BHEL	TECHNICAL SPECIFICATION FOR EOT CRANES	SPEC.NO. ROS : 6304 REV : 00

BHARAT HEAVY ELECTRICALS LIMITED,

RANIPET – 632 406.

TECHNICAL SPECIFICATION

OF

10 MT EOT CRANE

UDANGUDI PROJECT

00	27.10.20	A. Kumar ABH	J. N. Ramalingam IMRL	KMS	Fresh issue
Rev. No	Date	Prepared	Checked	Approved	Remarks

272856/2021/BAP-WS(CON)		Enquiry No. :			
		Due Date :			
		Supplier Qtn. No.:			
		Date :			

SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR 10 MT *EOT CRANES*

NOTE:-

1. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance. 2. The offer and all documents enclosed with offer should be in English language only.

ADDRESS OF THE SUPPLIER :	
TELEPHONE NOS.:	
FAX NOS.:	
E-MAIL ADDRESS :	

SCOPE: SUPPLY, ERECTION & COMMISSIONING OF 10MT METRIC TON EOT CRANE COMPLYING WITH SPECIFICATION AS BELOW

SNO	DESCRIPTION FOR BHEL REQUIREMENT	BHEL Requirement	VENDOR OFFER	DEVIATIONS	REMARKS
1.0.0	**APPLICATION:**				
1.1.0	The subject crane is meant for the purpose of handling small to medium components in RO Desalination Plant area.	Vendor to note & confirm			
1.2.0	The crane will be put to use for INDOOR application with CT, LT and Hoist movements, in which all three motions may occur simultaneously.	Vendor to note & confirm			
1.3.0	The environment will be dust prone, humid, Corrosive and ambient temperature going up to 45 to 50 º C.	Vendor to note & confirm			
2.0.0	**SCOPE OF SUPPLY:**				
	Design, manufacture, supply, erection & commissioning of **Overhead Type** Electrically Overhead Travelling (EOT) Crane with shrouded DSL and with suitable current collector system & Rail as per the clearence **Drawing 2-WT-220-00320, Rev.00 enclosed**. Quantity - 1 Set	Vendor to confirm			
3.0.0	**TECHNICAL SPECIFICATIONS:**				
3.1.0	**Capacity: Main Hoist**				
	SWL i.e. Safe Working Load	10 - Tons			
	Test Load : 1.25 time the rated load.	Vendor to confirm			
3.1.2	No. of Trolleys : One(1)	Vendor to confirm			
3.1.3	No. of hoists on trolley : One (1)	Vendor to confirm			
3.1.4	Hoist : Standard Single Swiveling hook with locking device.	Vendor to confirm			
3.1.5	Crane Structure : Box type steel bridge girder complete with bridge rails, end stoppers, walkway platforms across the span of either side of crane and access ladders for double girder crane.	Vendor to confirm			
3.2.0	**Design Standard:** The crane design standard as per IS 807 international standard.	Vendor to confirm			
3.3.0	**SPAN (Wheel Centre to Wheel Centre Dimension/rail cetre to rail centre):**	10000mm			
3.4.0	**Height of lift**	**5000 mm**			
3.5.0	**Bay Length: (Length of long travel)**	36000 mm			
3.6.0	**CONTROL (Floor Operated - Pendent Operation with Push Button Station)**	Vendor to confirm			
3.7.0	**Control Voltage:** Shall be 110 V AC derived from input supply.	Vendor to note			
3.8.0	**Input Power Supply:** Shall be 415 ± 10% Volts, 50 ± 5% Hz, 3 Phase, 3 wire- AC.	Vendor to note			
3.9.0	**Duty Class:** Class – 3 [Indoor Service]	Vendor to confirm			
3.10.0	**Mechanism Group Classification:**	**M6**			
3.11.0	**DUTY CYCLE:** (Related to Drive Motor & Mechanisms)				
3.11.1	Hoists	60 % CDF			
3.11.2	Long Travel	60 % CDF			
3.11.3	Cross Travel	60 % CDF			
3.12.0	**SPEED:** (Operating speed with full load / Working Speed)				
3.12.1	Main Hoist	2 mtrs./minute.(Max.)			
3.12.2	Cross Travel (CT) / Trolley Travel	10 mtrs./minute.(Max.)			
3.12.3	Long Travel (LT)	15 mtrs./minute.(Max.)			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	BHEL Requirement	VENDOR OFFER	DEVIATIONS	REMARKS
3.12.4	Creep Speeds : 10% of full speed for all motors.	Vendor to confirm			
3.13.0	**MOTOR DETAILS:** *Vendor to provide details like capacity of motor, Frame size, make, type and No. of poles etc.*	Vendor to confirm & submit details			
3.13.1	Hoist	Vendor to submit			
3.13.2	Cross Travel (CT)	Vendor to submit			
3.13.3	Long Travel (LT)	Vendor to submit			
3.14.0	**GEAR BOX SIZES:**				
3.14.1	Hoist	Vendor to specify the make, type & size			
3.14.2	Cross Travel (CT)	Vendor to specify the make, type & size			
3.14.2	Long Travel (LT)	Vendor to specify the make, type & size			
3.15.0	**Acceleration:**				
3.15.1	Cross Travel (CT)	Vendor to specify			
3.15.2	Long Travel (LT)	Vendor to specify			
3.15.3	Hoist	Vendor to specify			
3.16.0	**Runway Rail Size: All required railing & supporting beam to be supplied by the Vendor (Ref. drawing : 2-WT-220-00320)**	Vendor to specify			
3.17.0	**Wheel Sizes:**				
3.17.1	End carriage complete with minimum two (2) nos. of wheels for each end carriage and access ladders from gantry platforms, spring buffers etc.	Vendor to specify			
3.17.2	Cross Travel (CT)	Vendor to specify			
3.17.3	Long Travel (LT) - ***Shall be matched with the above rails.***	Vendor to specify			
3.18.0	**Brake Details / Sizes:**				
3.18.1	Hoist - Two(2) nos. Electro-hydraulic thruster type brake.	Vendor to specify the size, type & make			
3.18.2	Cross Travel (CT) - a) Two (2) nos. Electro-hydraulic thruster type brake.	Vendor to specify the size, type & make			
3.18.3	Long Travel (LT) - Two(2) Electro Hydraulic Thruster type Brake	Vendor to specify the size, type & make			
3.19.0	**Hoist Rope Details: (Size & Number of Falls)**	Vendor to specify			
3.19.1	The crane installations shall be supplied with all the ropes (slings), lifting beam (if required), chains, shackles etc. needed for maintenance of the plant equipment/component	Vendor to confirm			
3.19.2	The minimum scope of supply per handling equipment (crane & hoist) for each lifting tackle includes the following items: • Two (2) nos. single ropes each with 2 eyes at the ends, each rope 2 m long • Two(2) nos. single ropes each with 2 eyes at the ends, each rope 4 m long • Four (4) nos. shackles	Vendor to confirm			
3.19.3	The load-bearing capacity of the ropes and shackles must be suitable for the relevant crane & hoist.	Vendor to specify & confirm			
3.19.4	The maximum tension in the rope shall not exceed 1/8 of the calculated braking capacity of the rope. The ropes shall be of the stranded type, and galvanized wires shall be used.	Vendor to specify & confirm			
3.19.5	The eyes of the single ropes must be secured with compression fittings. The length of the eyes must be at least 15 times the nominal diameter of the rope.	Vendor to specify & confirm			
3.19.6	For each installation a list shall be submitted, showing the number, type, nominal loadcarrying capacity and strength characteristics of the materials used. In addition, factory and acceptance certificates shall be submitted for all ropes (slings) and materials.	Vendor to specify & confirm			
3.20.0	**The EOT cranes are designed with a maximum deflection of 1/900 of crane span at rated load.**	**Vendor to confirm**			
4.0.0	**Clearance:** End and Top clearance to be fixed to suit the workshop building clearances as per the enclosed tender drawin**g**	Vendor to submit the clearance drawing .			
5.0.0	**STRUCTURAL FABRICATION *(Constructional Details):***				
5.1.0	**Double Girder :** Bridge Girder of Box Type & Steel Fabricated Construction.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	BHEL Requirement	VENDOR OFFER	DEVIATIONS	REMARKS
5.2.0	**Raw Material:** Only steel plates tested and certified for quality by reputed inspection authorities, shall be used.	Vendor to confirm and produce certificates.			
5.3.0	**Girder Joint. One Joint is allowed in case of Box type construction and No Joint is allowed in case of I Beam Type.**	Vendor to confirm			
5.4.0	**Welded Joint Testing:** (Applicable for Box Type Only) All Butt Welded Joints in the girder (both compression/ tension and flanges / web joints) shall be subjected to 100% X-Ray Testing and X-Ray Films to be produced for BHEL evaluation and form part of the documentation.	Vendor to confirm			
5.5.0	**Platform on Girder:** TThe maintenance Platform shall provided along the girder shall be provided for maintaining the control panel & crab. Hand rail and toe guard shall also be provided	Vendor to confirm			
5.6.0	**Machining Operation:**				
5.6.1	All mechanical mating surfaces and wheel seating areas are to be machined to the required finish and protected.	Vendor to confirm			
5.7.0	**Surface Cleaning:**				
5.7.1	Both the Girder and the Trolley are to be shot blasted or chemically treated for surface cleaning, after completion of all operations but prior to painting.	Vendor to confirm and produce necessary certificates			
5.8.0	**Painting Instructions:**				
5.8.1	As per Annexure A- Painting Procedure Attached along with this specification.	Vendor to confirm			
6.0.0	**MECHANICAL ELEMENTS:**				
6.1.0	**Gears:** Gears in all the Stages shall be helical in design and to be of machined, lapped and hardened to 300-350 BHN	Vendor to confirm			
6.2.0	**Gear Box Casing:**	Vendor to specify			
6.3.0	**Rope Drum:** Rope-drums shall be grooved and welded steel conforming to IS 3938. Drum length shall be such that each lead of wire rope has a minimum of two full turns on the drum when the hook is at its lowest position not taking into consideration turns covered by wire rope anchorage and one spare groove for each lead of wire rope on the drum when the hook is at its highest position.	Vendor to confirm			
6.4.0	**Wheels:** Shall be of forged and Wheel Tread hardened to **300-350 BHN**. LT Wheels shall be fitted with L-Type Bearings	Vendor to confirm			
6.5.0	**Pulley Dimension:** Rope Pulley diameter shall be 23 times that of Rope diameter.Wire ropes shall be extra flexible with well lubricated hemp core having thirty-six (6X36) wires per strand shall be provided. Wire ropes shall be of Right Hand Ordinary (RHO) lay construction.Rope sheaves shall be of cast steel or fabricated steel with anti-friction bearings. Sheaves shall be fully guarded to prevent rope coming off	Vendor to confirm			
6.6.0	**Lifting Hook:** Hook shall be forged steel supported on a ball or roller bearing. The hook shall rotate freely on this bearing. Hook shall have swivels and safety latch. Locking pin shall be provided to prevent swivelling of hook. The sleeves of hook block shall be encased in an oil tight casing permitting generous lubrication of wire ropes & sheaves & also preventing accidental trapping of hands.	Vendor to specify			
6.7.0	**Lubrication:**				
6.7.1	Suitable lubrication system shall be provided for gear box, all rotating parts wherever applicable. Details of the same to be furnished.	Vendor to furnish			
6.8.0	**Buffers (End Stoppers):**				
6.8.1	Buffers of adequate size shall be provided both in CT & LT to stop the crane in the event of an overshoot by the operation.	Vendor to provide			
6.9.0	**Guards:** Suitable guards shall be provided for all rotating parts like couplings, wheels etc..	Vendor to provide			
7.0.0	**ELECTRICAL ELEMENTS:**				

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7.1.0	**Operational Controls:** The Crane shall be controlled Pendent push button Station with 7 push buttons (EMERGENCY STOP,LEFT,RIGHT,FORWARD,REVERSE,RAISE,LOWER), mounted on a suitable powder coated MS or FRP pendant station. Clustered LED Indication lamps for Power supply "ON". Control Voltage: Shall be 110V AC derived from 415/110v control supply transformers. For control transformer sizing, 20% over loading to be considered while sizing the rating. The EMERGENCY push button shall be so arranged as to immediately put off the main supply and apply all the brakes simultaneously irrespective of position. Control for Hoisting /CT/LT operations: Thru' VVVF with minimum 6 pulse design. VVVF system shall be capable of withstanding upto 50 Deg C without derating.	Vendor to confirm			
7.2.0	Control Panel & Protection: All Panels, Limit-Switches and Motors shall have IP 55 protection. The pendent control switch, limit switch etc. shall conform to IS: 3938. Control Panel frame shall be made of 1.6mm thick CRCA sheet, covers and hinged(continuous) doors of 1.6mm thick CRCA. Paint shade RAL 7035 Light grey. Gland plate shall be made out of 3mm CRCA Sheet with necessary gaskets, Earthing terminals shall be provided on both sides of the panel. 20% spare power, control terminals shall be provided in the panel. Control panel shall be suitable for Operating temperature of 50 Deg C(outside the enclosure) prevailing at site.Panel space heaters are to be provided to avoid condensation within panel.	Vendor to confirm			
7.3.0	Motors: Motors shall in general conform to IS-12615 and IS-1231 suitable for hoist duty. Crane motor not being of continuous duty hence shall also not be energy efficient. Motor ratings shall be 25% (at least) over the maximum power requirement. The hoist motors shall be rated to lift 125% of the design load at rated speed. Motors shall suit the duty class S4, cyclic duration factor 60% and 300 starts per hour. Motor shall have class F insulation temperature rise limited to class B and enclosures shall conform to the degree of protection IP-55. Motors shall be suitable for Operating temperature of 50 Deg C prevailing at site. Brakes shall be electromagnetic as per relavent Standard.	Vendor to confirm			
7.4.0	**Electric Contactors:** All Panels shall have ABB/SCHNEIDER/SIEMENS/L&T/GE/C&S contactors suitable for Crane operations. **Motors:** KIRLOSKAR/ NGEF/ SIEMENS/ BBL/ CGL/ Laxmi Hydraulics/ Jyoti Ltd/ BEML/ ABB/ MARATHON **VVVF Drive:** ABB/SIEMENS/SCHNEIDER/YASKAWA	Vendor to confirm			
7.5.0	BHEL will arrange the 415V, 3phase, 3 wire, 50Hz, AC power supply upto the Isolating box.	Vendor to confirm			
7.6.0	The Isolating MCCB box of minimum 32A (Vendor Scope of supply) & further distribution of power supply for control, panel space heating shall be in vendor's scope only.	Vendor to confirm			
7.8.0	**DSL**				
7.8.1	Copper Shrouded bus bar type. Minimum 20% allowance for wear and tear shall be considered during sizing. Voltage drop for all conductors and cables/ wires shall be limited to 3% of rated voltage between the main disconnect witch and motor terminals.	Vendor to confirm			
7.8.2	Multi core Trailing cable shall be 1100 V grade, tinned copper as per Class – 5 of IS-8130, heat resistant, with EPR insulation and should have inner sheath and outer sheath with heat resistant, oil resistant and flame retardant heavy duty FRLS properties	Vendor to confirm			
7.9.0	**Limits:** Each hoist shall be provided with both rotary and counter weight limits. 2 way lever type Limit switches shall be provided for both CT & LT.	Vendor to confirm			
7.10.0	**DSL & Current Collector System:**				
7.10.1	Crane shall be put into operation in the bay of bay length as indicated in enquiry. The vendor shall offer Copper conductor shrouded DSL of suitable rating with one end feed of power supply. DSL Current rating shall be chosen upon derating with factor of 0.87 over the sum of FL Currents of two motions having maximum KW that can work simultaneously plus aux. Load.	Vendor to confirm & provide details			
7.10.2	Erection of DSL and supply of fixing elements are vendor's scope.	Vendor to confirm			

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7.10.3	Current collection system suitable for the above DSL shall be offered along with the crane. Two point earthing scheme to be followed and earthing conductors shall be offered along with the crane.	Vendor to confirm			
8.0.0	**Cables**				
8.0.1	Multi core Trailing cable shall be 1100 V grade, tinned copper as per Class – 5 of IS 8130, heat resistant, with EPR insulation as per IEC 60502-1 and should have inner sheath and outer sheath with heat resistant, oil resistant and flame retardant heavy duty FRLS properties. Cables shall be suitably chosen upon derating with factor of 0.87 for current-carrying capacities for cables in the air and supported in festoon arrangement. Cable sizing shall be done such that the 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.	Vendor to confirm			
9.0.0	**DOCUMENTS/DETAILS for APPROVAL:** The following documents / details shall be submitted to BHEL for Approval within ***20 days of PO placement*** , prior to taking up the manufacture of the crane.	Vendor to confirm			
9.1.0	**Drawings / Documents:**				
9.1.1	GA Drawing of the EOT Crane.	Vendor to submit			
9.1.2	GA Drawing of Crab with Trolley.	Vendor to submit			
9.1.3	Drawings of Bridge, End-Carriage and their connections.	Vendor to submit			
9.1.4	Sub-Assembly Drawing for Wheels, Hook Blocks, Gear Boxes & Hoist Drums.	Vendor to submit			
9.1.5	Calculations for Selection of Electric Motors, Gear Reducers, Brakes, Couplings, etc.	Vendor to submit			
9.1.6	Calculations for Bridge Girder, Crab, End - Carriage and their connections.	Vendor to submit			
9.1.7	Wiring Diagram with Logic Circuits.	Vendor to submit			
9.1.8	Cable Selection based on current rating.	Vendor to submit			
9.1.9	Technical data sheets				
9.1.10	Crane clearance diagrams showing various dimensions				
9.1.11	GA Drawing for Drive and Transmission Unit for Bridge Travel, Trolley Travel, and Hoist				
9.1.12	GA Drawing for Suspension Unit for Hook Block				
9.1.13	GA Drawing for Main Hook Block				
9.1.14	GA Drawing for Protection Control & Lightning Panels				
9.2.0	**Technical Details:**	Vendor to submit			
9.2.1	Total Weight of the Crane including all Electrical Equipments.	Vendor to specify			
9.2.2	Total Weight of Trolley including all Electrical Equipments.	Vendor to specify			
9.2.3	Weight of each Bridge assembled and ready for erection with and without Mechanical and Electrical Equipment.	Vendor to specify			
9.2.4	Weight of each End - Carriage: In assembled and ready for erection condition.	Vendor to specify			
9.2.5	Total Weight of Structural, Mechanical and Electrical Equipments. (To be indicated separately)	Vendor to specify			
10.0.0	**INSPECTION:** The following Schedule of Stage Inspections shall be strictly adhered to prior to dispatch from the Supplier's Works in case of Box Type Girder. In case of I Beam Construction both stages will be done together prior to despatch	Vendor to confirm			
10.1.0	**STAGE-I Inspection before Closing BOX Construction:**				
10.1.1	Verification of Test Certificate for Raw Materials used for Girder,	Vendor to confirm			
10.1.1	Verification of X-Ray Report of Butt-Joints coming in the Girders and Random Testing on the Welds, by physical examination.	Vendor to confirm			
10.2.0	**STAGE- II (Final Inspection):**				
10.2.1	Verification of Test Certificate for Raw Materials used for Girder, End-Carriages, Trolley, Gear Box Casings, etc	Vendor to confirm			
10.2.2	Inspection of Bridges and End – Carriages with Wheel Assembly and Alignment checking	Vendor to confirm			
10.2.3	Measurement of CAMBER in the Bridges.	Vendor to confirm			
10.2.4	Full / Rated Load Test and Deflection Test.	Vendor to confirm			

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10.2.5	Deflection Measurement.	Vendor to confirm			
10.2.6	25% OVER-LOAD Lifting Ability Check.	Vendor to confirm			
10.2.7	Verification of Span & Diagonal Dimensions, Checking of Wheel Alignment, Mechanical Assemblies and Total Alignment.	Vendor to confirm			
10.2.8	Free running of the all the Mechanisms.	Vendor to confirm			
11.0.0	**CRANE ERECTION & COMMISSIONING:**				
11.1.0	**Unloading & Erection:** Vendor shall erect the crane at site (RO DM Plant building in the specified Thermal Power station) . Necessary Crane, tools & equipments required for erection shall be brought by the supplier.	Vendor to note			
11.2.0	**Crane Commissioning:** Prove –Out for the Crane's Capacity and Smooth Functioning of the Crane (at site) shall be the RESPONSIBILITY of the supplier.	Vendor to confirm			
11.3.0	All safety equipments like safety boot, safety belt, helmet, gloves, goggles etc. required for erection personnel shall be brought by the vendor.	Vendor to confirm			
12.0.0	**O & M MANUALS: 6 Copies** of Erection, Operation & Maintenance Manual, containing the following technical drawings & details shall be submitted.	Vendor to confirm			
12.1.0	**Drawings & Details:**				
12.1.1	Crane GA Drawing	Vendor to confirm			
12.1.2	Crab Assembly Drawing	Vendor to confirm			
12.1.3	Total Crane Wiring Schematics	Vendor to confirm			
12.1.4	Detailed Wiring Diagrams for Sub-Systems / Panels	Vendor to confirm			
12.1.5	Detailed part drawings with full dimensions and materials for all mechanical items such as gear boxes, wheel assembly, botom block assembly,coupling & brake units etc., shall be submitted.	Vendor to confirm			
12.1.6	Detailed Specifications/Ratings, model no, cable schedule,make shall be provided for all Electrical items such as Motors, Contactors, Push Button Station & Cables etc.,	Vendor to confirm			
12.1.7	Warranty / Guarantee Card for all Bought-Out-Items.	Vendor to confirm			
12.1.8	Trouble Shooting Chart for Main and all Sub-Systems	Vendor to confirm			
12.1.9	Electrical power & Control circuit wiring diagram with BOM, GA drg of pendant push button station, panel GA drg, Panel internal component arrangement drg.	Vendor to confirm			
13.0.0	**PERFORMANCE GUARANTEE:**				
13.1.0	The Performance of the Total Crane and / or the Components / Sub-Assemblies / Bought-Out-Items shall be guaranteed for a minimum period of 12 months from the date of acceptance of the crane at site .	Vendor to confirm			
14.0	**Vendor to submit the following along with the offer**				
14.1	Signed confimration of BHEL specification.				
15.0.0	**Mandatory Spares.**				
15.1.0	**Electrically Operated Crane (For each type & capacity)as applicable**				
15.1.1	**Spares for long travel unit**	Vendor to confirm			
	Set of axle bearings : 1 set	Vendor to confirm			
	Set of gearbox bearings with sleeves : 1 set	Vendor to confirm			
	Long travel end shaft bearings : 1 set	Vendor to confirm			
	Coupling : 1 set	Vendor to confirm			
	Seals for travel gear box : 1 set	Vendor to confirm			
	Long travel brake shoes : 1 set	Vendor to confirm			
	Long travel brake springs : 1 set	Vendor to confirm			
	Long travel brake shoe liners : 1 set	Vendor to confirm			
15.1.2	**Spares for cross travel unit**	Vendor to confirm			
	Axle bearings : 1 set	Vendor to confirm			
	Set of gearbox bearings with sleeves : 1 set	Vendor to confirm			
	Set of seals for gearbox : 1 set	Vendor to confirm			
	Cross travel end shaft bearing : 1 set	Vendor to confirm			
	Coupling : 1 set	Vendor to confirm			
	Cross travel brake shoes : 1 set	Vendor to confirm			
	Cross travel brake springs : 1 set	Vendor to confirm			
	Cross travel brake shoe liners : 1 set	Vendor to confirm			
15.1.3	**Spares for main hoist**	Vendor to confirm			
	Main hoist pulley bearings : 1 set	Vendor to confirm			
	Set of bearings for rode drum : 1 set	Vendor to confirm			

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	Set of bearings for gear box : 1 set	Vendor to confirm			
	Set of seals for main hoist : 1 set	Vendor to confirm			
	Main hoist brake shoes : 1 set	Vendor to confirm			
	Main hoist brake springs : 1 set	Vendor to confirm			
	Main hoist brake shoe liners : 1 set	Vendor to confirm			
	Disc pad : 1 set	Vendor to confirm			
15.1.4	**Electrical: control panels/motors**	Vendor to confirm			
	Power contactor of each rating : 2 nos	Vendor to confirm			
	Over load relays of each rating : 2 nos	Vendor to confirm			
	MCCB/MPCB of each rating : 2 nos	Vendor to confirm			
	Push button of each type : 2 nos	Vendor to confirm			
	Spares for VVVF drive of each rating : As required	Vendor to confirm			
	Set of bearings for main hoist motor : 1 set	Vendor to confirm			
	Set of bearings for cross travel motor : 1 set	Vendor to confirm			
	Set of bearings for long travel motor : 1 set	Vendor to confirm			
	Note : One set consists of quantity required for complete replacement for one hoist of each type & capacity				
16.0.0	**Commissioing Spares**				
16.0.1	Bidders to provide the list as applicable & the same will be considered for price evaluation.	Vendor to confirm			
17.0.0	**Erection, Commissioing & Testing**				
17.0.1	As per Attached Technical Specifcation ROS : 9054, Rev:00	Vendor to confirm			
Notes :					

1) Service cage with all protections and access ladder, for maintenance of DSL's.
2) Crab (trolley) with wheels and drive equipment for hoists and trolley complete with motors, gear reducers with Suitable arrangement for collection of oil spillage, brakes, limit switches, couplings, rope drums, wire ropes, main hook, auxiliary hook, end stoppers etc.
3) Set of crane longitudinal drive equipment complete with motor, gear reducers with Suitablearrangement for collection of oil spillage, brakes, shaft bearings, gear pinions, and limit switches.
4) EOT crane runway gantry rails complete with fixtures comprising of fixing clamps (machinedto suit rail flange contour), bolts, nuts etc for effective crane longitudinal runway length, end stoppers specified.
5) Brakes for all motion and limit switch for over hoisting/lowering, CT and LT motion.
6) Runway conductors & bridge cross conductors with accessories.
7) Crane shall be operated through Pendant Push Button station.
8) Crane buffer stops shall include the buffers on the crane itself. The stoppers to be fixed on the building frame and wheel stoppers shall be provided at either end of the crane runway.
9) Lifting beam, loose slings and cradle shall be provided as required.
10) The complete electrical equipment basically including:
• Load break changeover switch mounted on the building structure.
• Cabling between the load break switch and the down shop leads.
• Down shop leads and current collector for crane.
• Load break switch on the crane bridge walkway
• Protective and control switch gear
• Motors
• Festoon cable system for crab
• Master controllers
• Pendent controller (where specified)
• Wireless remote control (where specified)
• Indicating lamps, push buttons.
• Lighting panel, lighting fixtures, Cabin fan, light, alarm/bell, socket outlets etc.
• All power and control cables.
• Cable trays & supports, Conduits, Cable glands, lugs & clamps etc.
• Crane earthing system
• Variable Voltage and Variable Frequency (VVVF) control for speed control of crane motors.
• Electronic Anti-collision device
10) First Fill of Grease & Oil is in the scope of the bidder.
11)Crane and hoist control shall be from Variable Voltage and Variable Frequency (VVVF) drive. Creep speed shall be achieved through VVVF drive for cranes.
12)Layout Considerations: The span of EOT cranes shall be derived based on the building layout with considerations to clearances and hook approach to handle all equipments.
13) At crane girder level, Access walkway of minimum 500 mm width with safety handrails on one side shall be provided along the full span length of the cooling water building crane and other double girder cranes.

	SPECIFICATION FOR ELECTRICALLY OPERATED MONO RAIL HOIST WITH MOTOR DRIVEN TROLLEY	SPEC.NO. ROS :6305 REV : 00

BHARAT HEAVY ELECTRICALS LIMITED,
RANIPET – 632 406.

TECHNICAL SPECIFICATION

FOR

ELECTRICALLY OPERATED MONO RAIL HOIST WITH MOTOR DRIVEN TROLLEY & MANUALLY OPERATED HOIST.

UDANGUDI PROJECT

00	27.10.20	A. Kumar ABH	J.M. Ramalingam IMRL	KMS	Fresh issue
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बी एच ई एल BHEL	SPECIFICATION FOR ELECTRICALLY OPERATED MONO RAIL HOIST WITH MOTOR DRIVEN TROLLEY	SPEC.NO. ROS :6305 REV : 00

A) ELECTRICALLY OPERATED MONO RAIL HOIST

a) EQUIPMENT : Electrically Operated Mono rail Hoist with motor driven trolley (Over head/ under slung).
b) APPLICATION : Lifting and moving Equipments & Chemicals
c) INSTALLATIONS : INDOOR /OUTDOOR (Based on the location)
d) SURROUNDINGS : Humid & Corrosive atmospheric in RO Desalinaion Plant area.
e) AMBIENT TEMPERATURE : Upto 50 Deg. C

1. SCOPE OF SUPPLY FOR ELECTRICALLY OPERATED MONO RAIL HOIST

Sl. No.	Capacity (MT)	Height of the Lift(m) approx ..	Length of Long Travel (m)	Hoist Speed (mtr/min)	Long Travel Speed (mtr/min)	Location	Qty(Set)
1	10	9	12	3.5 to 5	5 to 10	Control Room	1
2	3	5.5	75	3.5 to 5	5 to 10	UF-RO-DM pump house	1
3	3	5.5	23	3.5 to 5	5 to 10	Clarified water pump house	1
4	1	9.5	32	3.5 to 5	5 to 10	Remin. Filter area	1
5	1	7	25	3.5 to 5	5 to 10	Filter shed pump house	1
6	1	5	55	3.5 to 5	5 to 10	Chemical Dosing Building	1

2. GENERAL REQUIREMENT FOR ELECTRICALLY OPERATED MONO RAIL HOIST.

a. Electrically operated hoist shall be a complete unit with hoisting motor, rope drum, wire rope, traveling trolley, travel motor, necessary gearing, sheaves, brakes, hook, pendent push button station, contactor panel, conductor for travel motion, limit switches, end stops, buffers, earthing terminals and all other accessories to make the equipment complete in all respects. Minimum factor of safety shall be (5) five for electrically operated hoist.

b. Parts requiring replacement or lubrication shall be easily accessible & without dismounting type. Equipment will include the devices as required and comply with applicable standards/ specification requirements.

c. Both hoists and trolleys are driven electrically as specified. Rope drum shall be as per IS 3938. Rope drum shall be either cast or welded to sustain concentrated loads resulting from rope pull. All brake shall be of “fail to safe” design and will operate automatically in case power failure.

2.1) ROPE DRUM

Rope-drums shall be grooved and welded steel conforming to IS 3938. Drum length shall be such that each lead of wire rope has a minimum of two full turns on the drum when the hook is at its lowest position not taking into consideration turns covered by wire rope anchorage and one spare groove for each lead of wire rope on the drum when the hook is at its highest position.

2.2) WIRE ROPES

Wire ropes shall be extra flexible with well lubricated hemp core having thirty-six (6X36) wires per strand shall be provided. Wire ropes shall be of Right Hand Ordinary (RHO) lay construction.

2.3) HOOKS

Hook shall be forged steel supported on a ball or roller bearing. The hook shall rotate freely on this bearing. Hook shall have swivels and safety latch. Locking pin shall be provided to prevent swivelling of hook. The sleeves of hook block shall be encased in an oil tight casing permitting generous lubrication of wire ropes & sheaves & also preventing accidental trapping of hands.

2.4) SHEAVES

Rope sheaves shall be of cast steel or fabricated steel with anti-friction bearings. Sheaves shall be fully guarded to prevent rope coming off.

Power supply	: 3 phase, AC, 415 Volts + 10%, 50 Hz +5%
Mono rail size (I-Beam)	: Vendor to confirm the suitable size of the I-Beam. I-Beam will be provided by BHEL.
Creep Speed	: 10% of operating speeds for all motion

Crane Runaway rails : Rails to suit.

3. DATA SHEET FOR ELECTRICALLY OPERATED MONO RAIL HOIST

Sl.No.	Description	Unit	Data
1	GENERAL		
1.1	Design according to standard service class/ load class		IS 3938 Class II
1.2	Location (Indoor/ Outdoor)		(Based on the location)
1.3	Type of control		Pendant
2	HOISTING SYSTEM		
2.1	Wire Rope		
a)	Rope construction		IS 2266 / 6 x 36 multi strand construction Fibre core.
b)	Rope quality (material)		Extra flexible plough steel
c)	Factor of safety		Not less than 5 / As per IS
2.2	Rope drum		
a)	Drum material		Fabricated from carbon steel as per IS 2062, Grade B and stress relieved or seamless pipe as per ASTM A 106 Grade A or B.
b)	Whether stress relieved		Yes (if fabricated)
c)	Bearing type		Antifriction ball or roller(with minimum Life of 10000 working hours.)
2.3	Hook		

a)	Hook type		Swivel “C” type single shank of suitable grade of either circular or standard trapezoidal section, point hook suitably heat treated with adequate lifting capacity. Swivel lock pin shall be provided.
b)	Hook material		Forged steel
c)	Safety latches provided		yes
d)	Hook suspension		Thrust Bearing
e)	sheave material		Fabricated from cast steel / steel plate IS 2062 Gr A or B / CS Gr 280-520 IS 1030
2.4	Hoist Brake		
a)	Type		DCEM “fail to safe”
b)	Torque	Nm	150% of rated torque or greater than the torque transmitted to the brake drum from the suspended load up-to the test load.
2.5	Gear box		Fabricated Fe 410w IS:2062 Gr A/B & stress relieved
Sl.No.	Description	Unit	Data
a)	Material of gears		EN 9 / 55C8
b)	Material of pinions		EN 19 /EN 24
c)	Type of gears & pinions		Spur / helical

2.6	Type of Limit Switch		Rotary geared + gravity type
3	TRAVEL		
3.1	CT brake		
a)	Type		DCEM " fail to safe"
b)	Torque	Nm	150% of rated torque
c)	Gear box		Fabricated Fe 410w IS:2062 Gr A/B & stress relieved
i)	Material of gears		EN 9 / 55C8
ii)	Material of pinion		EN 19 / EN 24
iii)	Type of gears & pinion		Spur / Helical
d)	Wheels		
i)	Materials		Forged steel
ii)	Hardness	BHN	Not more than 200BHN
iii)	Type		Single flanged
iv)	Wheel bearing type		Antifriction Ball / Roller
e)	Type of Limit switches		Lever
4	Rating		
			S4, 60% CDF
5	Number of starts/hour		300 starts / hr

4. CODES & STANDARDS :

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

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

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

IS 325 Three phase induction motors.

IS 816 Code of practice for use of metal arc welding for general construction in mild steel.

IS 2266 Steel wire ropes for general engineering purposes.

IS 2327 Straight sided splines for cylindrical shafts with internal centering-dimensions, tolerances and verification.

IS 2610 Power transmission straight-sided splines for machine tools-dimensions.

IS 15560 Point hooks with shank up to 160 tonne specification

IS 4029 Guide for testing three phase induction motors

IS 5749 Forged ramshorn hooks.

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

IS 12162 Specification for lifting hook

IS 3832 Specification for hand-operated chain pulley blocks

IS 3938 Specification for electric wire rope hoists

IS 1835 Specification for Round steel wire for ropes

IS 7847 General Characteristic of Lifting hook.

IS 3815 Specification for point hook with shank

5. ELECTRICAL

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

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

iii. The VVF drive control shall be used for control.

iv. The hoist shall be furnished complete with all electrical equipment, accessories, like drive motors with VVF drives, conductors, insulators, protective & operating devices, cables, all protective devices, start/stop and emergency controls, limit switches, mechanical overload and protection for electrical faults etc.

BHEL will arrange the 415V, 3phase, 3 wire, 50Hz, AC power supply upto the Isolating box. The Isolating MCCB box of minimum 32A & IP 55 rated enclosure (Vendor Scope of supply) & further distribution of power supply to hoist shall be in vendor's scope only. Double compression Ni-Cr plated brass cable glands and solder less crimping type heavy duty tinned copper lugs for power & control cables shall be provided by vendor for all cable terminations from Isolating MCCB box to all terminals. Cable gland and lugs for incoming cable shall be supplied as per cable size finalised by BHEL during detailed engineering.

Operational Controls: The hoist shall be controlled Pendent push button Station with 5 pushbuttons(EMERGENCY STOP, FORWARD,REVERSE, RAISE,LOWER), mounted on a suitable powder coated MS or FRP pendant station. Clustered LED Indication lamps for Power supply "on". **Control Voltage:** Shall be 110V AC derived from 415/110v control supply transformers. For control transformer sizing, 20% over loading to be considered while sizing the rating. The EMERGENCY push button shall be so arranged as to immediately put off the main supply and apply all the brakes simultaneously irrespective of position.

Earthing: Crane hoist structures, motor frames and metal cases of all electrical equipment including metal conduit and cable guards shall be effectively earthed. Two point earthing scheme to be followed and earthing conductors shall be offered along with the crane.

Control Panel & Protection: All Panels, Limit-Switches and Motors shall have IP 55 protection. The pendent control switch, limit switch etc. shall conform to IS: 3938. Control

Panel frame shall be made of 1.6mm thick CRCA sheet, covers and hinged(continuous) doors of 1.6mm thick CRCA. Paint shade RAL 7035 Light grey. Gland plate shall be made out of 3mm CRCA Sheet with necessary gaskets, Earthing terminals shall be provided on both sides of the panel. 20% spare power, control terminals shall be provided in the panel. Control panel shall be suitable for Operating temperature of 50 Deg C (outside the enclosure) prevailing at site. Panel space heaters are to be provided to avoid condensation within panel.

Motors: Motors shall in general conform to IS-12615 and IS-1231 and suitable for hoist duty. Crane motor not being of continuous duty hence shall also not be energy efficient. Motor ratings shall be 25% (at least) over the maximum power requirement. The hoist motors shall be rated to lift 125% of the design load at rated speed. Motors shall suit the duty class S4, cyclic duration factor 60% and 300 starts per hour. Motor shall have class F insulation temperature rise limited to class B and enclosures shall conform to the degree of protection IP-55. Motors shall be suitable for Operating temperature of 50 Deg C prevailing at site.
Brakes shall be electromagnetic as per relevent Standard.

Makes:
Electric Contactors: All Panels shall have ABB/SCHNEIDER/SIEMENS/L&T/GE/C&S contactors suitable for Crane operations.

Motors: KIRLOSKAR/ NGEF/ SIEMENS/ BBL/ CGL/ Laxmi Hydraulics/ Jyoti Ltd/ BEML/ ABB/ MARATHON

Cables : Multi core Trailing cable shall be 1100 V grade, tinned copper as per Class – 5, heat resistant, with EPR insulation as per IS-8130 and should have inner sheath and outer sheath with heat resistant, oil resistant and flame retardant heavy duty FRLS properties. Cables shall be suitably chosen upon derating with factor of 0.87 for current-carrying capacities for cables in the air and supported in festoon arrangement. Cable sizing shall be done such that the 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.
Trailing cable shall be supported with auxiliary girder track to facilitate linear as well as curved movement.

6. PAINTING PROCEDURE FOR ELECTRICALLY OPERATED MONO RAIL HOIST

Painitng to be carried out as per attached Annexure -A

7. MANDATORY SPARES FOR ELECTRICALLY OPERATED MONO RAIL HOIST

Electrically Operated Hoists (For each type & capacity)as applicable			
Sl. No.	**Item Description**	**Quantity**	**Remarks**
1.	Drum Bearings	1 Set	
2.	Rope guide & Rope tightner	1 No	
3.	Brake linings	2 Set	
4.	Limit switch	2 Set	
5.	Gear Box /Gear Set	2 Set	
6.	Brake Coil	2 Set	
7	Motor Bearings	1 Set	
8.	Motor / geared motor	10% of installed quantity or 1 –no whichever is higher	
Note : One set consists of quantity required for complete replacement for one hoist of each type & capacity			

B. MANUAL HOIST

EQUIPMENT : Manual Hoist
APPLICATION : Lifting and moving Equipments & Chemicals
INSTALLATIONS : INDOOR /OUTDOOR (Based on the location)
SURROUNDINGS : Humid & Corrosive atmospheric in RO Desalinaion Plant area.
AMBIENT TEMPERATURE : Upto 50 Deg. C

1. SCOPE OF SUPPLY FOR MANUAL HOIST.

Sl. No.	Capacity (MT)	Height of the Lift(m)	Length of Long	Location	Qty(Set)

		approx..	**Travel (m)**		
1	1	4	15	Remin Pump House	1

2. GENERAL REQUIREMENT FOR MANUAL HOIST.

The chain pulley block shall be a complete unit with trolley, load chain, load chain wheel, handchain, hand chain wheel, necessary gearing, brakes for hoisting, hook and other accessories.

Chain pulley block shall be of worm or spur gear type. Factor of safety shall be (5) five for chain pulley block.

The load chain shall be electrically welded, accurately calibrated, and pitched arid polished as per IS. And Load chain shall be heat treated to give required ductility & toughness.

The hand chain will also be electrically welded, calibrated, pitched and polished and will conform to IS: 3832.

The forged hook shall be properly heat treated and so designed that in loaded condition, it is free to swivel without twisting the load chain. The hook will conform to IS.

All other components of chain pulley block such as anchorage, guide, pawl, stripper etc. shall be designed and provided as per IS: 3832. Effort on the hand chain for traveling motion of manual hoist will not be more than 20kgforce.

3. DATA SHEET FOR MANUAL HOIST

Sl.No.	Description	Unit	Data
1	Standards		IS 3832 / Class-II
2	Application		(Based on location)
3	Trolley and hoist operation		Hand operated
4	Material of construction		
4.1	Trolley frame		Cast steel / Mild steel
4.2	Gears (Trolley)		Machine cut cast steel / Forged steel / C40 / C50

4.3	Lifting hook (Swivel)		Shank 'C'. Forged steel. Safety latch and swivel lock pin.
4.4	Gears		IS 3681/4460
5	Trolley wheel		Forged / cast steel / C40 with minimum 200BHN and single flanged to suit standard I beam section
6	Brake		Screw and disc friction type /Ratchet & pawl type

4. PAINTING PROCEDURE FOR ELECTRICALLY OPERATED MONO RAIL HOIST

Painitng to be carried out as per attached Annexure -A

C. INSPECTION

The inspection will be carried out based on the following documents.
1. BHEL Purchase order
2. BHEL Technical specification
3. Approved Qaulity Plan.
4. BHEL approved supplier drawing &data sheets.

D. DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

1) G.A. drawing for each mono rail hoist & Manual Hoist
2) Cross sectional drawing for each mono rail hoist & Manual Hoist
3) Technical Data Sheets for Crane /hoist/ motors, electrical power and control circuit diagram and other applicable technical documents.

E. DOCUMENTS TO BE SUBMITTED AFTER PLACEMENT OF ORDER(as applicable)

1. Power and Control scheme
2. Bill of material indicating description of the item, rating, make, quantity, type reference etc., for :
a) Panel mounted components
b) Pendent mounted components

c) Items covered in the system like trailing cable, trolley etc.
d) Hoist, Cross travel arrangement, Auxiliary Girder system, all cables under scope etc.

3. Detail drawings
a) OGA of Control panel
b) OGA of Pendent
c) Gasketting and locking arrangement of Control panel
d) EOH & trailing cable mounting arrangement.

4. Justification for
a) Motor rating selected
b) Rope selected
c) KVA rating of control transformer.

5. a) List of items mounted in the assembly and list of loose item supplied along with weight.
b) Packing drawings.

6.
a) Data sheet for Hoist & cross travel motor
b) Data sheet for brake.
c) Data sheet for trailing & pendent cable.

7. Cable schedule for hoist indicating size, termination between which equipments, rating, quantity, make etc.

F. PACKING:

Bidder to follow standar packing & submit the packing drawing for BHEL Review.

Note : 1) First fill of grease & Oil fill for each of the Mono Rail Hoist & Manual Hoist is in the scope of bidder only.

	GENERAL SPECIFICATION FOR ERECTION, TESTING, COMMISSIONING & HANDING OVER OF EOT CRANE	SPEC. No: ROS:9054
		REV: 00

BHARAT HEAVY ELECTRICALS LIMITED,
RANIPET- 632 406.

GENERAL SPECIFICATION

FOR

ERECTION, TESTING, COMMISSIONING & HANDING OVER OF EOT CRANE

00	01.12.18	A. Kumar ABH	J.M. Pandian IMRL	MR 01.12.2018	Fresh issue
Rev.No	Date	Prepared	Checked	Approved	Remarks

	GENERAL SPECIFICATION FOR ERECTION, TESTING, COMMISSIONING & HANDING OVER OF EOT CRANE	SPEC. No: ROS:9054
		REV: 00

1.0 SCOPE OF WORK ON SERVICES

The scope of Erection and Commissioning services covers erection, commissioning of EOT crane which comprises of collection of materials & equipment from site stores, transportation to erection spot, erection of complete system including site fabrication, stage clearance, testing, commissioning and handing over of the EOT crane.

NOTE

I. The equipment after inspection at manufacturer's works shall be transported to BHEL site and shall be delivered to the BHEL stores as detailed in the supply specification and commercial terms of the tender. The applicable materials shall be drawn from BHEL stores as per the relevant procedure.

The scope of major equipment covered for the erection & commissioning of the EOT crane at site is covered in Technical Specification.

The quantity and the details given are only indicative. However, the bidder shall supply required quantity to fully cater to the system requirement and carry out the erection of all the items to meet the system requirement as complete without any commercial implication to BHEL.

2.0 The Intent of this specification is to provide erection, testing commissioning according to most modern and proven techniques and codes. It is not the intent to specify completely herein, all aspects of the entire system. Nevertheless, the entire system shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation. The contract services towards installation of the Plant shall not relieve the contractor of the responsibility of providing such services, facilities to complete the project of portion of project awarded to him. The quoted rate shall deem to be inclusive of all such contingencies.

3.0 The Contractor shall carry out the work in accordance with instructions/ drawings/ specification/ standard practices supplied / approved by BHEL from time to time.

4.0 Modification / Rectification / repair / replacement of defective components if any shall be under bidder's scope within specified time.

5.0 Bidder to submit the erection schedule along with stage check data sheets. Each and every stage the bidder to get clearance from the BHEL Engineer / Consultant Engineer / Customer Engineer.

6.0 Establish the site co-ordination for identification of materials, withdrawal of material, storing and issue of materials, stage clearance for erection & commissioning.

7.0 Identification of consignment at BHEL stores, verification of the same in the presence BHEL official, taking delivery, co-ordination for the movement from store to erection work, safe custody, erection, testing & commissioning.

8.0 All the equipment and materials would be issued only at BHEL stores and it shall be the responsibility of the contractor to take delivery from BHEL stores, transport the same to site.

9.0 Necessary clearance for stage check, obtained from the customer engineer & pre – commissioning tests shall be carried out by the bidder.

10.0 Commissioning and putting into satisfactory operation and handing over of the system to the end user.

11.0 Finish coat (final coat) for all the equipment before hand over of the system to BHEL/Customer as mentioned elsewhere in the specification.

14.0 EXCLUSIONS

The following are excluded from the scope of supplier and will be arranged by BHEL

14.1 All civil works and I beam.

14.2 Service water/construction water at one point

14.3 Construction Power supply at one point

14.4 Supply of service / instrument air at one point

14.5 Receipt Storage of shipped items / container at BHEL store as of received condition

The requirement shall be specified by the bidder in their technical offer and the supply shall be limited to the specified quantities.

	GENERAL SPECIFICATION FOR ERECTION, TESTING, COMMISSIONING & HANDING OVER OF EOT CRANE	SPEC. No: ROS:9054
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15.0 Specification, Standards & Codes:

All equipment shall be designed, tested and supplied as per the specification, relevant national / international standards & statutory codes.

16.0 Name plates, labels and directional marks:

Each equipment shall be provided with nameplate details designating the tag no., service of the item etc. Necessary directional arrow marks shall be provided.

17.0 Tools and Tackles:

All the Tools & tackles required for the complete erection of components shall be arranged by the contractor at his cost. The bidder shall have & own a complete set of special tools and tackles required erection, assembly, disassembly and maintenance. The bidder shall also supply any special tools and tackles that may be required additionally during commissioning. All tools & tackles shall be reputed make acceptable to the Purchaser and shall be handed over BHEL after the completion of erection & commissioning.

18.0 Commissioning Consumables / Spares:

The bidder shall supply all consumables like lubrication oil etc for commissioning of the equipment.

The bidder shall consider sufficient quantity of the commissioning spares so that the commissioning of the system will not be delayed. The bidder shall also supply any spare components that may be required additionally during commissioning. These commissioning spares shall be included in the basic scope of supply.

19.0 Inspection & Testing:

All the stage checks & materials shall be offered to BHEL / Customer/ BHEL'S authorized representative for inspection. No material shall be dispatched without obtaining written clearance from BHEL. During inspection, the internal inspection reports shall be submitted to BHEL / customer for information.

20.0 Packing & Dispatch:

20.1 All equipments 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. Each packing shall have necessary handling marks

20.2 Each packing shall contain a packing slip indicating the details of item like item description, quantity, weight etc.

20.3 Details of handling & Storage instruction shall also be provided in each packing.

20.4 All items shall be properly packed with adequate cushioning material to prevent damages due to rough handling and inland transport. The packing shall be in such a way so as to avoid seepage of water into the packing.

20.5 Special care shall be given to prevent damage to the fragile components.

21.0 Additional requirements

21.1 After completion of all erection and commissioning works, the left out items shall be handed over to BHEL site stores.

21.2 During commissioning at site some smaller equipment may get added or Logics may have to be changed. The bidder shall carryout these changes at site without any commercial implications to BHEL.

22.0 GENERAL INSTRUCTIONS TO THE BIDDER

22.1 Bidder shall quote for complete work specified in the document. Incomplete quotations for the part of the work will not be considered even if the quoted rates/price is lower.

22.2 Bidder shall contact BHEL and obtain additional details/data if any required to submit proper quotation.

22.3 The BHEL reserves the right to omit any one or more items of work at any time of the contact without assigning any reason what so ever.

22.4 The Bidder shall include all necessary commissioning spares in his basic scope of supply and the left out spares shall be handed over to BHEL after the completion of E & C.

22.5 Adequate lighting facilities such as low volt hand lamps shall be arranged by the contractor at the site of construction etc. at his cost.

22.6 All the lifting tackles including wire ropes, slings, shackles and electrically operated equipment shall be got approved by BHEL Engineer before they are actually put on use. Test certificates should be submitted before their usage. Test

certificate obtained from the statutory authority should be submitted before their usage.

22.7 All equipment so used by contractor shall be of proven quality and safe in operation as approved by BHEL Site Engineers from time to time.

22.8 At periodic / intervals of work, complete and detailed account of the equipment so erected shall be submitted to the BHEL Engineer. The required format shall be submitted to BHEL Officials for approval.

22.9 All equipment shall be handled very carefully to prevent any damage and loss. No bare wire ropes, slings etc.., shall be used for unloading and / or handling for equipment without the specific written permission of the BHEL engineer. The equipment from the storage yard shall be moved to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage for such equipment at site.

22.10 The work covered under this scope of work is of highly sophisticated nature requiring best quality / precision workmanship engineering and construction management. Contractor should also ensure successful and timely commercial operation of equipment installed. The contractor must have adequate quantity of precision tools, construction aids in possession. Contractor must also have adequate trained qualified and experienced supervisory staff and skilled personnel.

22.11 All the necessary certificates, licenses statutory clearances required to carry out his scope of work are to be arranged by the contractor then and there at no extra cost.

22.12 When the work is temporarily suspended contractor shall protect all construction materials equipment and facilities from causing damage to existing property interfering with the operations of the station when it goes into services. The contractor shall comply with all applicable provisions of the safety regulations clean – up programme and other precautionary measures which the BHEL has in effect at the site.

22.13 It will be the responsibility of the contractor to ensure the safe lifting of the equipment taking due precautions to avoid any accidents and damage to other equipments and personnel.

22.14 Sometimes it may become necessary for the contractor to handle certain un-required components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

22.15 It shall be contractor`s responsibility to arrange for required labour, brush, paint and other consumable like thinner, cotton waste, cloth etc., for carrying out preservative painting. The quoted rates shall be inclusive of above work.

22.16 Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required paint, thinner all other consumables like painting brush, emery paper, cotton waste, cloth etc.., have to be arranged by the contractor at his cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to adequacy of application of paint.

23.0 SITE CLEANLINESS AND SAFETY REQUIRMENTS:

23.1 Contractor shall strictly follow all safety regulations / conditions as per general conditions of contract booklet enclosed with this tender.

23.2 Non – conformity of safety rules and safety appliances will be viewed seriously and the BHEL has right to impose fines on the contractor as under.

23.3 Contractors shall ensure that the quality is maintained in all the works connected with this contract at all stages of the requirement of BHEL.

23.4 Contractor shall ensure that all Inspection, Measuring and Testing equipment that are used, whether owned by the contractor or used on loan, are calibrated by the authorized agencies and the valid calibration certificate will be available with them for verification by BHEL. A list of such instruments possessed by contractor at site with its calibration status is to be submitted to BHEL Engineer for control.

23.5 Contractors shall arrange for the inspection of the works at various stages as required by BHEL. Immediate corrective action shall be taken by the contractor for the non-conformances if any, observed and pointed out by BHEL.

24.0 PAYMENT TO CONTRACTORS

24.1 All payment due to the contractors shall be paid by “E-payment” only.

24.2 All recoveries due from the contractor shall be effected in full from his bills unless specific approval from the competent authorities is obtained otherwise.

24.3 The bill shall be prepared in the proforma prescribed for the purpose based on the certificate issued by BHEL Engineer that entire work as stipulated in the tender

specification has been completed in all respects to the entire satisfaction of BHEL. Contactor shall give unqualified “No Due” and “No Demand” certificates. Quantities / Weight erected shall be prepared and paid as per agreed payment terms. The quantities and financial value shall be entered in Measurement Book and signed by both the parties to the contract.

25.0 PROVIDENT FUND & MINIMUM WAGES

25.1 The contractor is required to extend the benefit of provident fund to the labour employed by them in connection with this contract as per the Employees Provident Fund Act 1952. For due implementation of the same, the tenderer is hereby required to get themselves registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish us the code number allotted to them by the Provident Fund authorities with in one month from the date of issue of this letter of intent. In case any exemption from such remittance, an attested copy of authority for such exemption is to be furnished. Please note that in the event of failure to comply with the provisions of said Act, if recoveries there fore are enforced from payments due to us by the customer or paid to statutory authorities by us, such amount will be recovered from payments due to the contractor.

25.2 The contractor shall ensure the payment of minimum labour wages to the workmen under him as per the rules applicable from time to time in the state.

26.0 OTHER STATUATORY REQUIREMENTS:

26.1 The contractor shall submit a copy of labour licence obtained from the licencing Officer (Form VI) u/r 25 read with u/s 12 of contract labour (R&A) Act 1970 & rules and valid WC Insurance copy or ESI Code (if applicable) and PF code no along with the first running bill.

26.2 The contractor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r 78 (1) (a) (1) of contract labour rules, copies of monthly return of PF contribution with remittance challans under EPF Act 1952 and copy of renewed WC insurance policy or copies of monthly return of ESI contribution with challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

26.3 The contractor should ensure compliance of Sec 21 of Contract Labour (R&A) act 1970 regarding responsibility of payment of wages. In case of “Non compliance of sec21 or non-payment of wages” to the workmen before the expiry of wage

period by the contractor, BHEL will reserve its right to pay the workmen under the orders of appropriate authority at the risk and cost of the contractor.

27.0 TIME OF COMPLETION

27.1 The time schedule as prescribed in the contract is the essence of the contract. The time for completion shall always be reckoned from the date of commencement of work as certified by the BHEL Engineers.

27.2 The entire work shall be completed by the contractor with in the time schedule or within the such extended time as may be allowed under relevant clause.

28.0 ENGAGEMENT OF L ABOUR

28.1 The contractor will be directly responsible for provision of health and sanitary arrangements more particularly described in contract labour (regulations & Abolition) Act, safety precautions etc., as may be required for safe and satisfactory execution of the contract.

28.2 The contractor shall be responsible for proper accommodation including adequate medical facilities & transportation to the work spot and back for the personnel employed by him.

29.0 COMPLIANCES WITH LABOUR LAWS & RULES

29.1 The contractor shall comply with all state and central Laws, statutory rules, regulation etc.., relating to labour in respect of following acts and also as amended by the Government during the tenure of the contract and having in force or jurisdiction at site.

a. Payment of wages act, 1936
b. Minimum wages act, 1948
c. Workmen's Compensation act, 1923
d. Industrial dispute act, 1947
e. Employees Provident fund scheme, 1952
f. Payment of Bonus act, 1965
g. Payment of Gratuity act, 1972
h. Contract Labour (Regulation & Abollition) Act, 1970

30.0 TAXES & DUTIES, ETC.:

The contractor shall pay all taxes, VAT, licence fee, deposits, duties, royalty, commissions or other charges, other than such taxes specifically mentioned in the special conditions of contract, which may be leviable on account of any of his

operations in executing the contract. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from the contractor either from his bills or other wise as deemed fit.

VOLUME II

SUB-SECTION 2.25

CLEANING, PROTECTIVE COATING AND PAINTING

1.0.0 GENERAL

This specification covers the general requirements related to the cleaning protective coating and painting of equipment, components and systems that are covered under main equipment / system specifications for 2x660 MW Supercritical Thermal Power Plant. The components and/or equipment shall be mechanically and /or chemically cleaned during the following stages of the Contract.

- Cleaning in workshop
- Cleaning before painting and/or corrosion protection (application of prime coat)
- Cleaning before erection and during installation.

Cleaning of fabricated component items shall be carried out after fabrication and final heat treatment or welding at manufacturer's works or at site, as appropriate. No paint shall be applied surfaces within 75 mm of field welded connections. These surfaces shall be coated with a consumable preservative and marked.

For cleaning in workshop and before painting, mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, hand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the Owner / Engineer.

Machined surfaces shall be protected during the cleaning operations.

In the event of the surfaces not being cleaned to the Owner's satisfaction, such parts of the cleaning procedures or agreed alternatives as are deemed necessary to overcome the deficiencies shall be carried out at the supplier's sole expense.

For reclining small areas, hand cleaning by wire brushing may be permitted.

2.0.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the Codes indicated below and shall conform to the relevant IS Code for the material and workmanship.

The following codes and standards shall be followed for the surface preparation, surface protection and painting works.

IS: 5	Colors for ready mixed paints and enamels.
IS: 101	Methods of test for ready mixed paints and enamels.
IS: 104	Ready mixed paint, brushing, Zinc Chrome, priming.
IS: 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS: 161	Heat resistant paints
IS: 1303	Glossary of terms relating to paints.
IS: 1477	Code of practice for painting of ferrous metals in buildings (Parts I & II).
IS: 2074	Specifications for ready mixed paint, Air drying, red oxide zinc chrome priming.
IS: 2338	Code of practice for finishing of wood and wood based materials: Parts 2 schedules.

IS: 2339	Aluminum paint for general purposes, in dual container.
IS: 2395	Code of practice for painting of concrete, masonry and plaster surfaces: Part 2 schedules.
IS: 2524	Code of practice for painting of non-ferrous metals in buildings (Parts I & II).
IS: 2932	Specification for enamel, synthetic, exterior (a) undercoating, (b) Finishing
IS: 3140	Code of practice for painting asbestos cement building products.
IS: 6158	Recommended practice for design safeguarding against Embrittlement of hot dip Galvanized Iron & steel products.
IS: 6159	Recommended practice for design & fabrication of Iron &steel products prior to Galvanizing & metal spraying.
IS: 6278	Code of practice for white washing and Color - Washing.
IS: 10221	Code of practice for coating & wrapping of underground mild steel pipelines.
IS: 33	Inorganic pigments and extenders for paints –Methods of sampling & test.
IS: 13183	Aluminum paint, Heat resistant - specifications.
IS: 144	Specification for ready mixed paint brushing, petrol resisting, Air drying for Interior paints of tanks and containers, Red oxide.
IS: 9954	Pictorial surface preparation standards for painting of steel surfaces.
IS: 11883	Specification for Ready Mixed Paint, Air Drying, Red Oxide Priming for metals.
IS: 9404	Color code for identification of pipelines used in the Thermal Power Plants.
IS: 12744	Specification for Ready Mixed Paint, Air Drying, Red Oxide-Zinc Phosphate Priming.
BS: 2015	Glossary of paint selected terms.
BS: 5252	Final coat color.
BS: 7079A1/S1	Specification for rust grades and preparation grades of uncoated substrates after overall removal of previous coating.
BS: 7079A2	Preparations grades of previously coated steel substrates.
BS: 7079GrC	Surface roughness characteristics of blast cleaned steel substrates.
BS: 7079GrD	Methods for surface preparation.
BS-4232	Surface Finish of Blast cleaned steel for painting.
ASTM	American Standard for Testing Material.
ASTM A 780	Standard practice for repair of damaged galvanized coatings.
AWWA	American Water Works Association.
ASA-A-13.1-1981	Scheme for identification of piping system (American National Standard Institution).
DIN	Deutsehes Institute for Normung
S1S-055900-1967	Surface preparation standards for painting steel surfaces. (Swedish standard Institution)
SSPC-SP	Preparation Specifications (Steel structures painting council, U.S.A.).
	National Association of Corrosion Engineers, U.S.A. (NACE).

3.0.0 SCOPE OF WORK AND GENERAL REQUIREMENTS

This specification covers the surface preparation, method of application and material to be used for all coating of equipment, steel structures and piping. Steel material subjected to surface preparation on shop/site shall have minimum requirements in accordance with Rust Grade B (SSPC/SSPM Volume-2).

Coating materials according to SSPC, EN ISO, ASTM, BIS or DIN standards, shall be used. The paint shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work. The materials shall be matched with each other so that they are compatible. Coatings deviating this specification shall be subject to approval.

Standards of surface preparation and painting shall give a time to first maintenance of minimum 10 years.

The paint to be applied shall be approved by Owner.

All paints & paint material used shall be procured from approved manufacturers. Paint shall be supplied in manufacturers original containers with the description of content, specification No., colour, ref no, date of manufacture, shelf life expiry date & pot life.

The paint manufacturers shall provide coating system data sheet for each coating system to be used containing the following information

a. Surface preparations
b. Film thickness (min and max)
c. Min and max recoating intervals at relevant temperatures
d. Mixing ratio, thinner details and coating repair systems

The sample for testing the paint being used may be taken by the Owner at any time.

In general Shop fabricated equipment will be delivered to the site coated with a shop applied system or the manufacturer's standard finish in accordance with the requirements of this specification.

For equipment that has received shop prime coat, all touch-up prime coat and additional coats shall be applied in accordance with the coating schedule. It is responsibility of the vendor to ensure compatibility between shop and field applied paint systems.

Necessary precautions shall be provided to all equipment, structures to protect other surfaces from abrasive blasting, coating over spray and spatter. Damage to other surfaces or equipment shall be repaired by the vendor.

The Contractor shall submit the following for review and approval by the Owner:

a. Manufacturer's recommended paint scheme for the project
b. Latest published product & instructions for application data,
c. Procedures for surface preparation and application.
d. Pre qualification for equipments and blasting materials, product, procedure and personnel qualifications for the paint and painting systems.
e. Painting repair procedures

Painting records shall contain:

- Equipment/components/location painted
- Date of painting
- Paint details such as specification No, colour, date of manufacture, shelf life, expiry date
- Application equipments

- Ambient conditions at the time of painting
- Surface temperature
- Drying time between coating, DFT and number of coatings
- Appropriate work plan for painting.

The supply of all necessary equipments, weather protection, and scaffolding for painting to ensure work is carried out in accordance with the specification and agreed programme.

Maintenance of the paint work until completion of the contract, this shall include repair of any damaged areas caused by third party.

Disposal of painting waste resulting from painting, shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work and coating materials.

It is a mandatory requirement that all operatives working to this procedure take full cognizance and implement necessary safety precautions.

4.0.0 CLEANING AT MANUFACTURER'S WORKS

Mechanical cleaning shall preferably be carried out by abrasive blasting. The Owner is prepared to consider alternative methods such as chemical cleaning provided they achieve the necessary surface condition.

In case of chemical cleaning, the detailed procedure for chemical cleaning as well as the system for which chemical cleaning is required shall be submitted by the contractor for Owner's approval. The procedure shall comprise of pre-treatment and acid treatment to achieve cleanliness equivalent to that specified for mechanical cleaning.

Surface condition:

The Metal surfaces shall be clean and free of mil scale, rust, dirt, grease and any other deleterious matter.

Where metal surfaces are to be painted the surface profiles shall conform to the painting specification requirements.

Where this does not apply, surfaces shall have a surface texture not coarser than Grade 80 abrasive paper.

Abrasives:

Abrasives containing silica, silicates or slag residues shall not be used for water/steam side surfaces of plant except for cleaning sand castings, where hydro blasting may be employed.

For austenitic materials only, abrasives containing 98% or more of alumina, $Al_2 O_3$, shall be used.

Removal of abrasive and debris:

After cleaning, abrasive and debris shall be thoroughly removed for components.

5.0.0 PROTECTION AT MANUFACTURER'S WORKS

As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

All water, air and steam side surfaces shall be protected by the application of approved water soluble corrosion inhibitors, or vapor phase inhibitors that can be subsequently removed by site water washing or steam blowing.

The gas side of steam generating plant items shall be protected by the application of temporary protective that do not require to be removed before commissioning, but which are removed during initial firing.

The rate of application of volatile corrosion inhibitors shall be at least 10 grams per square meter or 35 grams per cubic metre, whichever is the greater, except for pipes up to 300 mm diameter for which the minimum application rates shall be 5 grams per square metre.

Immediately after the protective treatment has been applied all vessels and pipes shall be suitably sealed off by discs or caps or approved alternatives to prevent ingress from the surroundings. Cylindrical plugs shall not be driven into the ends of pipes. These protective covers shall not be removed until immediately before final connection is made to the associated equipment.

6.0.0 WEATHER CONDITIONS

Painting shall be done only when the surface temperature is above 5℃. Surface temperature must be at least 3℃ above dew point to ensure that condensation does not occur on the surface.

Reasonable protection against precipitation and seawater spray shall be exercised for the painting of outdoor parts.

Precautions shall also be taken against solar radiation to ensure that the specified dry film thickness of priming or finish coats is obtained.

Any prime coat exposed to excess humidity, rain, dust etc., before drying, shall be permitted to dry and the damaged area of primer shall be removed and the surface prepared and primed again.

Sheltered or unventilated horizontal surfaces on which dew may collect require more protection, and to achieve this additional top coat of paint shall be applied.

The temperature quoted as “normal” in the “Paint System Tables” refers to the average local climatic conditions.

7.0.0 SURFACE PREPARATION

In preparing any surface to be coated, all loose paint, dirt, grease, rust, scale, weld slag or spatter or any other extraneous material shall be removed and defects repaired, so as to obtain a clean, dry, even surface to receive the priming or finishing coat (s) as called for in the painting schedules. Sharp edges should be rounded, especially when tank linings have to be applied.

All machined surfaces, including flange faces, shall be suitably covered to prevent damage during surface preparation.

All surfaces should be blast cleaned whenever possible.

Surface preparation methods:

Bare steel surfaces should be prepared by one of the methods described below in order of preference and in accordance with Swedish Standard SIS 05 59 00 or Steel Structures Painting Council, SSPC, Vis 1, or DIN 55928, section 4.

The relative humidity level should not be more than 60% & the steel surface temperature at least 3º C above the dew point during dry blast cleaning operations.

a. White metal blast cleaning Sa 3 or SSPC - SP 5

Sa 3 Blast cleaning to bare metal. Mill scale, rust and foreign matter must be removed completely. Subsequently, the surface is cleaned with vacuum cleaner, clean dry compressed air or a clean brush. It must then have a uniform metallic color and correspond in appearance to the prints designated Sa 3.

b. Near white metal blast cleaning Sa 2 1/2 or SSPC - SP 10

Sa 2 1/2. very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight imperfections in the form of spots or stripes. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It must then correspond in appearance to the prints designated Sa 2 1/2.

Mechanical cleaning should only be used when procedures (a) and (b) are not practicable.

c. Near white metal blast cleaning P Sa 2 1/2 DIN 55928

Very thorough blast cleaning. Very adhesive coatings remain. From all other surface mill scale and rust are to be removed to such an extent that the only traces remaining are slight imperfections in the form of spots or stripes. Further treatments see Sub b).

The adhesivity of residual coatings in the transition zone has to be tested even after the application of the primer.

d. Very thorough mechanical scraping and wire brushing St 3

St 3 very thorough scraping and wire-brushing - machine brushing - grinding - etc. are to be preferred. Surface preparation as for St 2. But much more thoroughly. After the removal of dust, the surface must have a pronounced metallic sheen and correspond to the prints designated St. 3.

e. Thorough scraping and wire brushing St 2

St 2 Thorough scraping and wire-brushing - machine brushing - grinding - etc. The treatment shall remove loose mill scale, rust and foreign matter. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It should then have a faint metallic sheen. The appearance must correspond to the prints designated St 2.

f. Air Blasting with Non-Metallic Abrasives Powder

Whenever the "Duplex"-process is to be applied (hot dip galvanising followed by painting), prepare the hot dip galvanised surface by water washing to remove flux residues and careful air blasting with non-metallic abrasive powder. Use an abrasive with grain size from 0.1 to 0.5 mm, at a greatly reduced air pressure, max. 2 bar (g) (28 psig).

This procedure also applies to stainless steel and aluminium surfaces to be coated.

Surface preparation methods	SIS 055900	DIN 55928 Part-4	BS 4232 only for blasting	SSPC-Vis
Blasting acc to item (a),(b),(c),	Sa 3		First quality	White metal SP 5
Blasting acc to item (b)	Sa 2 1/2		Second quality	near White SP 10
Blasting acc to item (c)	Sa 2		Third quality	Commercial blast SP 6
Hand/or power tool derusting acc to item (e)	St 2		--	Hand tool cleaning SP 2
acc to items (d) and (e)	St 3		--	Power tool cleaning SP 3
Flame jet cleaning		F1	--	Flame cleaning SP 4
Pickling		Be	--	Pickling

Steel structures to be blast cleaned have to be free of pitting and other severely corroded places in accordance with B.S. 4232 and SIS 055900.

The abrasives used for blast-cleaning shall be graded flint, grit, shot or silica sand and shall be such that they will produce an average keying profile on the blast-cleaned surface of not more than 40 microns.

An air pressure of 7 bar g at the nozzle shall be used.

After blast-cleaning, all accumulated grit, dust, etc., must be removed leaving the surface clean, dry and free of mill scale, rust grease and other foreign matter.

In the event of rusting after completion of the surface preparation, the surface must be cleaned again in the manner specified.

Oil, grease, soil, cement, salts, acids or other corrosive chemicals shall be cleaned from steel surfaces, by the use of solvents, emulsions or cleaning compounds. The final wiping shall be with clean solvent and clean rags or brushes. There shall be no detrimental residue left on the surface.

Primed areas which suffer damage must be spot blasted on site to a degree of cleanliness Sa 2 1/2 before, touching up.

Protective coating must be applied as quickly as possible after the completion of surface preparation no matter what cleaning method has been used.

No blast-cleaned surface shall be allowed to remain uncoated overnight.

Steel work protected by shop primer after arrival on site must be cleaned of salt, sand, oil etc. Before the first coat of paint is applied on site. Shop primer damaged during transport must be rectified by blast-cleaning and coating before application of the site coats.

Wood surfaces shall be sanded clean. All nail holes shall be puttied and sanded before priming.

Concrete: If a protective coating is required, concrete shall be allowed to cure before painting.

8.0.0 PREPARATION OF COATING MATERIALS

All containers shall remain un-opened until required for use.

Primers and paints which have livered, gelled or otherwise deteriorated shall not be used.

The oldest primer or paint of each kind shall be used first.

All ingredients in any container shall be thoroughly mixed before use, and shall be agitated frequently during application to keep the primer in suspension.

Primer or paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the body of liquid.

Mixing in open containers shall be done in a well ventilated area.

Primer or paint shall be mixed in a manner ensuring the breakdown of all lumps, complete dispersion of pigment and uniform composition.

Two-component primers shall be mixed in accordance with the manufacturer's instructions.
Thinners shall not be added to primers or paints unless necessary for proper application according to the manufacturer's instructions.
When use of thinners is permitted, it must be added to the primer or paint during mixing.

8.1.0 Primer Paint

After the surface is prepared, one coat of suitable primer shall be applied. After this first coat is dried up completely, second coat of primer shall be applied.

Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be as specified in the Annex- ANNEX 25.1.2 -Paint System of this specification.

The primer should be worked by brush application to cover the crevices, corners, sharp edges etc. in the presence of inspector.

The shades of successive coats should be slightly different in color in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per specification approved by Engineer before application of successive coats.

The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.

Elko meter for measuring the Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detectors for checking the painted surface discontinuities should be provided by the contractor.

The contractor shall make arrangements for paint manufacturer to provide expert technical service at site as and when required free of cost and without any obligation to the Owner, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations.

Final inspection shall include measurement of paint dry film thickness, check of finish and workmanship.

8.2.0 Rub down and Touch Up of Primer

The shop coated surfaces shall be rubbed down thoroughly with emery paper to remove all dust, rust and other foreign matters, washed, degreased, then cleaned with warm fresh water and air dried.

The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry before applying a coat of primer.

The compatibility between shop coat and field primer shall be ascertained from the paint manufacturer. In case degreasing with white spirit is not effective, the surface shall be finally wiped clean with aromatic solvent like xylol or light naphtha.

8.3.0 Non Compatible Shop Coat Primer

a) The compatibility of finishing coat shall be confirmed from the paint manufacturer. In the event of use of primer such as zinc rich epoxy, inorganic zinc silicate etc., the paint system shall depend on condition of shop coat. If the shop coat is in satisfactory condition showing no major defect, the shop coat shall not be removed. The touch up primer and finishing coat(s) shall be identified for application by Engineer. Shop coated (coated with primer & finishing coat) equipment shall not be repainted unless paint is damaged.

b) Shop primed equipment and surfaces shall only be 'spot cleaned' in damaged areas by means of power tool brush cleaning or hand tool cleaning and then spot primed before applying one coat of field primer unless otherwise specified. If shop primer is not compatible with field primer then shop coated primer shall be completely removed before application of selected paint system for particular environment. For package units/equipment, shop primer shall be as per the paint system given for particular environment.

c) In case of existing paint, compatibility between finishing coat and new selected finish coat shall be ascertained before application of finish coat. In case, the coat is selected for upgrading existing alkyd coating to high performance coating then, surface preparation shall be by manual/mechanical means to remove loose rust, peeled off/damaged paint, but sound old coating need not be removed. It shall be touched with suitable primer wherever it has peeled of before application of tie coat. The tie coat shall be applied after 7 days of curing of the primer. If, new paint system is not suitable to upgrade existing coating then complete paint shall be removed by mechanical or blast cleaning before application of new coating system.

8.4.0 Finish Paint

Suitable Finish paints as per the schedule shall be applied for the jobs. The color/shade shall be as approved by the Owner. After cleaning the dust on the dried up primer, first coat of finished paint shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After applying second coat, allowing the water to get evaporated completely, third finish coat of finish paint may be applied(if applicable).

9.0.0 STEEL STRUCTURES PAINTING

Generally, all steel structures shall receive two primer coats and two finish coats of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied (if required) after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection.

Steel surface which is to painted shall be cleaned off dust and grease and the heavier layers of rust shall be removed by chipping to grade ST-2 as per SIS05-5900 or as per IS: 1477 (part -I) prior to actual surface preparation. Suitable primer of required DFT shall be applied as specified in the Paint system of this document- Annex-25.1.1.

Suitable finish paint of required DFT shall be applied as specified in the Paint system of this document- Annex-25.1.1. The undercoat and finish coat shall be of different tint to distinguish

the same from finish paint. All paints shall be of approved brand and shade as per the Owner's requirement.

Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

10.0.0 PAINT MATERIALS

The paints shall conform to the specifications given in this Annex and class - 1 quality in the products range of any of the following manufacturers:

a. Asian Paints (India) Ltd.
b. Bombay Paints
c. Berger Paints India Ltd.,
d. Good lass Nerolac Paints Ltd.,
e. Garware Paints
f. Jenson & Nicholson
g. Shalimar Paints
h. Equivalent other country manufacturer after prior approval of Owner.

11.0.0 STORAGE

All paints and painting material shall be stored only in rooms to Engineer's approval. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separated from adjacent buildings. A signboard bearing the words "PAINT STORAGE - NO NAKED LIGHT - HIGHLY INFLAMMABLE - DANGER - NO SMOKING" shall be clearly displayed outside. All paints shall be stored in the safest manner so that no container rolls down and causes accidents. The shelf life of the paints shall be ensured so that the paint materials are not in storage and use after the date of expiry.

12.0.0 APPLICATION

Health and safety of work

The supplier has to check all painting work to be carried out according to the specification of the paint supplier further to all relevant prescriptions and regulations concerning the health and safety of work.

The paint supplier has to present a written specification including at least the flash point of the paints, ventilation requirements, handling precautions such as inhalation, eye and skin protection, and first aid procedure, storage requirements, spill or leak procedure, fire precaution, waste disposal.

Methods

Quality of the surface to be painted or coated has to be tested acc. to DIN 55928 and DIN 8202.

Temporary corrosion protections are to be completely removed prior to applying the definite one, in acc. with DIN 55928.

All prime coatings shall be applied by brush or airless spray or a combination of these methods, as approved by the coating manufacturer.

All doors, windows, stairways, handrails (if painted), bolts, flanges and equipment supports shall be finish painted by brush.
Spray guns should not be used outside in windy weather or near surfaces of a contrasting colour unless the latter is properly protected.

All cold-spray painting shall be done using standard equipment in accordance with accepted standards and methods.

Care has to be taken not to connect spraying devices for nitro and backelite paints simultaneously to oil based paints.

Paint applied to items that are not being painted shall be removed at the supplier's expense, leaving the surface clean, unstained and undamaged.

Dry film thickness (DFT)

To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats shall not be of the same colour.

For a composite paint or coating system consisting of several coats, the total DFT must be at least equal to the sum of the minimal DFT's for the individual coats. If, the paint system does not have the required minimum DFT those areas should be marked & repainted. If the occurrence of those areas is high, the complete surface must be repainted. It is also critically important to check the DFT of primers and intermediate coats and to correct them where necessary.

For paintings based on Zinc silicate the DFT is limited as well on minimum DFT as on maximum (150µm) because of the risk of mud cracking.

Consumption of paints

Has to be evaluated according to DIN 53220. The paints shall be tested as per
IS - 101.

Each coat of paint shall be allowed to harden before the next is applied. For epoxy paint the hardening time normally is 12-14 hours. Suppliers' recommendations regarding hardening time of epoxy paints must be followed.

Particular attention must be paid to full film thickness at edges.

The minimum total dry film thickness of the paint systems shall be as recommended in the **Annex 25.1.2**. The DFT is given in microns (millionths of a metre).

13.0.0 PROTECTIVE COATINGS AND PAINT SYSTEMS

The colour coding for identification of pipelines should comply with IS-2379 & IS -9404.

The type and number of protective coats for any item requiring painting are to be in accordance with DIN 55928 and are to be at least of a quality as shown in the attached Annex-25.1.1- Paint System.

Alternative to the Annex-25.1.1- Paint System specified, are to be presented on the schedule Departure from Specification, as indicated elsewhere.

Generally, all parts shall receive the specified prime coat (s) at the supplier's works to ensure that no corrosion occurs during transport to the site and storage at the site.

Parts which cannot be damaged during transport shall receive the full number of coats.

Types of Substrate, Base metal:

- Ferrous (Surface Temperature during operation < 120º C, EN ISO 12944:1998)

  To this group belongs carbon steel, low alloyed steel & high alloyed steel. All paint systems are inevitable for corrosion protection.

- Hot dip galvanized surfaces.

  Hot dip galvanized surfaces do require painting in a wet, industrial, chemicals and/or marine environment

- SS (EN ISO 12944:1998 conditionally applicable)

  In general, SS surfaces do not require painting unless in a chemical and/or marine environment. In case of chemical and/or marine environments determination of whether or not the surface requires painting depends on the chemical content of the base metal.

  The following formula applies:
  W = Cr + 3.3 x Mo + 22.45 N2

  If W < 23, then the surface has to be painted.

  If W < 28 & W > 23, then the surface to be painted if splash contact with the media (i.e. sea) is possible. This may also occur if there is a strong wind carrying drops to the surface.
  If W > 28, then the surface need not be painted.

- Aluminium

  By default such surfaces/components will not be painted. Exceptions are architectural/aesthetic reasons and high corrosive conditions, which shall be evaluated separately depending on aluminum alloys.

14.0.0 GALVANIZING

Galvanizing works shall conform in all respect to B.S. 729, B.S. 3083 and B.S.C.P. 2008 and to DIN 50976 whatever requires the higher quality and shall be performed by the hot dip process, unless otherwise specified.

It is essential that details of steel members and assemblies which are to be hot-dip galvanized should be designed in accordance with B.S 4479.

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

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

All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed in accordance with B.S. 4360. All drilling, cutting, welding, forming and final

fabrication of unit members and assemblies shall be completed, where feasible, before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from paint, oil, grease and similar contaminants in accordance with DIN 55928, part 4 and DIN 50976. The weight of zinc coating per unit area has to be noted in the manufacturing documents in accordance with DIN 50976.

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

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

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

Galvanized contact surfaces to be joined by high-tensile friction-grip bolts shall be roughened before assembly so that the required slip factor (defined in B.S. 3294, part 1 and B.S. 4604, part 1) is achieved. Care shall be taken to ensure that the roughening is confined to the area of the mating faces.

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

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

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

- Cleaning the area of any weld slag rust and other impurities and by thorough wire brushing to give a metallic clean surface.

- Application of suitable number of coats of zinc-rich paint containing more than 90 % w/w of zinc in dried film. The dry film thickness shall exceed at least 50 % the thickness of the desired galvanization. In case of application of a low melting point zinc alloy repair rod, the rods shall be in accordance with DIN1707, the thickness of the alloy shall be at least as of the desired galvanization.

The restored area is not to exceed 1 % of the galvanized surface.

Surface restoration of parts in contact with drinking water is not allowed and the quality of the galvanization is to be in accordance with DIN 2444.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc-rich paint. Connections between galvanized surfaces and copper, copper alloy or aluminum surfaces shall be protected by suitable preferably hydrophobe tape wrappings to the owner's approval.

15.0.0 SPRAYED METAL COATINGS

Corrosion protection may be also achieved by spraying of suitable metals as zinc and/or aluminum on the surfaces of structures. For special cases tin, copper, lead can be used as well. Methods of surface preparation have to conform to B.S. 2569 or to DIN 8567. A proper treatment of the surface followed by an immediate spraying is to apply to ensure adhesion of the sprayed metal. The surface has to be clean, free of impurities, rust, mill scale and rough enough to have binding properties to ensure good enticulation with the sprayed layer. Suitable roughness can be achieved by blast cleaning acc. to BS 4232 or DIN 8567. Welds are to be cleaned and prepared with special care. All surfaces to be treated have to be dry and accessible.

Application of coatings, requirements for thickness, adhesion, composition of coating metals, and subsequent treatment have to conform to BS 2569, DIN 8565 and 8567.

Testing of the spray coated layers are to be carried out in accordance with DIN 8565.

The contractor has to specify the type, composition and thickness of the sprayed metal and of the sealing coating according to DIN 8565 including the corresponding warranties and tests if, sprayed metal coating will be applied.

Safety of work:

All precautions connected with this type of application of corrosion protection have to be in accordance with German regulation DVS 2307, page 1. 2.

Sprayed, unfused coating of metals and metallic compounds applied by combustion gas flame, plasma arc, detonation and similar processes, and the preparation of components, spraying techniques, sealing, finishing and inspection shall be according to B.S. 4761.

The hot galvanized surface has to be cleaned before the application of the coats to remove corrosion products, dirt, dust, grease.

The cleaning can be achieved by

- brush off
- washing with 1 - 1.5 % ammonia water with up to 0.1 % detergent added and followed by wet grinding to turn the foam to grey color,
- steam blasting.

16.0.0 WARNING NOTES / SIGNALS

This Instruction serves the identification of the coated surfaces that are received from shop in assembled condition / module wise.

The warning note shall prevent any possible damage to the coated surfaces during transportation / assembly at site.

Eg.: Welding work OR Heat treatment work on the outside of coated or lined surfaces is prohibited.

17.0.0 COLOUR CODE FOR PIPING

a. The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding consists of a ground colour and colour bands superimposed on it. The colour coding for the identification of pipelines shall comply with **Annex – 25.1.1** of this specification.

Ground Colour shall be applied throughout the entire length for un insulated pipes. For insulated pipes, on the metal cladding or on the pipes of material such as non-ferrous metals, austenitic stainless steel etc., ground colour coating of minimum 2m length or of adequate length not to be mistaken as colour band shall be applied at places requiring colour bands. Colour band(s) shall be applied at the following location.

i. At battery limit points

ii. Intersection points & change of direction points in piping ways.

iii. Other points, such as midway of each piping way, near valves, junction joints of service appliances, walls, on either side of pipe culverts.

iv. For long stretch/yard piping at 50 M interval.

v. At start and terminating points.

b. Flow direction shall be indicated by an arrow in the location stated above and as directed by Engineer. Colors of arrows shall be black or white and in contrast to the color on which they are superimposed. The size of the arrows shall confirm to IS:2379. Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by Engineer. As a rule minimum width of color band shall conform to 75 mm up to 300 NB and to 100 mm over 350 NB. Whenever it is required by the Engineer to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of red and golden yellow as per IS:2379 shall be painted on the ground color.

c. All uninsulated piping systems, hangers and supports shall have two coats of suitable primer coats and with suitable finish paints as per Annex 25.1.2 Painting system. Shades shall be as per IS 5 or as indicated by Owner /Engineer. Service of the pipe/line designations shall be painted on all pipes at visible locations.

18.0.0 IDENTIFICATION OF VESSELS, PIPING ETC.

Equipment number shall be stenciled in black or white on each vessel, column, equipment and machinery after painting.

Line number in black or white shall be stenciled on all the pipelines of more than one location as directed by Engineer; size of letters printed shall be 150 mm (high) for column & vessels. 50 mm (high) for pump compressor and other machinery and shall be as per IS: 9404 for piping. The storage tanks shall be marked as detailed in the respective drawing.

19.0.0 INSPECTION AND TESTING

a) All painting materials including primers and thinners brought to site for application shall be procured directly from manufacturer as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable. Engineer at his discretion, may call for tests for paint formulations. Contractor shall arrange to have such tests performed including batch wise test of wet paints for physical & chemical analysis. All costs thereof shall be borne by the contractor. The paints shall be tested as per IS: 101 / equivalent international standard and approved by the Owner.

b) The painting work shall be subject to inspection by Engineer at all times. In particular, following stage wise inspection shall be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection shall be surface preparation, primer application and each coat of paint. In addition to above, record shall include type of shop primer already applied on equipment e.g. red oxide zinc chromate or zinc phosphate or Silicate primer etc.

c) Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Engineer before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor shall be responsible for making good of any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint shall be applied to make-up the DFT specified without any extra coat to the Owner.

20.0.0 GUARANTEE

The contractor shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specifications contained herein/to be provided during execution of work. The contractor shall produce test reports from the manufacturer regarding the quality of the particular batch of paint supplied. The Engineer shall have the right to test wet samples of paint at random for quality of the same. Batch test reports of the manufacturer's for each batch of paints supplied shall be made available by the contractor.

ANNEX-25.1.1

STANDARD FINAL COLOUR OF EQUIPMENT AND PIPING

1.0.0 STANDARD COLOUR CODE FOR MECHANICAL EQUIPMENT

Sl. No.	Description	Ground Colour
A	**CLOSED COOLING WATER SYSTEM**	
1	Closed cooling water pumps	Sea Green
2	Plate heat exchanger	Sea Green
3	Closed Cycle cooling Water (CCCW) pumps	Sea Green
4	CCCW Expansion tank	Sea Green
5	CCCW chemical dosing tank	Sea Green
B	**WATER TREATMENT PLANT**	
1	Raw water	
a	Raw water pump	Sea Green
b	Clarifier	Sea Green
c	- Raw / Fire water storage tank	Sea Green
d	DM plant supply pump	Sea Green
e	Filter air blower	Sea Green
f	Filter back wash pump	Sea Green
g	Lime slaking tank & agitator	Sea Green
h	Lime slurry transfer pump	Sea Green
I	Lime solution tank	Sea Green
j	Lime solution dosing pump	Sea Green
k	Alum solution tank	Sea Green
l	Alum solution metering pump	Sea Green
m	Polyelectrolyte solution tank	Sea Green
n	Polyelectrolyte solution metering pump	Sea Green
o	Sludge feed pump	Sea Green
p	Filter press	Sea Green
q	Service water tank for DM building	Sea Green
r	Service water tank for control annex	Sea Green
2	Demineralization system	
a	Activated carbon filter	Sea Green
b	Cation exchanger	Sea Green
c	Anion exchanger	Sea Green
d	Degasser tower	Sea Green
e	Air blower for degasser tower	Sea Green
f	Strong base anion exchanger	Sea Green
g	Degassed water transfer pump	Sea Green
h	Strong base anion exchanger	Sea Green
I	Mixed bed polisher	Sea Green
j	Air blower for mixed bed polisher	Sea Green
k	DM Water Storage tank	Sea Green
l	DM water transfer pump	Sea Green
m	Acid unloading cum transfer pump	Dark Admiralty Grey
n	Bulk acid storage tank	Dark Admiralty Grey
o	Acid measuring tank for SAC	Dark Admiralty Grey
p	Acid measuring tank for MB	Dark Admiralty Grey
q	Regeneration water pump	Dark Admiralty Grey
r	Caustic Lye unloading cum transfer pump	Dark Violet
s	Bulk caustic storage tank	Dark Violet
t	Caustic regeneration tank & agitator	Dark Violet

Sl. No.	Description	Ground Colour
u	Caustic solution filter	Dark Violet
v	Caustic dilution tank for SBA/WBA	Dark Violet
w	Caustic dilution tank for MB	Dark Violet
x	Caustic pump for regeneration for WBA/SBA	Dark Violet
y	Waste water recirculation cum disposal pump	Sea Green
C	**CRANE & HOIST**	
1	Power house EOT crane	Canary Yellow
2	CW pump house EOT crane	Canary Yellow
D	**COMPRESSED AIR PLANT**	
1	Air compressor	Sky Blue
2	Compressed air dryer	Sky Blue
3	Air receiver	Sky Blue
E	**Chemical Dosing**	
1	Hydrazine preparation tank	Dark Admiralty Grey
2	Ammonia preparation tank	Dark Admiralty Grey
3	Hydrazine & ammonia dosing tank	Dark Admiralty Grey
4	Hydrazine & ammonia dosing pump	Dark Admiralty Grey
5	Phosphate preparation tank	Dark Admiralty Grey
6	Phosphate dosing tank	Dark Admiralty Grey
7	Phosphate dosing pump	Dark Admiralty Grey
8	Sampling system	Dark Admiralty Grey
F	**FIRE PROTECTION SYSTEM**	
1	Diesel engine driven pump	Fire Red
2	Fuel tank for diesel engine driven pump	Fire Red
3	Main hydrant pump (Electrical)	Fire Red
4	Jockey pump	Fire Red
5	Fire Water Storage tank	Fire Red
6	CO2 cylinder	Fire Red
G	**FUEL OIL SYSTEM**	
1	Fuel oil pumps skid	Light Brown
2	Fuel oil Storage tank	Light Brown
3	Fuel oil strainer	Light Brown
H	**ASH DISPOSAL SYSTEM**	
1	Ash transmitting vessel	Aluminium
I	**AIR CONDITIONING AND VENTILATION SYSTEM**	
1	Refrigerant compressor	Sky Blue
2	Chilled / condenser pumps	Sea Green
3	Condenser water pipe	Sea Green
4	Fans	Grey

Notes:

1. This color code basically refers to IS:2379 for piping with necessary modifications
2. For any item left out, color coding will be decided after Owner's approval.

2.0.0 STANDARD COLOUR CODE FOR ELECTRICAL EQUIPMENT

	Description	Colour	Colour No.
1	Generator	Two undercoats of high quality epoxy based primer followed by two coats of epoxy painting	
2	Generator circuit breaker a) Outdoor	-	RAL 7032
	b) Indoor	Glossy white	-
3	Transformers	Pebble grey	RAL 7032
4	Bus ducts	Pebble grey	RAL 7032
5	Junction boxes.	Pebble grey	RAL 7032
6	HT/LT Switchboards, Distribution boards, Control & Relay panels		
	a) Indoor	Pebble grey	RAL 7032
	b) Outdoor	Pebble grey	RAL 7032
7	UPS Panel, charger panels	Pebble grey	RAL 7032
8	DG Alternator	Onan Green	-
9	NGR	Pebble grey	RAL 7032
10	Motor	Pebble grey	RAL 7032
11	Lighting fittings	As per manufacturer's standard	As per manufacturer's standard
12	Cable trays	Galvanized	
13	Elevator	Red oxide primer paint	

1. For interior coating, manufacturer's standard can be adopted subject to Owner's approval.
2. All panels that are to be erected at CCR floor shall be painted using RAL 7032 (exterior colour). All Electrical, C&I, Fire alarm or any other panel shall have this colour.

3.0.0 COLOUR CODING FOR IDENTIFICATION OF PIPELINES USED IN THERMAL POWER PLANTS

		Ground Shade		Band Shade		
Sl.No	**Medium**	**Color**	**Color No. as per IS:5**	**Color**	**Color No. as per IS:5**	**Remarks**
1	Water system					
a)	Untreated or raw / service	Sea green	217	White	-	White is not included in IS - 5-2007
b)	Treated/dematerialized	Sea green	217	Light orange	557	
c)	Condensate	Sea green	217	Light brown	410	
d)	Potable water	Sea green	217	French blue	166	
e)	RO water	Sea green	217	Light orange	557	
f)	Service & clarified water	Sea green	217	French blue	166	
2	Steam system					
a)	Auxiliary steam	Aluminum	-	Signal red	537	with aluminum
3	Air system					
a)	Instrument	Sky Blue	101	White	-	
b)	Service/Plant	Sky Blue	101	White	-	White not included in IS-5 - 2007
c)	Vacuum pipes	Sky Blue	101	Black	-	Black not included in
4	Gas system					
a)	Hydrogen	Canary yellow	309	Signal red	537	
b)	Chlorine	Canary yellow	309	Dark violet	796	
c)	Carbon dioxide	Canary yellow	309	Light grey	631	
d)	Oxygen	Canary yellow	309	White	218	White is not included in
5	Oils					

		Ground Shade		Band Shade		
Sl.No	**Medium**	**Color**	**Color No. as per IS:5**	**Color**	**Color No. as per IS:5**	**Remarks**
a)	LDO/HFO	Light brown	410	Brilliant green	221	
b)	Transformer oil	Light brown	410	Light orange	557	
6	Chemical feed					
a)	Acid piping (in water treatment plant)	Dark admiralty grey	632	Signal red	537	Hazard mark is given
b)	Alkali Piping (in water treatment plant)	Dark violet	796	Golden yellow	356	Hazard mark is given
7	Fire services	Fire red	536	-	-	-
8	Effluent pipes	Black	-	-	-	-

4.0.0 COLOUR CODE FOR STRUCTURAL STEEL

SL. NO	ITEAM/SERVICE	COLOR	COLOR No. as per IS:5
1	Gantry girder & monorail	Brilliant green	221
2	Gantry girder & monorail stopper	Signal red	537
3	Building structural steel columns brackets, beams bracings, roof truss, purloin, side grit, louvers, stringers	Dark admiralty grey	632
4	Pipe rack structure & trestle	Dark admiralty grey	632
5	Chequered plate (Plain Face)	Black	-
6	Grating	Black	-
7	Ladder	Dark admiralty grey	632
8	Hand railing Hand rail	Signal red	537
9	Middle rail	Signal red	537
10	Toe Plate	Signal red	537
11	Vertical post	Black	-
12	Structural steel for Silo	Smoke grey	692

Notes

1. Covering capacity and DFT depends on method of application. Covering capacity specified above is theoretical. Allowing the losses during application, min specified DFT shall be maintained.

2. All primers and finish coats shall be cold cured and air dried unless otherwise specified.

3. All paints shall conform to relevant Indian Standard and shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship shall be ensured.

4. Technical data sheets for all paints shall be supplied at the time of submission of quotations.

5. In case of use of epoxy tie coat, manufacturer shall demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat, alternate system may be used taking into consideration the service requirement of the system.

6. Contractor will submit the final colour shade for all equipments & piping under his scope for final approval by client / consultant.

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
Structural Steel work, piping (Oil + Water), tanks outside surface, transmission towers cranes, steel floors, galleries, stairways, Outdoor.	< 130 Deg	SA 2 1/2	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	1	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	200
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**350**
Structural Steelwork, piping, indoor and outdoor	130 to 200 Deg	SA 2 1/2	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Sealer	1	Single pack Heat Resistant Silicon Acrylic Finish paint.	25
			Finish	2	Single pack Heat Resistant Silicon Acrylic Finish paint.	25
					Total	**150**
Alternative -2		SA 2 1/2	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
				1	Single pack Moisture Cured, Inorganic Silicate based heat resisting finish up to 400 Deg - Grey shade./ white/ Aluminium.	50
			Finish	1		50
					Total	**175**
Alternative-3			Finish	1	Single pack Heat Resistant Silicon Acrylic Finish paint. - either Aviation White/ Aviation Orange.	80
					Total	**155**
Structural Steel work Piping, Un-insulated	200 to 400	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs	75

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
Carbon Steel Indoor and Outdoor	Deg C.				/ 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level 2.	(75)
			Finish	2	Heat Resisting Silicon Aluminium Paint. VS to be min 28%.	20
					Total	**115**
Carbon steel surfaces subjected to temperature up to 400℃. But Under Thermal Insulation.	< 400℃	Power tool cleaning to St 2 /3		**2**	Red-oxide Zinc phosphate primer to IS 12744	**30**
						60
Components coming in the gas path (other than Coils), including water walls, SH panels, SH Headers, Hot air ducts etc.		Power tool cleaning		**2**	Red-oxide Zinc phosphate primer to IS 12744	**30**
						60
Structural Steel work, Piping (Oil + water) , Tanks Indoor.	<130 Deg.C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	2	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	100
			Finish	2	Two component Polyamide Cured Epoxy Coating.	25
					Total	**325**
Structural Steel work in the battery rooms, chlorination plant and	Ambien t	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance	75

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
water treatment plant, (extremely aggressive atmosphere)					specifications for SSPC Paint 20 , Level 1	
			Touch up		Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	1	Two component, high build rust encapsulating, aluminium pigmented modified epoxy coating.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	150
					Total	**350**
Steel Tanks inside Surface (Total) for Oil Storage	Normal	SA 2.5	Primer	1	Two component high build amine cured epoxy Primer with zinc phosphate pigment.	75
			Finish	2	Two component Self priming High Build Polyamine adduct cured epoxy coating.	125
					Total	**325**
Alternative-1			Finish	3	Two component Self priming High Build Polyamine adduct cured epoxy coating. **(No primer required. Self priming coating post blasting)**	125
					Total	**375**
Alternative-2			Finish	2	Two component High build high solid Solvent free epoxy coating - certified by CFTRI for Potable water usage.**(Primer same as above)**	150
					Total	**300**
Steel Tanks inside Surface (Total) for Water Storage (Potable and Distilled Water)	Ambient	SA 3	Primer	1	Two component high build polyamide cured zinc phosphate Primer	75
			Finish	2	Two component Self priming High Build Polyamine adduct cured epoxy coating - certified by CFTRI for Potable water usage.	125
					Total	**325**
Alternative 1			Finish	2	Two component High build high solid Solvent free epoxy coating - certified by CFTRI for Potable water usage. **(No primer required. Self priming coating post blasting)**	200
					Total	**400**
Steelwork immersed in	< 60	SA 3	Primer	1	Two component High Build High Solid Rapid Curing Epoxy	75

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
seawater such as inlet/ outlet structures, dolphins, sheet piling	Deg C				Zinc Phosphate Primer.	
			Finish	1	Two component High build High Solid Modified Epoxy coating.	500
					Total	**575**
			Wherever TAR based product is not to be recommended.			
			Finish	1	Two component High build High Solid Modified Epoxy coating	500
					Total	**500**
			Finish	1	Two component High build High Solid Modified Epoxy coating with Glass Flake.	500
					Total	**500**
Alternative 1						
Cast Iron Water pipelines - Outside surface, buried in Soil	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Finish	2	Polyamide Cured Coal Tar Epoxy, Vs min 65% black.	200
					Total	**475**
Alternate-1			Finish	1	Two component High build High Solid Modified Epoxy coating	500
Alternate -2			Finish	1	Two component High build High Solid Modified Epoxy coating with Glass Flake	500
Steel Pipes - Inside surfaces such as cooling water lines.	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Finish	2	Coal Tar Epoxy, Vs min 65% black.	225
					Total	**525**
Water Pipelines - Outside Surface, Indoor	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch	1	Two component Zinc rich Primer meeting performance and	(75)

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
			up		compositional specifications of SSPC Paint 20 Level2	
			Finish	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	**275**
Oil pipelines - Outside surface, above ground	< 100 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up		Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**350**
Pumps, Motors, Turbine, Claddings, Steam Turbine Condenser, Indoor	Up to 90 Deg	SA 2.5	Primer	1	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.	75
			Finish	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	**275**
Alternative 1		SA 2.5	Primer	1	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.	75
			Mid coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
			Finish	2	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**250**
Heat Exchangers - Inside Surface.	Up to 60 Deg	SA 2.5	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Finish	2	Coal Tar Epoxy, Vs min 65% black.	200

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
					Total	**475**
Heat exchanger Coils coming in the gas path . (Eco, SH, RH coils & Loose tubes etc.)		Power tool cleaning			One coat of dip-coat paint -Red-oxide Zinc phosphate primer	35
Instrument panels, Electrical cubicles and similar steel sheet – indoor **(Can be used on Aluminium, steel, stainless steel and galvanized substrates.)**	Ambient	Oil grease and contamin atnts must be removed	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	75
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide	100
			Top coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	**275**
Instrument panels, Electrical cubicles and similar steel sheet – outdoor **(Can be used on Aluminium, steel, stainless steel and galvanized substrates.)**	Ambient	Oil grease and contamin atnts must be removed	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	100
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide.	150
			Top coat	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**325**
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated. - Outdoor	<120 Deg	Air blasting with Nonmetallic abrasive Powder	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	50
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide	150

ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**275**
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated.- Indoor	<120 Deg	Air blasting with Nonmetallic abrasive Powder	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level 2.	75
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	**225**
			For Outdoor Application			
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**200**
			For Indoor Application			
Substrate, Stainless Steel - Non insulated.	< 120 Deg	Air blasting with Nonmetallic abrasive Powder	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	**225**
			For Outdoor Application			
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**200**
Applicable for Water -				**For Indoor Application**		

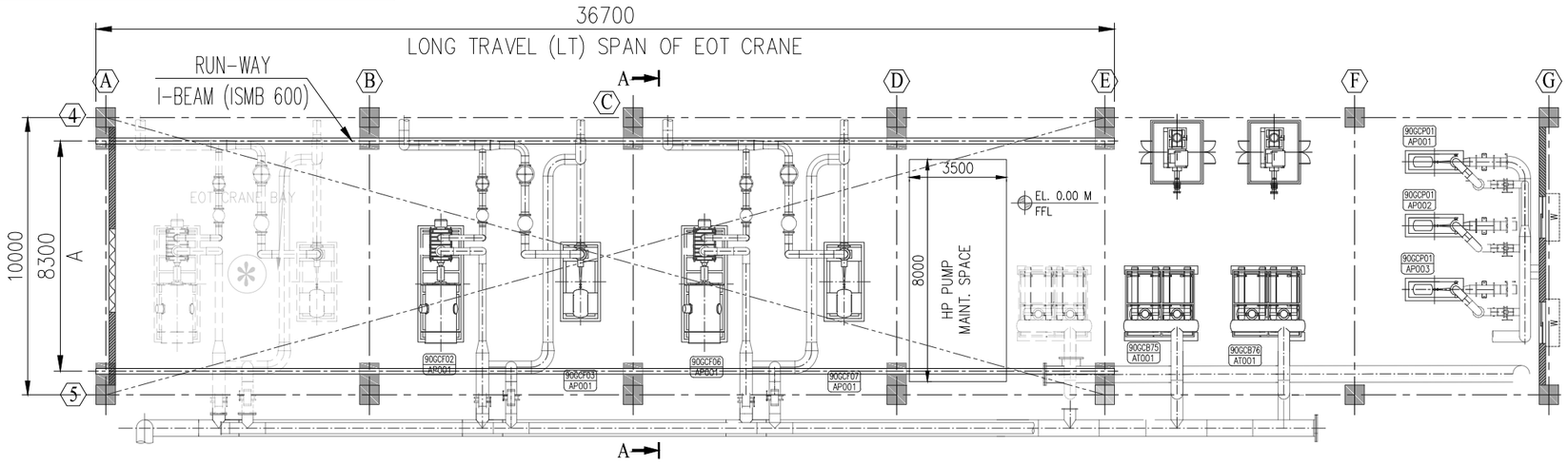
ANNEX 25.1.2 PAINTING SYSTEMS						
Cleaning, Protective Coating and Painting - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**					
		Surface prep	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
Water Cooled heat Exchangers like Condensers, Flash box, Water - Water coolers etc. For Outdoor installations in corrosive atmosphere - like Chemical/ Marine.	< 120 Deg	Air blasting with Nonmetallic abrasive Powder	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	75
			Top coat	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	**275**
				For Outdoor Application		
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Mid coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
			Top coat	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**300**

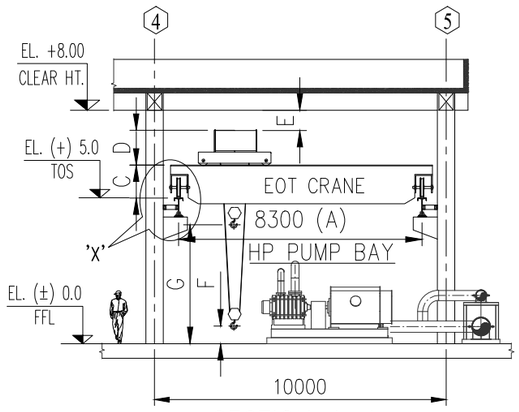
PAINTING SPECIFICATION FOR CIVIL BUILDINGS – COASTAL

S.No.	Location	Description
1	Metal and Timber Joinery	Two component high build, self priming, rust encapsulating, modified epoxy coating. Min VS 80%.
2	All Ceiling	Oil bound distemper (Office rooms) White Washing - all areas.
3	Internal wall surfaces	Oil Bound distemper
4	Control room/office	Acrylic Emulsion.
5	External faces of walls	Cement based Water proof paint
6	Walls of battery room and other acid/alkali spillage areas	1. Primer -1 coat of 50 microns - Two pack Polyamide Epoxy Primer with Zinc phosphate Pigment for concrete application. Min VS 48%. 2. Top coat - 1 coat of 125 microns - Two component self priming, high build polyamine adduct cured epoxy coating having excellent chemical resistance. Min VS 60%.
7	Cooling Tower External	
	a. Steel sections	i) Blasting to SA 2.5 ii) 1 x 75 microns - Inorganic Zinc Silicate as per SSPC Paint 20 Level 2. iii) 1 x 150 microns –Two components high build epoxy intermediate pigmented with lamellar micaceous iron oxide. Min VS 65%. iv) 1 x 75 microns - Two component high solids, Glossy, Acrylic Aliphatic Polyurethane paint, Min VS of 57%, Gloss retention of 90% after exposure to 2000 hrs under QUV B 313 lamp
	b. Concrete sections	1. 1 x 50 microns - Epoxy Polyamide Primer 2. 1x 500 microns-Two components high build high solid, engineered epoxy coating. Min VS 87%. - Typical dft - 500 microns per coat. Condensation as per IS 101 - 9000 hrs, Salt spray as per ASTM G 85 - 8000 hrs.
8	Chimney external	i) 1 x 50 microns Concrete Epoxy Polyamide primer followed by ii) 2 Coats of 50 microns of Acrylic Aliphatic Polyurethane paint

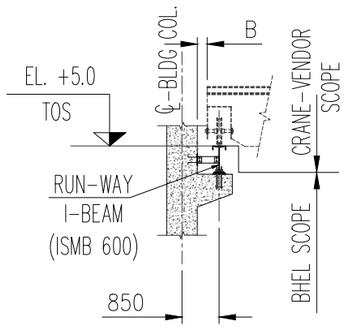
DRAWING NO. 3-WT-226-01430

ALL DIMENSIONS ARE IN MILLIMETRES





SECTION A–A



DETAIL –X

UF–RO BUILDING LAYOUT –PLAN

(CRANE IS NOT SHOWN IN PLAN VIEW)

CRANE LOAD DETAILS

SAFE WORKING LOAD OF CRANE IN MT:	10.0 MT
SHIPPING WT. OF CRANE ASSY. IN KG.	VENDOR TO FURNISH
NO. OF LT WHEELS	04
STATIC LOAD ON EACH LT WHEEL IN KG.	VENDOR TO FURNISH
DYNAMIC LOAD ON EACH LT WHEEL IN KG.	VENDOR TO FURNISH

CRANE DIMENSION DETAILS

SL NO	DIM. MARK	DESCRIPTION	DIMENSION IN MM.
1	A	C/C BETWEEN LT WHEELS	VENDOR TO FURNISH
2	B	END CLEARANCE BETN. CRANE AND STRUCTURE	
3	C	HT. FROM TOS OF I–BEAM TO TOP OF CT RAIL	
4	D	HT. FROM TOP OF CT RAIL TO CRANE TOP	
5	E	TOP CLEARANCE	
6	F	LOWER LIMIT OF HOOK (MAIN HOIST)	
7	G	UPPER LIMIT OF HOOK (MAIN HOIST)	
8	H*	LOWER LIMIT OF HOOK (AUX. HOIST)	
9	J*	UPPER LIMIT OF HOOK (AUX. HOIST)	

*NOT MARKED IN THE SECTIO A–A

NOTES;

1. ELEVATION OF FINISHED FLOOR LEVEL OF THIS BUILDING IS 0.00 M.
2. CRANE SHALL BE ERECTED IN THE HP PUMP BAY OF THIS BUILDING.
3. VENDOR HAS TO FURNISH DIMENSION DETAILS AND LOAD DETAILS DURING BIDDING STAGE.
4. SCOPE OF SUPPLY AND OTHER DETAILS SHALL BE AS PER TECHNICAL SPECIFICATION NO. ROS:6233.
5. ANY OTHER DETAILS PERTAINING TO CRANE ERECTION AND OPERATION SHALL BE FURNISHED BY VENDOR FOR CONSIDERATION IN CIVIL CONSTRUCTION.
6. DSL SHALL BE PLANNED ALONG GRID –C.

FOR TENDER PURPOSE ONLY

ZONE		CHECKED	

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: **2 X 660MW UDANGUDI SUPERCRITICAL TPP Stage-1 AT UDANGUDI, THOOTHUKUDI DISCTRICT, TAMIL NADU**

BHARAT HEAVY ELECTRICALS LTD., UNIT: BOILER AUXILIARIES PLANT, RANIPET – 632 406.

	NAME	SIGN	DATE
DRN	M SAKTHI	Sd/–	31.10.20
CHD	BB SAHU	Sd/–	19.04.21
APPD	G RAJENDIRAN	Sd/–	19.04.21

NO.OF VAR.

DEPT	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/~~OLD~~ DRG.	ITEM NO.	NO. OF ITEMS
NP		NTS	– – –			– – – –
CODE 9776	PR: QA: 500					

TITLE	CARD CODE	DRAWING NO.	REV
EOT CRANE (SWL: 10.0 MT) LAYOUT	U 01	**3-WT-226-01430**	0

Size A3