall be designed to provide one no. 10T capacity Double girder EOT Crane for GIS Hall Building of **3X800MW PATRATU SUPER THERMAL POWER PROJECTS EXPANSION PHASE-I -400 KV GIS.**

2.0 Scope

One number (1) Double girder Electrically Operated Travelling Crane or EOT Crane **(having 10T capacity)** with Variable Voltage Variable Frequency i.e. VVVF Drive in all three controls of Hoisting, CT & LT suitable for erection of various equipment at 400 kV GIS Hall Buildings shall be required

Crane shall be designed on the following main technical parameters:

S.N.	Description	Technical Particulars
1.	GENERAL	**Double Girder EOT Crane at 400KV GIS Hall Building**
2.	Type of Crane	Double Girder Over Head EOT
3.	Capacity (SWC)	**10T**
4.	Span*	14.5 m (Approx.)
5.1	Lift	9.5 m
5.2	Bay Length*	120 m (Approx.)
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
9.	Speed Control	Thru’ VVVF drive
10.	Design Temperature	50 degC

Please refer architecture drawing of GIS hall Building attached to this specification for exact dimension.

Reference: GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400KV GIS BUILDING (9585-001-572-PVC-C-0249)

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.

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 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 50^0 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 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 ***Centralized grease lubrication unit with hand operated grease pump shall be provided for all bearings as per bidder's standard proven practice.***

4.9.0 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.

4.10.0 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.

4.11.0 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

4.12.0 Cranes shall be operated through fixed type pendent push button station and through Radio remote control (RRC) also.

<u>Radio remote Control of EOT Crane</u>:

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

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

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

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

The remote unit should have transmitter which can be mounted on shoulder by suitable belt. Main controls can be of single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch type or push control type.

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

The transmitter and receiver unit should have its own frequency and address code with each system having its own security code so that one particular set becomes unique and there is no interference from any other remote unit device. A microprocessor should check all security codes. The processor should have its own watchdog circuit. The receiver FM band should be sufficiently narrow to allow only passing of desired frequency and valid command. Any error should shut down the system immediately.

The remote unit should have safety key to prevent any unauthorized operation. All the crane operations should stop at once the communication breakdown occurs.
On local unit (receiver side), the system should be provided with one selector switch so that EOT crane can be operated either from push button or radio remote unit.
In case tandem operation is envisaged, a suitable selector switch shall be provided for selection of Tandem/normal operation.

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.

4.13.0 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

4.14.0 Maintenance platform throughout the span of the crane, along with bridge girders shall be provided.

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

4.16.0 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/900. 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.

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.

Over load test, travel & hoist speed checks etc., shall be demonstrated as per IS 3177 (latest edition).

Shop Test for EOT Cranes

1.0 HOOKS
1.01 ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT.
1.02 MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST.
2.0 STEEL CASTING
2.01 DPT ON MACHINED SURFACE SHALL BE CARRIED OUT.
3.0 GIRDERS, END CARRIAGE, CRAB, GEAR BOX AND ROPE DRUM
3.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.
3.02 NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS:
a) BUTT WELDS IN TENSION: 100% RT AND 100% DPT
b) BUTT WELDS IN COMPRESSION: 10% RT AND 100% DPT
c) BUTT WELDS IN ROPE DRUM: 100% RT AND 100% DPT

d) FILLET WELDS: RANDOM 10% DPT

4.0 FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION)

4.01 ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING.

4.02 DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING.

5.0 WIRE ROPE SHALL BE TESTED AS PER RELEVANT STANDARD.

6.0 REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION.

7.0 THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL ETC. AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP.

8.0 ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.

9.0 LIFTING BEAM:

9.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.

9.02 NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS:

a) BUTT WELDS IN TENSION: 100% RT AND 100% DPT

b) BUTT WELDS IN COMPRESSION: 10% RT AND 100% DPT

c) FILLET WELDS: RANDOM 10% DPT

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

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**	01 No. of 10T capacity
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	*(It shall be furnished by manufacturer)
	b.	Test load SWL – tonnes	Rated SWL and over load test : 125% of SWL
1.4.2		Deflection test of crane	Shall be carried out at SWL
1.5.0		**Span**	14.5 m (Approx.)
1.6.0		**Operation from**	Fixed type pendent push button station and through Radio remote control (RRC) also. Refer clause 4.12.0

2.00		**CRANE PERFORMANCE**		
2.1.0		Crane speed with full load	**Full speed M/Min**	**Creep speed M/Min**
	a.	Main hoist	**1.6**	10% of max. speed (thru' VVVF drives)
	b.	Trolley travel (CT)	**15**	10% of max. speed (thru' VVVF drives)
	c.	Longitudinal bridge travel (LT)	**30**	10% of max. speed (thru' VVVF drives)
2.2.0		Acceleration values	LT motion (bridge travel)	CT motion (trolley travel)
			As per IS: 3177	As per IS: 3177
2.3.0		**Lift in Metres**	The lifting rope shall be of sufficient length to permit the main hook to reach the zero level.	
	a.	Main Hoist	9.5 m	
2.4.0		Hook Approaches		
	a.	Main hook (DSL end)	To suit the layout requirement.	
	b.	Main hook (Other end)		
2.5.0		**Hand rail pipes**	***32 mm NB Medium class of IS: 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick).***	
3.0.0		**COMPONENT DETAILS**		
3.1.0		**Trolley**		
	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	5.25 as per IS 3177	

	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***		
3.5.0		**Coupling & Shafting**			
3.5.1	**A.**	***Coupling details (between motor and gear box)***	***Main Hoist***	***Cross Travel***	***Long Travel***
	a.	***Type***	***Flexible shock absorbing coupling excepting pin bush type***		
	b.	***Guards and Enclosures***	***Provided***		
	B.	***Coupling details (gear box and wheels)***	***Cross Travel***	***Long Travel***	
	a.	***Type***	***Flexible geared type***		
	b.	***Guards and Enclosures***	***Provided***		
	C.	***Coupling details (gear box and rope drum)***	***Main Hoist***		
	a.	***Type***	***One of the following arrangements will be adopted for connecting the rope drum with the gear- box.*** ***1. Flexible joint, incorporating flexible geared coupling housed within the drum.*** ***2. Fully flexible geared coupling between the drum & gearbox.***		
	b.	***Guards and Enclosures***	***Provided***		
3.5.2	**A.**	***Shafting (Output)***			
	a.	***Factor of Safety***	***As per IS : 3177 (latest edition)***		
	b.	***Arrangement of Lubrication***	***Grease cups/ Nipples***		
	c.	***Type of Lubricant***	***Grease***		
3.6.0		**Gear box details**			
3.6.1		Hoist Motions			
	a.	Type of mounting of gear box	Horizontal / Vertical		
	b.	Classification	Suitable for M5 duty		
	c.	Type of gears	Helical / Spur for MH & through VVVF drive for MH micro		
	d.	Type of lubrication	Splash lubrication		

	e.	Difference in Gear and pinion hardness	Min 20 BHN	
	f.	Materials (gear/pinions)	Main Gears En 9/ 55C8/ 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	
	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 anb d 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)	
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	*(to be provided by manufacturer)	
	c.	Material	Class II of 1875 :1992 (re affirmed 2004) for hooks conforming to IS : 5749	
	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 speed of 50 % of the rated speed.				
	b.	Numbers provided	4		4		
3.10.0		**Brakes**					
3.10.1		**Hoist Motions**					
	a	Type of brake (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	Centralized grease lubrication unit with hand operated grease pump shall be provided for all bearings as per bidder's standard proven practice.				
	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 The girder shall be of box type and construction shall ensure non-accumulation of water/oil inside the box.				
	b.	Vertical Deflection	Span / 900 (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**
3.15.1		**Hoist Motions**	**MH**
	a.	Type	**Three phase squirrel cage induction motors operated from VVVF Drive system and suitable for inverter duty.** These motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for Inverter duty. Motors shall conform to latest revision of IS 325, IS 3177 and motor subsection of this specification.
	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. 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.
3.16.2		**Travel Motions**	**CT & LT**
	a.	Type	**Three phase squirrel cage induction motors operated from VVVF Drive system and suitable for inverter duty.** These motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for Inverter duty. Motors shall conform to latest revision of IS 325, IS 3177 and motor subsection of this specification.
	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		
3.17.0		**Limit switches**	**Main hoist**	**Cross Travel**	**Long Travel**
	a.	Type	Rotary gear (screw type) + Gravity	Two way lever type/ One way lever type	
	b.	Number provided	1+1	1/2	1/2
	c.	Material of contacts	Double break Silver Cadmium		
	d.	Control voltage / Enclosure	110V / IP-55		
3.18.0		**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.		
3.19.0		**Control Panel**			
	a.	Material & size	Fabricated from sheet steel, minimum 1.6 mm thick.		
	b.	Degree of protection	IP 52		
	c.	Numbers and location	One each for MH, AH, CT and LT located on bridge platform		
	d.	Illumination	Internal illumination with florescent lamp		
	e.	Space heaters	To be provided		
	f.	Paint Shade	Paint shade shall be RAL 9002 for front & rear and RAL 5012 for side covers.		

3.20.0		**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 ^{o} C without de rating.	
3.21.0		**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.	
3.22.0		**Earthing**		
	a.	Material of earthing	G.I / Copper	
3.23.0		**Power supply**	415 V, 3 phase, 4 wire supply at 1.5m above operating floor at centre of bay length	
3.24.0		**Transformer**	Dry type, with insulation class B or better. Following transformers shall be provided.	
	a.	Control transformer	2 x 100 %. 415V/110V	
	b.	Lighting Transformer	One, 415/240V	
	c.	Hand Lamp	One, 415/24V	
3.25.0		**Contactors**	AC 4 duty for reversing application. AC 3 duty for non-reversing application	
3.26.0		**Switches**	AC 23 for motor application, AC 22 for other application.	
3.27.0		**Illumination**		
	a.	Over Bridge	2 nos. 60 W Bulk-head fittings with incandescent lamps 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.
3.28.0	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
3.29.0	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.
		Main Isolating switch	**Main isolating switch at Middle of the bay length (1.5M above operating floor)**
3.30.0		**Painting & Color Coding**	As per ***Annexure I***
3.31.0		**Fire Extinguisher**	
	a.	Type and size	4.5 kg , CO2 type
	b.	Numbers & Location	One no. on bridge
3.32.0		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.*

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.*

6.2.0 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 (clause 6.1.0). Vendor shall provide main isolating switch at 1.5 M above the ground / operating floor level and cable required from isolating switch to DSL.
4. Any other supply required by the bidder shall be arranged by the bidder himself by using suitable transformer as per the specification.
5. Supply of earthing flats.

6.3.0 Make of Sub - Vendor items

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

6.4.0 Various Heads to be quoted

Sl. No.	Item Description	Unit	Quantity	Total Ex-works	Total ETC
1.	10 T Double Girder EOT Crane for 400 kV GIS Building as per technical specification	Set	01		
2.	Mandatory Spares as per Annexure-M of technical specification	Set	01		Not Applicable

6.5.0 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.

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. And 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

ANNEXURE-M

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

Sl. No.	Description	Quantity
1.0	**MECHANICAL ITEM SPARES FOR CRANES IN EACH HALL**	
I	Bearing for long travel wheels	1 SET
II	Bearing for cross travel wheels	1 SET
III	**Bearing for boxes**	1 SET
a)	Main hoist	1 SET
b)	C.T.	1 SET
c)	L.T.	1 SET
	One set of bearing consist of all the bearing used in one gear box	
IV	**Brake line with rivets**	
a)	Main Hoist	1 SET
b)	E.M. Brake	1 SET
c)	E.M. Thruster brake	1 SET
	One set of liner consists of 2 Nos. liners used on each brake	
V	**Oil seal for gear boxes**	
a)	Main hoist	1 SET
b)	C.T.	1 SET
c)	L.T.	1 SET
	One set of oil seal consists of all the seals used in the one gear box.	
VI	**Brake springs for main hoist**	
a)	E.M. Brake	1 SET
b)	E.M. Thruster brake	1 SET
2.0	**ELECTRICAL ITEM SPARES FOR EOT CRANES IN EACH GIS HALL**	
I	Bearing for long travel wheels	
a)	Main hoist	1 SET
b)	C.T.	1 SET
c)	L.T.	1 SET
II	**Solenoid Coils for EM brakes**	
a)	Main hoist	1 SET
b)	C.T.	1 SET
c)	L.T.	1 SET
III	**Set of fuse links**	***One set consists of all the fuse links required for***

		whole crane.
IV	**Overload relays for motors**	
a)	Main hoist	1 SET
b)	C.T.	1 SET
c)	L.T.	1 SET
V	**Limit switches for**	
a)	Main hoist	1 SET
b)	C.T.	1 SET
c)	L.T.	1 SET

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	

ANNEXURE II

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

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

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

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

SECTION-2

EQUIPMENT SPECIFICATION

2.0 TYPE

Electrically operated indoor travelling type.

2.1 APPLICABLE CODES

(a) Design and duty of crane structure, main hoist, auxiliary hoist, cross travel, long travel in accordance with class M5 of IS: 3177 (latest edition).

(b) All other structure of cranes in accordance with IS-807.

(c) Main hook Ramshorn type conforming to IS-5749 (latest edition) and auxiliary hook shank type conforming to IS 15560 (latest edition). In case the load is more than 250 Tonne, Main hook (Ramshorn type) shall conform to DIN-15402 (latest edition).

2.3 BRIDGE STRUCTURE

(a) Vertical deflection caused by safe working load and weight of trolley in central position not to exceed 1/900 of the span.

(b) Trolley stops of spring type to be mounted independently on bridge rails to prevent trolley from running off.

2.4 BUFFER

(a) Suitable buffer to be fitted to each end of carriage assembly and crab.

(b) Buffers to be designed to bring the loaded crane to rest from a speed of 50% of the rated speed

2.5 WIRE ROPE

Wire rope of extra flexible plough steel and of 6/36 or 6/37 construction conforming to IS: 2266 (latest edition).

2.6 BEARINGS AND LUBRICATION

(a) The type of bearings for various parts as per IS:3177 (latest).

(b) Bearing life not less than 10,000 working hours.

(c) Centralised grease lubrication with hand operated grease pump for all bearings as per bidder's standard proven practice.

2.7 RUNWAY/TROLLEY RAILS AND RAIL JOINTS

Rails to be as per relevant Indian Standard and joints to be butt welded by thermit welding or fusion welding.

2.8 BRAKES

2 X 100 % Brake shall be provided for each motion. Each brake for hoisting motion, cross travel, long travel etc., shall be designed as per following:
Brakes to be as per IS 3177. The Capacity of hoisting motion brakes to be 150% of torque transmitted to the brake drum with full load and that of cross travel and long travel to be 125% of motor rated torque before deaerating.

2.9 MOTORS

Three phase Squirrel Cage Induction motors to be operated from VFD system shall be suitable for speed range and torque without exceeding temperature rise limits as specified elsewhere in this specification. These motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for Inverter duty. Motors shall conform to latest revision of IS 325, IS 3177.

2.10 CONTROLS

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

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

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

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

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

vi) Provision for controlling the motion from push button station as well as radio remote control (RRC) shall be available.

vii) Squirrel cage Induction motor with VPI insulation shall be provided With VVVF system.

viii) **Protective Panel:** Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer.

ix) **Starter Panel:** Separate VVVF system panels to be provided for CT, LT and hoist motion

a) Contactors : AC 4 duty for reversing application AC 3 duty for non-reversing application

b) Switches: AC 23 for motor application, AC 22 for other application.

c) Fuses: HRC

d) Overload relay : Temperature compensated, bimetallic with single phasing preventor.

x) Panel shall be fabricated out of 1.6 mm thick rolled sheet steel. IP 52 degree of protection. Paint shade shall be RAL 9002 for front & rear and RAL 5012 for side covers. Space heaters to be provided.

2.11 RADIO REMOTE CONTROL FOR EOT CRANE

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

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

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

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

v) The remote unit should have transmitter which can be mounted on shoulder by suitable belt. Main controls can be of single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch type or push control type.

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

vii) The transmitter and receiver unit should have its own frequency and address code with each system having its own security code so that one particular set becomes unique and there is no interference from any other remote unit device. A microprocessor should check all security codes. The processor should have its own watchdog circuit. The receiver FM band should be sufficiently narrow to allow only passing of desired frequency and valid command. Any error should shut down the system immediately.

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

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

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

xi) The receiver unit along with I/O interface unit should be able to bear the vibrations and shocks encountered in normal usage of EOT crane.

xii) The system should have very fast response time.

2.12 POWER SUPPLY

(a) Down shop Lead (DSL):

(i) Shall conform to IS : 282 and shall be sized to

- Cater to all cranes working simultaneously with 40% cyclic duration factor for load.

- Limit voltage drop at motor terminals within 2% at extreme positions.

(ii) DSL shall be sized with a margin of 10% over load requirement.

(iii) Protective cover over DSL to be provided.

(iv) Two (2) numbers isolating switches in enclosure shall be provided at extreme ends of operating floor for disconnecting supply to DSL while maintaining the crane.

(v) DSL shall be located on 'A' -row side for Turbine hall EOT crane.

(b) Transformers

Dry type, with insulation class B or better. Following transformers shall be provided.
(i) Control Transformers : 2x100%, 415V / 110V
(ii) Lighting Transformers : One 415V/240V
(iii) Hand lamp : One 415V/24V

2.13 ILLUMINATION

HPSV lamps under the bridge. Florescent lamp over the bridge.

2.14 CABLES

(a) EPR insulated, copper conductor trailing cables, as per IS:9968, on the bridge.

(b) Extruded PVC insulated, copper/Aluminium conductor,1100 Volt grade power cables. This shall include cable lengths between changeover switch & DSL and isolating switch & DSL.

(c) Extruded PVC insulated, copper conductor 1100 volt grade control cables. Mechanical overload protection - to be provided for hoist mode.

2.15 MAXIMUM SPAN/DEPTH RATIO FOR GIRDER:

(a) Plate girders : 18
(b) Lattice girders : 12

Material

(i) Structural steel plates : Mild steel, grade 'B' of IS 2062 in 100% killed, rolled section normalised and ultrasonically tested quality or high strength steel of IS 8500 as appropriate

(ii) Nuts & Bolts : As per IS:1363, IS:1364 and IS:1367. High Tension Friction grip bolts as per IS: 3757. High Tension Friction grip nuts as per IS: 6623.

(iii) Electrodes : Radiography quality, covered electrodes with heavy covering as per IS : 814 and relevant requirements of ASME Sec. IX and IIC. Bare Electrodes as per IS:7280 and flux wire combination as per IS : 3613.

(iv) Chequered plates : IS: 3502 (Minimum 6 mm thick O/P)

(v) Hand rail pipes : 32 mm NB Medium class of IS : 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate(100 mm high and 6 mm thick).

(vi) Crane Rails : As per IS : 3443.

2.16 Minimum thickness of Structure Members:

(a) Load Carrying members : 8 mm
(b) Tubes with both ends sealed : 4.9 mm (6 SWG)
(c) Tubes with unsealed ends : 8 mm
(d) Chequered plate : 6 mm O/P

2.17 Approximate max. full load speeds

- Main Hoist : 1.6 m/min
- Trolley travel : 15.0 m/min.
- Crane travel : 30.0 m/min.
- Creep speed for cross travel and long travel : 10% of the maximum speed

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

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

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

3.1 PROJECT DETAILS

	Particular	Details
a)	Customer	Patratu Vidyut Utpadan Nigam Ltd (PVUNL) – A Subsidiary of NTPC in Joint Venture with JBVNL.
b)	Engineer/Consultant/ Inspector	NTPC Ltd.
c)	Project Title	Patratu Super Thermal Power Project Expansion Phase – I (3X 800MW) – 400kV GIS Switchyard at Patratu STPP
d)	Project Location	Place: Patratu District: Ramgarh State: Jharkhand
e)	Latitude & Longitude	**Latitudes and Longitudes of the site are as follows:** Corner name: Top Corner — Latitude: 23° 38 ' 60 '' N — Longitude: 85° 17' 51.5" E Corner name: Bottom Corner — Latitude: 23° 38 '12.5 '' N — Longitude: 85° 17' 27" E Corner name: Left Corner — Latitude: 23° 38 ' 22.5 ''N — Longitude: 85° 17' 10.6 ''E Corner name: Right Corner — Latitude: 23° 38 ' 40 '' N — Longitude: 85° 17' 57 '' E
f)	Nearest Railway Station	Patratu – At a distance of about 4 km on Barkakhana-Barwadih Railway Line.
g)	Distance of project location from the Railway station	4 km (approx.)
h)	Nearest Major Town	Ranchi
i)	Distance of the town from the project site	45 km
j)	Nearest commercial airport	Birsa Munda Airport, Ranchi.
k)	Distance of airport from the project site	45 km

	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000 meters
d)	Pollution Severity	Heavily polluted
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3)
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	39 m/ sec
g)	Category of terrain	Cat –2
h)	Risk Coefficient "K1"	1.06

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV
1	Highest system voltage	420 kV rms
2	Lightning Impulse voltage	±1425kVp
3	Switching impulse voltage	±1050kVp
4	Power frequency withstand for 1 min (rms)	650 kV(rms)
5	Max. fault level (1 sec.)	63 kA
6	Minimum creepage distance	10500 mm

3.1.2 **AUXILIARY POWER:**

Sl.No.	Nominal Connection Voltage	Variations in Voltage	Frequency	Phase	Neutral
1	415V	±10%	50 (+3% -5%)	3Phase , 4 Wire	Solidly Earthed
2	240V	±10%	50 (+3% -5%)	1 phase	Solidly Earthed

Combined variation of voltage and frequency shall be + 10%. Design fault level of 415V system shall be restricted to 50kA rms for 1 second.

The operational limits for variation of DC voltage are (+) 10% to (-) 15%.

3.1.3 The various minimum heights of the AIS switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level	Line Take Off Gantry Height	Peak
400kV	8000mm	23000mm	8500mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

The minimum height of intermediate gantry tower for 400kV wherever required shall be 25 m and the peak (s) shall be of 8.5 m. The gantry width for 400kV AIS shall be minimum 27m or as required to meet the specified clearances.

3.1.4 The minimum clearances for 400kV switchyards shall be as given below:

	400kV
Phase to earth clearance	3500 mm
Phase to phase clearance	4000 mm
Section clearance	6500 mm

3.2 INSTRUCTION TO BIDDERS:

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

The supplier should be approved by Employer. If not, it is the responsibility of the vendor to be assessed and approved Employer, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Purchaser. Sufficient amount of information for justifying such proposals shall be furnished to Purchaser alongwith the bid to enable the Purchaser to determine the acceptability of these proposals.

Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood to be indicative of the function and quality desired and not restrictive. Other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories 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 unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard 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 under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

a) Indian Electricity Act

b) Indian Electricity Rules

c) Indian Explosives Act

d) Indian Factories Act and State Factories Act

e) Indian Boiler Regulations (IBR)

f) Regulations of the Central Pollution Control Board, India

g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

h) Pollution Control Regulations of Department of Environment, Government of India

i) State Pollution Control Board.

(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996

(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998

(m.) Explosive Rules, 1983

(n.) Petroleum Act, 1984

(o.) Petroleum Rules, 1976,

(p.) Gas Cylinder Rules, 1981

(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981

(r.) Workmen's Compensation Act, 1923

(s.) Workmen's Compensation Rules, 1924

(t.) NTPC Safety Rules for Construction and Erection

(u.) NTPC Safety Policy

(v.) Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening: 03-March-2017), of the codes and standards given below shall also apply:

a) Bureau of Indian standards (BIS)

b) Japanese Industrial Standards (JIS)

c) American National Standards Institute (ANSI)

d) American Society of Testing and Materials (ASTM)

e) American Society of Mechanical Engineers (ASME)

f) American Petroleum Institute (API)

g) Standards of the Hydraulic Institute, U.S.A.

h) International Organization for Standardization (ISO)

i) Tubular Exchanger Manufacturer's Association (TEMA)

j) American Welding Society (AWS)

k) National Electrical Manufacturers Association (NEMA)

l) National Fire Protection Association (NFPA)

m) International Electro-Technical Commission (IEC)

n) Expansion Joint Manufacturers Association (EJMA)

o) Heat Exchange Institute (HEI)

p) IEEE standard

q) JEC standard

Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

As regards highly standardized equipment such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective

equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.
In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

In case of any change in codes, standards & regulations between 03-March-2017 and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.

3.4 ENGINEERING DATA

3.4.1 Drawings

All drawings submitted by the supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the bidder (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

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

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

All manufacturing, fabrication and execution of work in connection with the equipment/system prior to the approval of the drawings shall be at the bidder's risk. The bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Purchaser. However, if some changes are necessitated in the design of the equipment/system at a later date, the bidder may do so, but such changes shall promptly be brought to the notice of the Purchaser indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. Approval of bidder’s drawing

or work by the Purchaser shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity with technical specification, unless otherwise expressly requested by the purchaser in writing.

3.4.2 Bidder's Drawing Submission and Approval Procedure

The following procedure for submission and review/approval of the drawings, data reports, information, etc. shall be followed by the bidder:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for Employer's information/interface and/or review and approval are referred by the general term "drawings".

b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be furnished by the bidder. This list shall be updated if required at suitable interval during detailed engineering.

c. All drawings (including those of sub-vendor) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The bidder shall furnish this format to his sub-vendor along with his purchase order for sub-vendor's compliance.

d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved, subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Bidder shall resubmit the drawings approved under Category II, III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.).

g. In case Bidder does not agree with any specific comment, he shall furnish the explanation for the same to Employer for consideration. In all such cases Bidder shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

h. It is the responsibility of the Bidder to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

i. Bidder shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Bidder shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**

j. As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Bidder will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per clause 3.5.5.

k. **Final Submission of drawings and documents:**

The Bidder shall furnish the following after approval of all drawings /documents and test reports:

List of drawings bearing the Employer's and Contractor's drawing number.

Six (6) bound sets along-with two (2) sets of CD-ROMs/ DVD/Portable hard disk of all final drawings/documents.

Bidder shall also furnish six (6) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.

The Bidder shall also furnish four (4) copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of instruction/ operations & maintenance manuals (after approval) for all the equipments.

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**

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

Date

Signature of the authorized representative of Bidder

Name ----------

Designation----------

Company seal----------

SCHEDULE-2

SCHEDULE OF TECHNICAL DEVIATION

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

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

1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract are deemed to be in compliance with the specification.

2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

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

Place

Signature of the authorized representative of Bidder

Name ----------

Date

Designation----------

Company seal----------

SCHEDULE – 3

SCHEDULE OF PAST EXPERIENCE AND QUALIFYING REQUIREMENT

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

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

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

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

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

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

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

SCHEDULE-5

SCHEDULE OF TYPE TESTS AND SPECIAL TESTS

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

Sl no.	Clause no/ page no of Specification	Details of test	Lab in which to be conducted
		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

Name----------

Date

Designation----------

Company seal----------

SCHEDULE-6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

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

SCHEDULE –7

ENCLOSURES TO SPECIFICATION

DRAWINGS

GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400 KV GIS BUILDING (9585-001-572-PVC-C-0249-Total Sheets-05 Nos.)

ANNEXURES

- ANNEXURE- QA1 – MQP (NTPC format) To be submitted by vendor during detailed engineering stage
- ANNEXURE- QA2 – FQP (NTPC format) To be submitted by vendor during detailed engineering stage

ANNEXURE-QA1

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV.NO.:	CONTRACT NO. :
		SUB-SYSTEM:	DATE:	MAIN-SUPPLIER:
			PAGE: …. OF….	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.		11.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER C**:** MAIN SUPPLIER, **N**: NTPC **P:** PERFORM **W**: WITNESS AND **V:** VERIFICATION. AS APPROPRIATE, **CHP:** NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"	एनटीपीसी NTPC	DOC. NO.:	REV…… CAT…..	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1 1/1 ENGG. DIV./QA&I

ANNEXURE-QA2

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV. NO.:	CONTRACT NO. :
		SUB-SYSTEM:	DATE:	MAIN-SUPPLIER:
			PAGE: …. OF….	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. **LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A'** SHALL BE WITNESSED BY NTPC FQA, **'B'** SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND **'C'** SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)	एनटीपीसी NTPC	DOC. NO.:		REV……
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F2-R1 1/1 ENGG. DIV./QA&I

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

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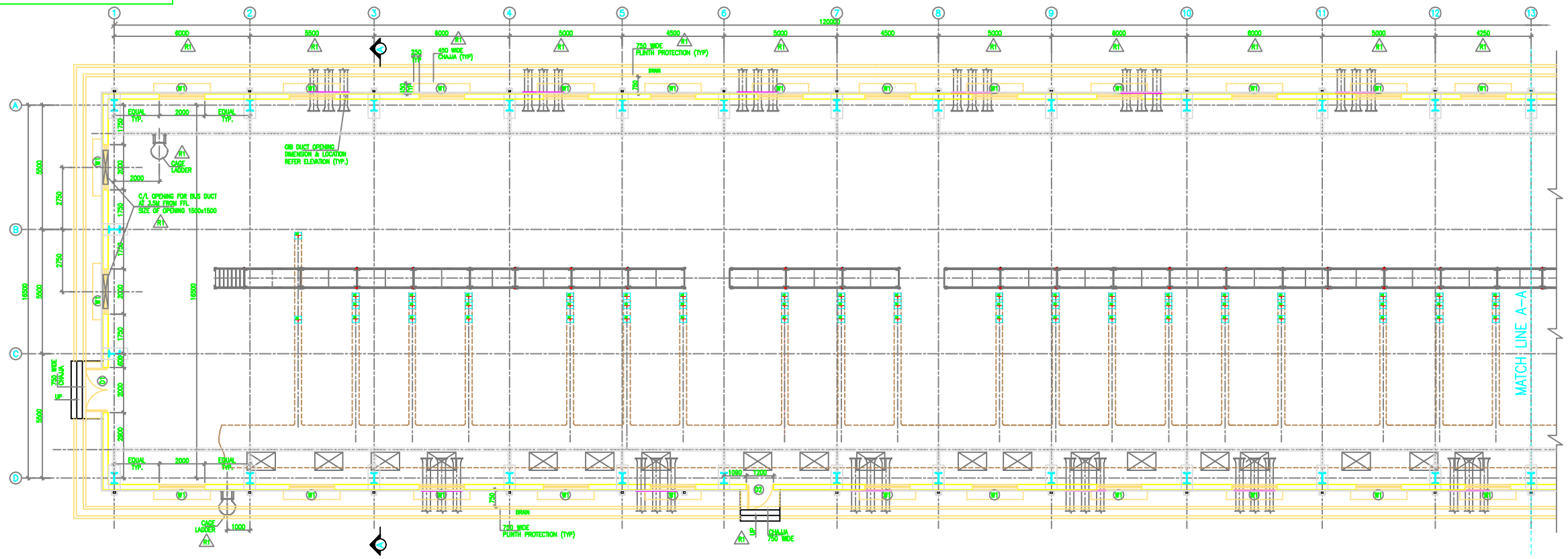
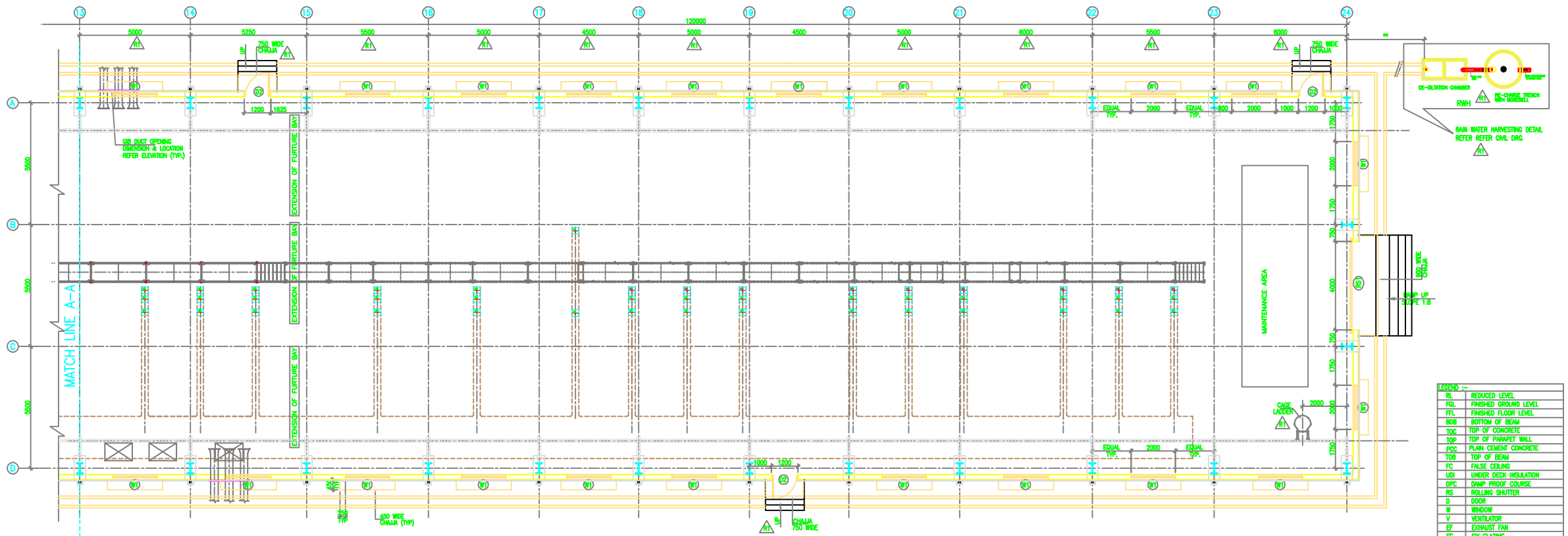
DRAWING No.



GROUND FLOOR PLAN



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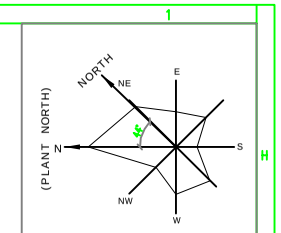
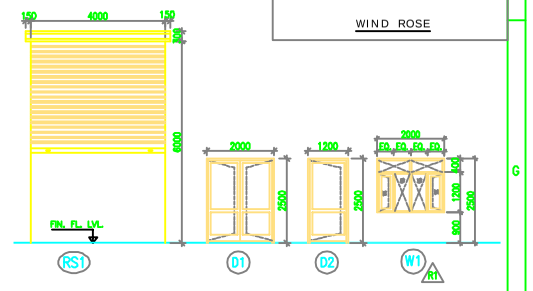




SCHEDULE OF DOORS & WINDOWS

TYPE	OPENING SIZE	CILL LEVEL	LINTEL LEVEL	NOS.	DESCRIPTION
RS1	4000x6000	--	6000	1	STEEL ROLLING SHUTTER
D1	2000x2500	--	2500	1	DOUBLE SHUTTER STEEL FRAME DOOR AS PER SPECS.
D2	1200x2500	--	2500	4	SINGLE SHUTTER STEEL FRAME DOOR AS PER SPECS.
W1	2000x1600	900	2500	47	PARTLY FIXED & PARTLY OPENABLE ALUMINIUM FRAME GLAZED SHUTTER WINDOW AS PER SPECS.

SCHEDULE OF FINISHES

1.0 BRICK WORK:
1.1 230mm THK. BRICK MASONARY IN C.M. (1:6) USING FLY ASH BRICK/ (IS 12894).

2.0 PLASTER:
2.1 INTERNAL: 12mm THK. PLASTER (1:6 CEMENT : SAND) MORTOR
2.2 EXTERNAL: 16mm THK. PLAIN PLASTER (1:6 CEMENT : SAND)

3.0 FLOORING:
3.1 GIS BLDG. CEMENT CONCRETE WITH METALLIC HARDENER TOPPING.
3.2 SKIRTING: 150 HIGH SKIRTING MATCHING WITH THE FLOOR SHALL BE PROVIDED.

5.0 PAINTING.
5.1 INSIDE FACES OF BRICK WALL WILL HAVE 2-COATS OF ACRYLIC DISTEMPER.
5.2 OUTSIDE FACES OF WALL BE PREMIUM ACRYLIC SMOOTH EXTERIOR PAINT. OVER PLASTER SURFACE.

WALL CLADING & ROOF SHEETING–
MINIMUM 0.5MM BMT (i.e. EXCLUDING THE THICKNESS OF GALVANIZING/ ALUMINIUM ZINC COATING & PAINTING) OF GRADE G550 AS PER AS1397 GRADE SS340 CLASS 4 AS PER ASTM A792M/ GRADE S350GD AS PER EN 10326 WITH ZINC COATING TO CLASS Z275/ ALUMINIUM ZINC ALLOY COATING TO CLASS AZ150 AND
ROOF SHEETING 50MM THICK PREFABRACATED INSULATED MATEL SANDWICH PANEL AS PER TECHNICAL SPECIFICATIONS.

ALL FINISHES SHALL BE AS PER TECHNICAL SPECIFICATIONS SAMPLES OF FINISHING ITEM SHALL BE APPROVED BY EIC BEFORE ORDERING IN BULK.

TERMS :-

RL	REDUCED LEVEL
FGL	FINISHED GROUND LEVEL
FFL	FINISHED FLOOR LEVEL
BOB	BOTTOM OF BEAM
TOC	TOP OF CONCRETE
TOP	TOP OF PARAPET WALL
PCC	PLAIN CEMENT CONCRETE
TOB	TOP OF BEAM
FC	FALSE CEILING
UDI	UNDER DECK INSULATION
DPC	DAMP PROOF COURSE
RS	ROLLING SHUTTER
D	DOOR
W	WINDOW
V	VENTILATOR
EF	EXHAUST FAN
FG	FIX GLAZING

NTPC REFRENCE DRGS.
1. GIS BUILDING – PLAN LAYOUT DRG. NO. – 9585-001-572-PVE-F-0283

NOTES:
1. ALL DIMENSION ARE IN MILIMETRE & ELEVATIONS ARE METRE.
2. SIZE OF COLUMNS ARE TENTATIVE AND SUBJECT TO CHANE AS PER STRUCTURAL DRAWING.
3. DOOR WIDTH ARE CLEAR MASONARY OPENING AND DOOR HEIGHTS ARE FROM FFL TO BOTTOM OF LINTEL.
4. ALL DIMENSIONS ARE READ AS UNPLATERED MASONARY & CONCRETE UNLESS NOTED OTHERWISE.
5. READ THIS DRAWING IN CONJECTION WITH TECHNICAL SPECIFICATION AND TENDOR DRAWING.

CA NO.	
ADDITIONAL INFORMATION W.O.No.	ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	

भारत हैवी इलेक्ट्रिकल्स लिमिटेड
पारेषण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता /SIGN.	दि/DATE
बनाया DRAWN	NS		22-04-19
जाँच CHECKED	TR	VG	22-04-19
स्वीकृत APPROVED	RDU	BVG/PLK	22-04-19

REV.	DATE	DRN
R1	16.05.19	DESN
		CHECKED
		APPROVED
ZONE	REVISED AS PER COMMENTS	

विभाग DEPT. | ग्रुप GRUP CODE | अनुपात / SCALE | कार्ड कोड CARD CODE

शीर्षक/TITLE
GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400 KV GIS BUILDING

इकाई.क्र./BHEL DRAWING NO. TB-397-607-662 | पुनर्/REV. 01

इकाई.क्र./NTPC DRAWING NO. 9585-001-572-PVC-C-0249 | पुनर्/REV. 01

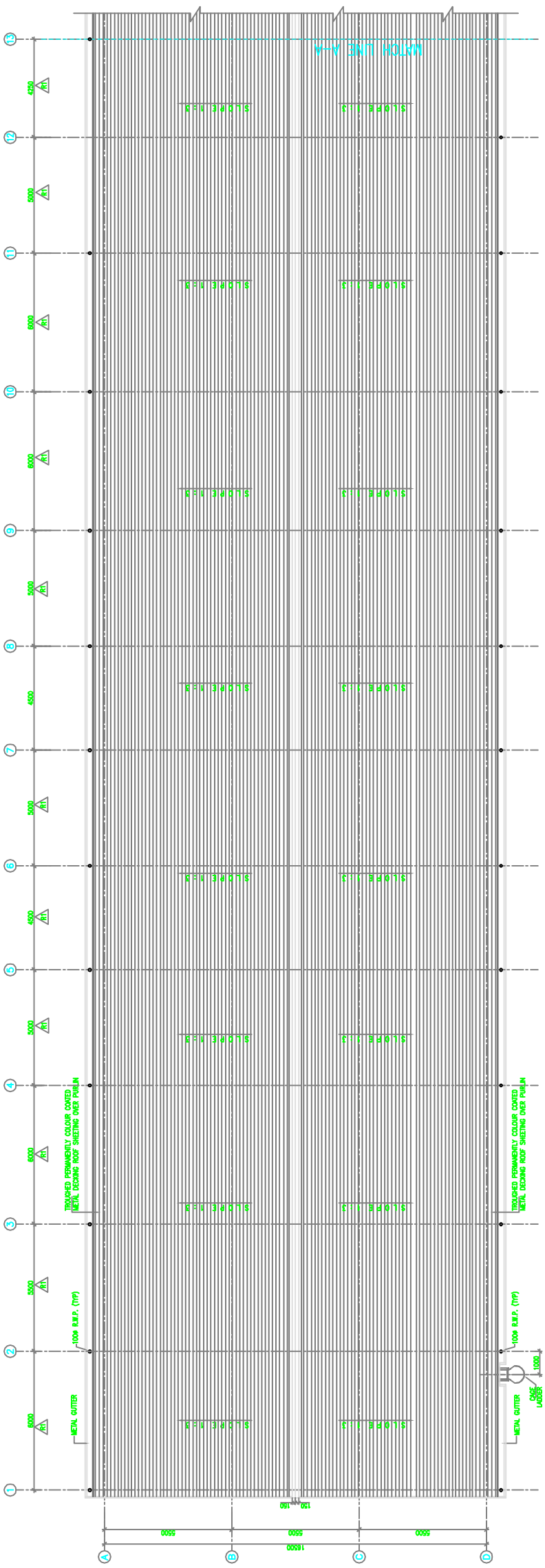
पृष्ठ क्र./SHEET No. 01 | अगला पृष्ठ /NEXT SHEET 02

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE

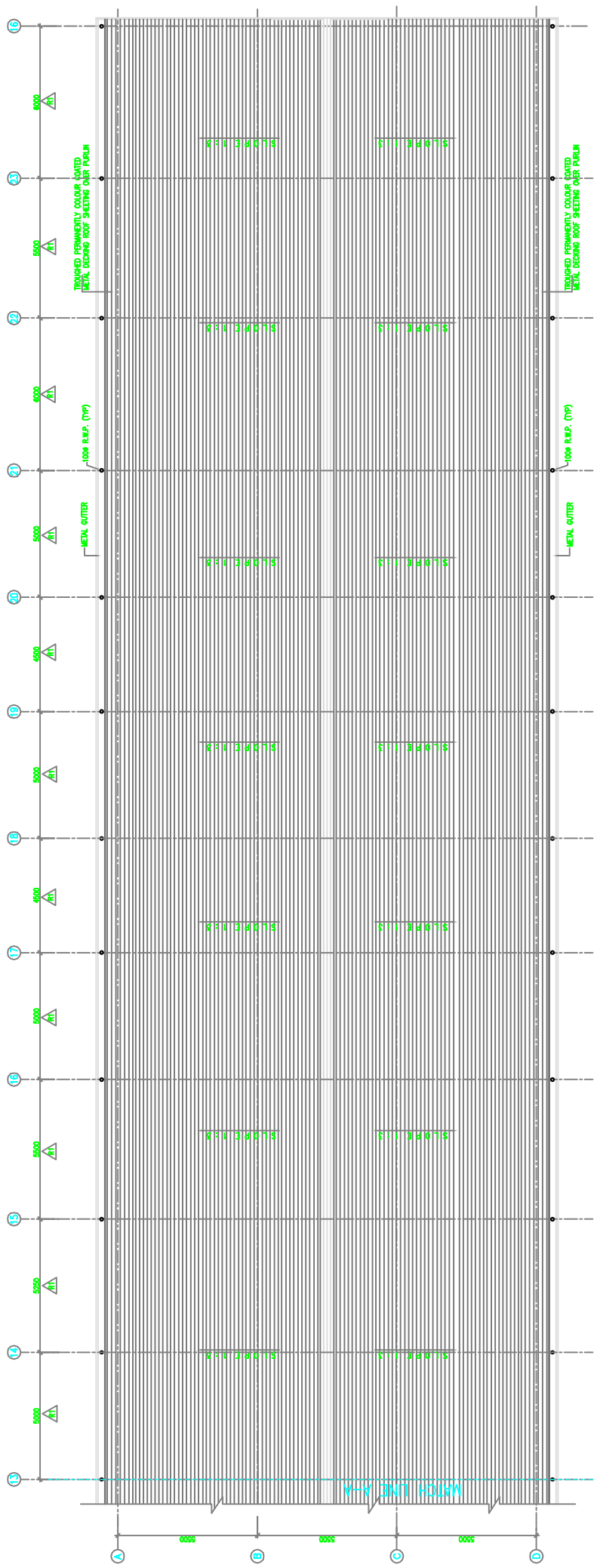
COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE
INVENTORY No.

E:\TEEKARAM\BHEL PATRATU\GIS BLDG\ARCH\ARCH GIS BUILDING FOR PATRATU (R1-16-05-19).dwg

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



TERRACE PLAN



TERRACE PLAN

CA NO.

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम

NAME OF CUSTOMER/PROJECT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता. /SIGN.	दि/DATE
डिज़ाइन DESIGN	NS		22-04-19
चेक्ड CHECKED	TR	VG	22-04-19
अनुमोदित APPROVED	RDU	BVG/PLK	22-04-19

ड्रॉइंग नं./BHEL DRAWING NO. TB-397-607-662 — पुनर्र/REV. 01

ड्रॉइंग नं./NTPC DRAWING NO. 9585-001-572-PVC-C-0249 — पुनर्र/REV. 01

पृष्ठ सं./SHEET No. 02 — अगला पृष्ठ /NEXT SHEET 03

विभाग DEPT. — कोड CODE — कार्ड कोड CARD CODE — अनुपात / SCALE

शीर्षक/TITLE
GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400 KV GIS BUILDING

REV.	DATE	DRN / DESN / CHECKED / APPROVED	ALTERED / CHECKED / APPROVED
R1	16.05.19		
ZONE	REVISED AS PER COMMENTS		

E:\TEEKARAM\BHEL PATRATU\GIS BLDG\ARCH\ARCH GIS BUILDING FOR PATRATU (R1-16-05-19).dwg

DRAWING No.

INVENTORY No. | SIGN. & DATE | REF. DRG. No.

COMPUTER DRC. PATH NAME :

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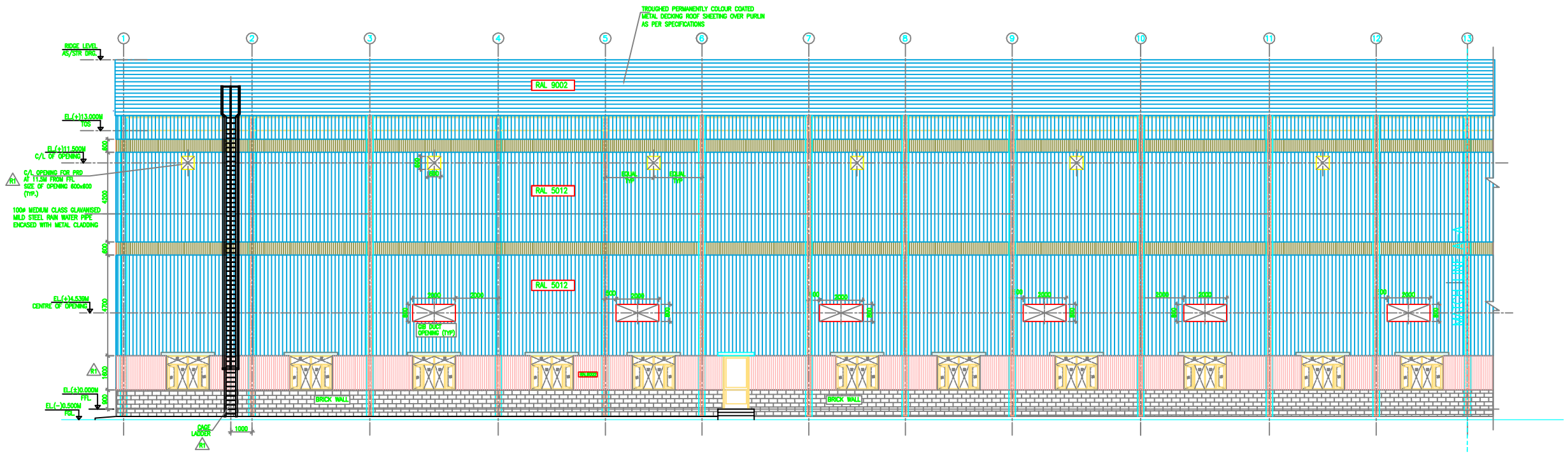
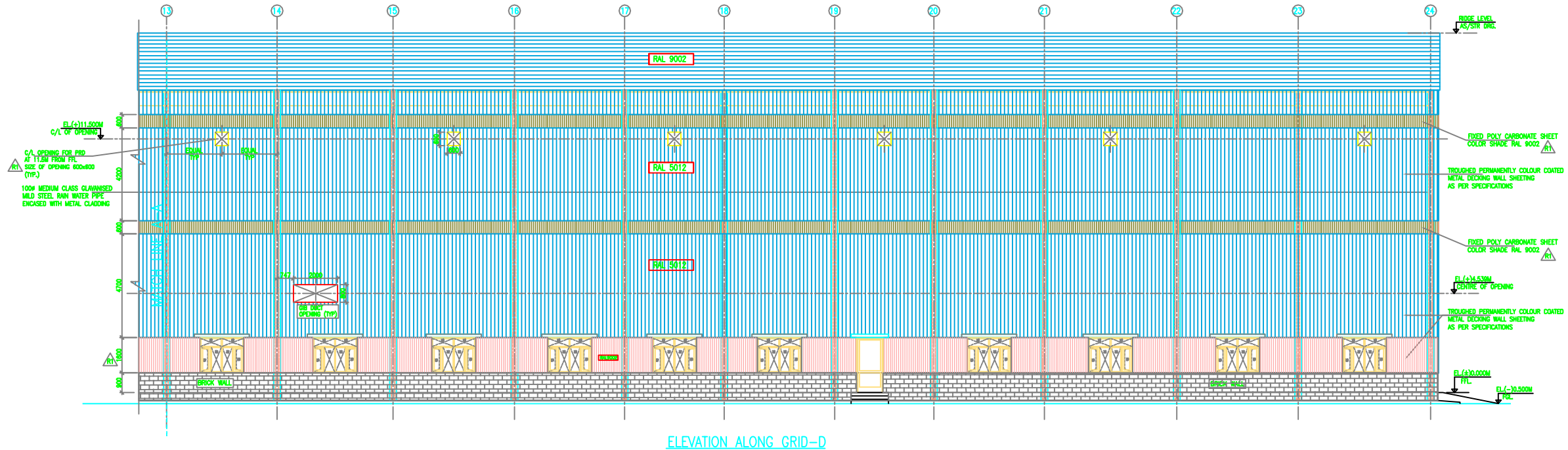
DRAWING No.



ELEVATION ALONG GRID-D



ELEVATION ALONG GRID-D

COLOUR CODE:-

SL. NO.	LOCATION	COLOUR CODE
1	SIDE CLADDING	(CODE: RAL5012)
2	POLYCARBONATE SHEET FOR CLADDING.	(CODE: RAL9002)

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	DRN / ALTERED / CHECKED / APPROVED
ZONE			ZONE			ZONE			ZONE			ZONE			ZONE			ZONE		

REV.	DATE	DRN / DESN / CHECKED / APPROVED	ZONE	REVISED AS PER COMMENTS
R1	16.05.19			

CA NO.

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
संचारण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता /SIGN.	दि./DATE
बनाया DRAWN	NS		22-04-19
जाँचा CHECKED	TR	VG	22-04-19
स्वीकृत APPROVED	RDU	BVG/PLK	22-04-19

विभाग DEPT. / कोड CODE / अनुपात / SCALE / कार्ड कोड CARD CODE

शीर्षक/TITLE
GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400 KV GIS BUILDING

हुबीगा.क./BHEL DRAWING NO. TB-397-607-662 — पुनर/REV. 01

हुबीगा.क./NTPC DRAWING NO. 9585-001-572-PVC-C-0249 — पुनर/REV. 01

पृष्ठ क्र./SHEET No. 03 अगला पृष्ठ/NEXT SHEET 04

COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE.

INVENTORY No.

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FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

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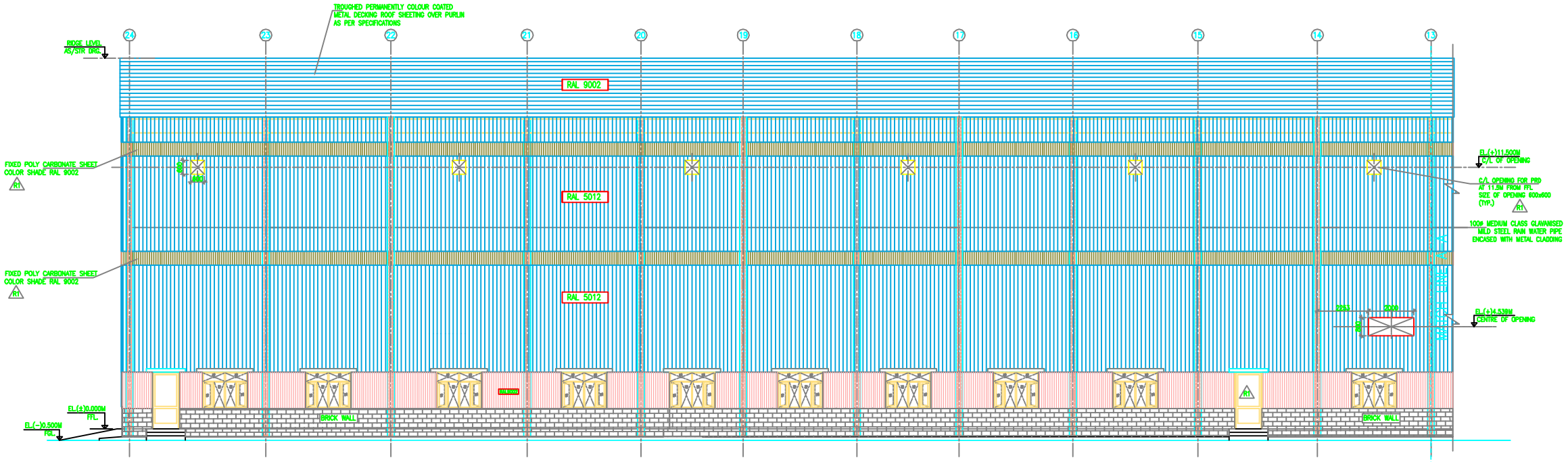
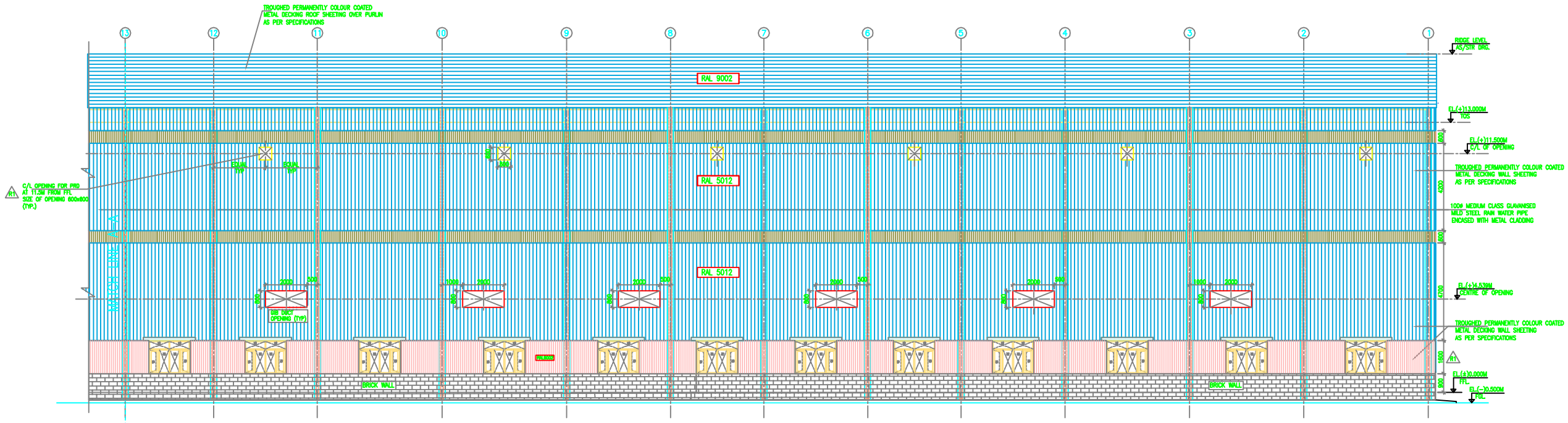
DRAWING No.



ELEVATION ALONG GRID-A



ELEVATION ALONG GRID-A

COLOUR CODE:-

SL. NO.	LOCATION	COLOUR CODE
1	SIDE CLADDING	(CODE: RAL5012)
2	POLYCARBONATE SHEET FOR CLADDING.	(CODE: RAL9002)

R1

CA NO.			
ADDITIONAL INFORMATION W.O.No.		ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT	
STATUS OF DRAWING		भारत हैवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	
DISTRIBUTION OF PRINTS			
REV. R1	DATE 16.05.19	DRN / DESN / CHECKED / APPROVED	
ZONE	REVISED AS PER COMMENTS		

	नाम /NAME	हस्ता /SIGN.	दि./DATE
बनाया DRAWN	NS		22-04-19
जाँचा CHECKED	TR	VG	22-04-19
स्वीकृत APPROVED	RDU	BVG/PLK	22-04-19

विभाग DEPT.	
कोड CODE	
अनुपात / SCALE	
कार्ड कोड CARD CODE	
शीर्षक/TITLE	GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400 KV GIS BUILDING
हाई.वा.क./BHEL DRAWING NO.	TB-397-607-662
पुनः/REV.	01
हाई.वा.क./NTPC DRAWING NO.	9585-001-572-PVC-C-0249
पुनः/REV.	01
पृष्ठ क्र./SHEET No. 04	अगला पृष्ठ/NEXT SHEET 05

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE

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COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE.
INVENTORY No.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

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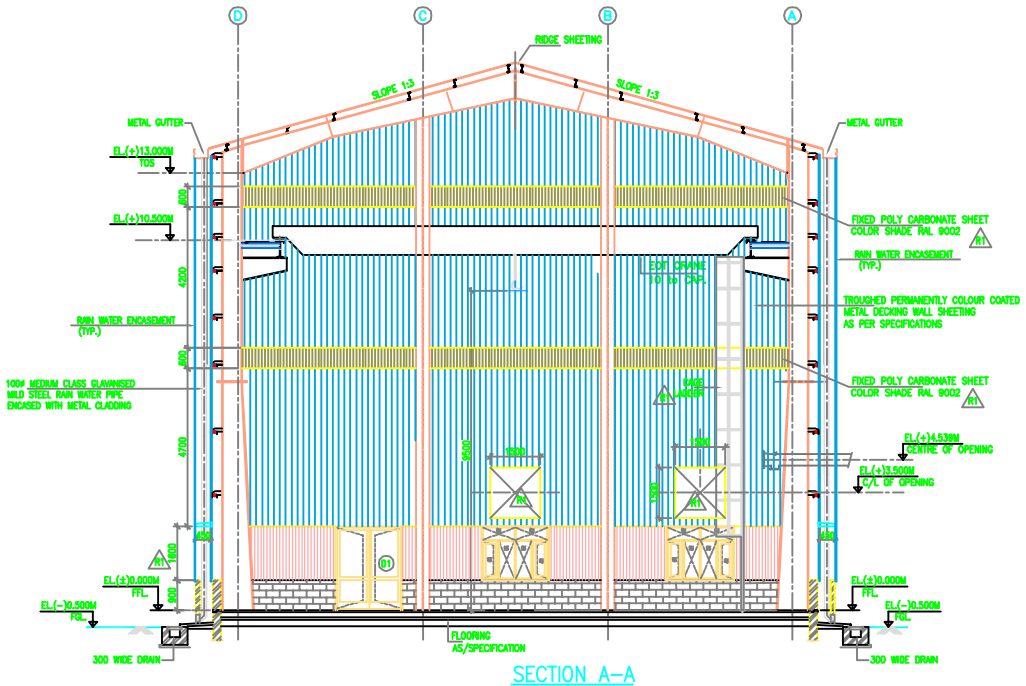
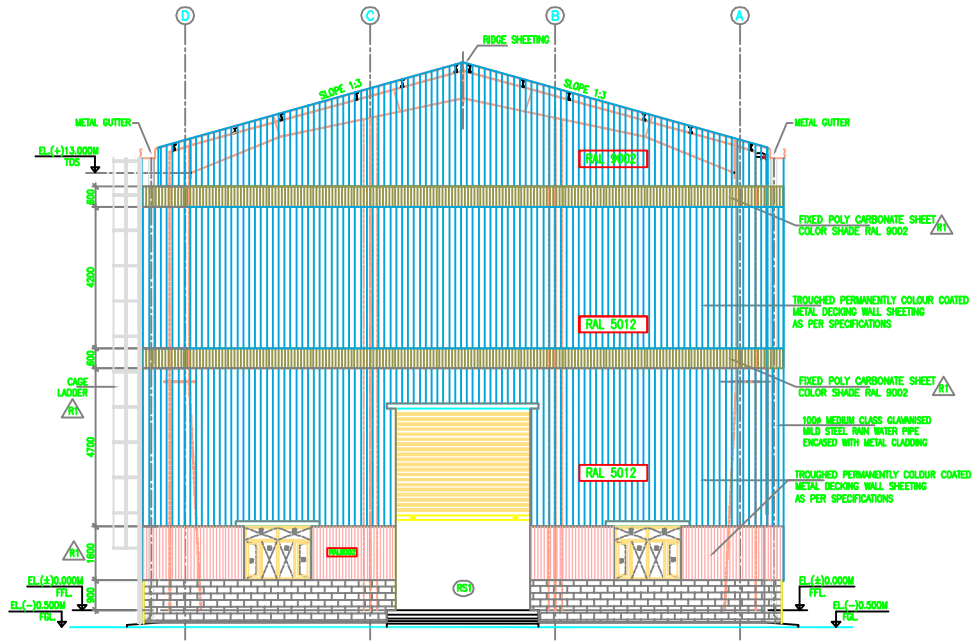
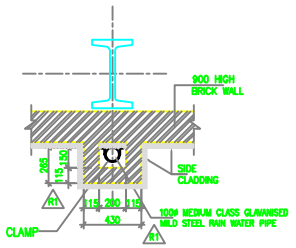
DRAWING No.



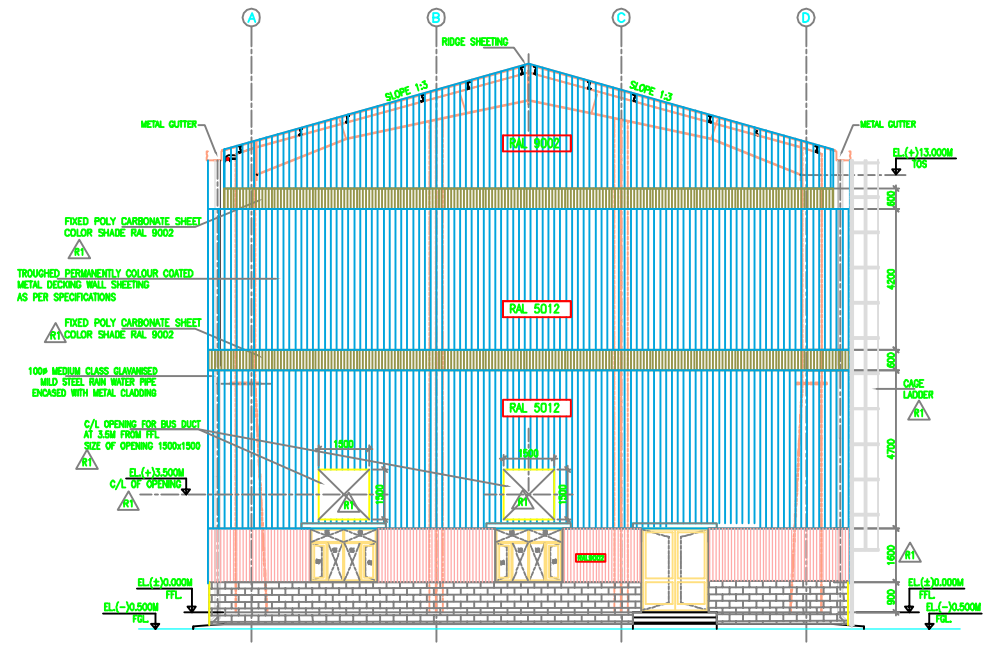
SECTION A-A



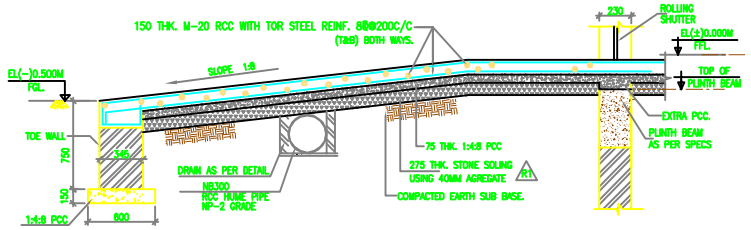
ELEVATION ALONG GRID-24



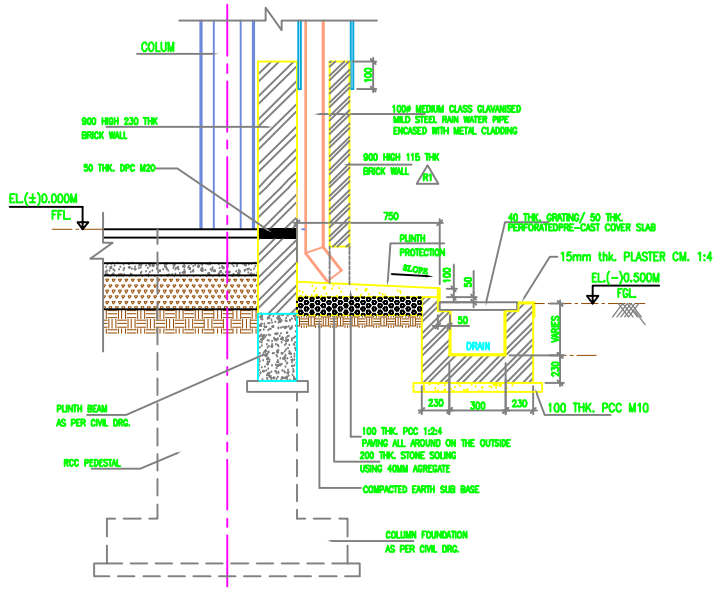
TYP. RWP FIXING DETAIL



ELEVATION ALONG GRID-1



DETAIL OF RAMP



PLINTH PROTECTION ALONG BUILDING WITH DRAIN-TYPICAL

COLOUR CODE:-

SL. NO.	LOCATION	COLOUR CODE
1	SIDE CLADDING	(CODE: RAL5012)
2	POLYCARBONATE SHEET FOR CLADDING.	(CODE: RAL9002)

R1

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	DRN / ALTERED / CHECKED / APPROVED
ZONE			ZONE			ZONE			ZONE			ZONE			ZONE		

REV.	DATE	DRN / DESN / CHECKED / APPROVED
R1	16.05.19	REVISED AS PER COMMENTS

CA NO.

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
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	नाम /NAME	हस्ता /SIGN.	दि./DATE
बनाया DRAWN	NS		22-04-19
चेक CHECKED	TR	VG	22-04-19
स्वीकृत APPROVED	RDU	BVG/PLK	22-04-19

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शीर्षक/TITLE
GA & ARCHITECTURAL PLAN, ELEVATION AND SECTION FOR 400 KV GIS BUILDING

ड्राईंग क्र./BHEL DRAWING NO. TB-397-607-662 — पुनर/REV. 01

ड्राईंग क्र./NTPC DRAWING NO. 9585-001-572-PVC-C-0249 — पुनर/REV. 01

पृष्ठ क्र./SHEET No. 05 | अगला पृष्ठ /NEXT SHEET --

COMPUTER DRG. PATH NAME :

SIGN. & DATE | REF. DRG. No. | INVENTORY No.

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