VOLUME- IV
SECTION-18,
GROUNDING & LIGHTNING PROTECTION

TABLE OF CONTENTS

1 GENERAL

This specification is intended to cover the design, engineering, manufacture, assembly, testing at manufacturer's works, supply in properly packed condition for transport to site and delivery Grounding and Lightning system complete with all accessories for efficient and trouble-free operation of 2 x 500 MW Neyveli New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2 CODES AND STANDARDS

All equipment and materials will be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below except where modified and/or supplemented by this specification. All standards, specifications and codes of practice referred to herein will be the latest editions including all applicable official amendments. All work will be carried out as per the following standards/ codes as applicable.

IS:513	Cold rolled low carbon steel sheets and strips.
IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.
IS:1079	Hot Rolled carbon steel sheet & strips
IS:1239	Mild steel tubes, tubulars and other wrought steel fittings
IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating
IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear

IS:2309	Code of Practice for the protection of building and allied structures against lightning.
IS:2629	Recommended practice for hot dip galvanising of iron & steel
IS:2633	Method for testing uniformity of coating on zinc coated articles.
IS:3043	Code of practice for Earthing
IS:3063	Fasteners single coil rectangular section spring washers.
IS:6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS:8308	Compression type tubular in- line connectors for aluminium conductors of insulated cables
IS:8309	Compression type tubular terminal ends for aluminium conductors of insulated cables.
IS:9537	Conduits for electrical installation.
IS:9595	Metal – arc welding of carbon and carbon manganese steels – recommendations.
IS:13573	Joints and terminations for polymeric cables for working voltages from 6.6kv upto and including 33kv performance requirements and type tests.

BS:476	Fire tests on building materials and structures
IEEE:80	IEEE guide for safety in AC substation grounding
IEEE:142	Grounding of Industrial & commercial power systems
DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.
DIN 46329	Cable lugs for compression connections, ring type, for Aluminum conductors
VDE 0278	Tests on cable terminations and straight through joints
BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables.
	Indian Electricity Act.
	Indian Electricity Rules.
	National Electrical Code, 1985.

Equipment complying with other internationally accepted standards such as IEC, BS, DIN, , VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Contractor will clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments.

3 GROUNDING & LIGHTNING PROTECTION

3.1 General

The main objectives of grounding system are to :

a) Provide safety to personnel from contact of dangerous potential caused by ground fault.

b) Ensure sufficient grounding current for effective relaying.

c) Stabilize circuit potential with respect to ground.

3.2 Grounding system

In order to meet the above objectives, ground grid mesh will be provided for the entire area within battery limit.

Fault current for the earthing system will be designed for 50 KA for a duration of 1 sec.

All electrical equipment, non current carrying metal parts, structures, building steel, lightning protection system, generator/transformer neutrals will be connected to this station ground grid.

Treated earth pits including riser will be provided for Transformer neutral earthing.

Connection between the equipment earth lead and the grid conductor will be welded. For rust protection, the welds will be treated with zinc chromate primer and coated with zinc rich paint.

Entire erection of grounding work will be carried out in such a way as to be capable of withstanding the intended services of carrying full short circuit level currents to ground mat without any damage/deformation.

The major aspects to be considered for grounding system design are given below:

3.3 Ground Grid Conductor

a) Ground grid conductor of mild steel rod will be used.

b) The minimum conductor section is determined on the basis of ground fault current. This section is then increased by an allowance to account for the soil corrosion loss of 0.3 mm (on diameter of conductor) per year over the design life of at least 30 years.

3.4 Underground Grid

a) The ground grid mesh is designed to keep the touch and step voltages within safe limits as per recommendation of IEEE 80.

b) The ground grid conductors will be buried in earth at a depth of 600 mm. The length of ground conductors below earth will be sufficient to ensure a ground resistance less than one (1) ohm.

c) The ground grid conductor will be so laid as to provide short and direct connection to building steel and major electrical equipment.

d) Ground rods will be provided at the points where system neutrals/lightning protections are connected to the ground grid.

e) All ground grid conductor connections will be welded type.

f) Ground grid will be interconnected with the ground grid of neighboring areas at least at two (2) points for further reducing the ground grid resistance.

g) Suitable pigtails will be provided and shown in the layout drawing for connection with ground grid of neighboring areas.

h) A minimum earth coverage of 300 mm will be provided between the ground grid conductor and the bottom of trenches, tunnels, underground pipes, foundations, railway tracks etc. The ground grid

conductor will be re-routed in case it fouls with equipment foundations.

i) In some cases, it may happen that the construction work of cable trench, foundation and laying of underground pipes are being taken up after the grounding mat has been laid. It may be required to cut a portion of grounding conductor to avoid fouling with cable trench, equipment foundations, underground pipes etc. In this case, the ground conductor will be properly rerouted and rejoined/reconnected with the main grounding mat during the construction/laying of above underground objects and good electrical continuity of grounding conductor will be ensured.

j) Grounding conductors crossing the road may have to be laid at greater depth to suit the site conditions.

k) Grounding conductor around the building will be buried in earth at a minimum distance of 1200 mm from the outer boundary of the building.

l) The Contractor will carryout the interconnection among various peripheral earthing grids/mats, steel structures, lightning protection system as well as grounding of all electrical equipment, etc.

3.5 Ground Electrode

Ground electrodes will be 40 mm dia and 3 metre long M.S. rod. These are to be fabricated and driven into the ground by the side of mat conductors. All connections to the conductors will be done by arc welding process.

3.6 Above Ground Connections

a) Galvanised steel flats will be used for all connections above earth.

b) Inside building, ground conductors will be run for each floor supported on building steel and/or cable trays. These ground conductors in turn will be connected to the station ground grid through riser (at least two) coming up along building columns/cable shafts.

c) Two separate and distinct ground connections will be provided for each electrical equipment in compliance with I.E. Rules.

All connections above ground will be welded type except connection to equipment/structures which will be bolted type.

3.7 Column Grounding

All steel columns and structures will be connected to the earth mat through 40 mm dia M.S. rods. All welded joints will be painted to protect from rusting.

3.8 Risers

Risers are required for connecting the equipment and structures with the ground mat. Risers are to be provided from underground mat to above ground levels where the ends will be left free for connecting to the equipment. Each riser will be 1 No. 40 mm dia. M.S. rod and will project above grade level/concrete floor level by minimum 300 mm. They are to be clamped or supported along the outer edge of the concrete foundation. Connection to the ground mat will be done by arc welding.

3.9 Equipment Ground Lead

Equipment ground connections will be sized to carry the ground fault current. Considerations will also be given to mechanical ruggedness of the connections and to limit the number of sizes.

The minimum ground conductor sizes for various equipment and structures are given in below.

DESCRIPTION	SIZE	MATERIAL
a) Main Grounding Grid Conductor	40 mm dia Rod	Mild Steel
b) Riser/Pigtail From Grounding Grid/Mat	40 mm dia Rod	- Do -
c) Electrode	40 mm dia,3000 mm long Rod	- Do -
d) Conductor used for connection of various equipment/structures as listed below		
HT motors, Earthing ring, Earthing lead to earth pits etc.	75 x 5 mm	Galvanised steel
Structures, Control Panels, Cable Trays etc.	50 x 6 mm Flat	- Do -
415V Power Control Centres, Motor Control Centres, Distribution Boards etc.	50 x 6 mm Flat	- Do -
Local Panels, Lighting Panels	35 x 6 mm Flat	- Do -
Motors :		
Above 90 kW	50 x 6 mm Flat	Galvanised steel
Above 30 kW Upto 90 kW	25 x 6 mm Flat	- Do -
Above 5 kW Upto 30 kW	25 x 3 mm Flat	- Do -
Upto 5 kW	8 SWG	- Do -
Miscellaneous Items, viz. Push Button Station, Junction Boxes etc	8 SWG	- Do -

50 x 6 mm galvanised steel flats(minimum size) will be run as main earthing conductors above ground along building columns, walls, steel structure, etc. for equipment and other structures earthing. These earthing conductors will be interconnected between them and to the main ground grid through risers/pigtail. The connection between earthing conductor and riser will be made above ground. Earthing conductors along their run on column, wall etc. will be supported by suitable welding/clamping at intervals set exceeding 750 mm.

Earthing conductors can be embedded in concrete floor of the building wherever necessary without having direct contact with the reinforcement rods. At the crossing of building walls, floors etc. the earthing conductor will be passed through galvanised conduit sleeves. Both ends of the sleeve will be sealed to prevent the passage of water through the sleeves.

All indoor and outdoor electrical equipment and associated non-current carrying metal works, supporting structures, building/ boiler columns, fence, system neutrals, lightning masts/arresters will be connected to the plant ground system.

Miscellaneous devices such as junction boxes, pull boxes, pushbutton stations, lockout switches, cable end boxes, lighting fixtures, receptacles, switches etc. will be effectively grounded whether specifically shown or not.

Metallic conduits and pipes will not be used as earth continuity conductor. These will be grounded at both ends.

A continuous 50 x 6 mm (minimum size) G.S. flat earthing conductor will run along the cable trays and supporting structure of all cable routes. This earthing conductor will be attached to each section of cable tray/trays through 50 x 6 mm G.S. flats. The earthing conductor will be securely connected to the earth mat at both ends.

Fence within the ground grid will be bonded to the plant ground system at regular interval not exceeding ten (10) metres. Fence gate will be separately grounded with flexible connection to permit movement.

The street lighting poles, junction boxes mounted on the poles, flood light supporting structures etc. will be connected to ground grid at minimum two points.

The steel columns, metallic stairs, hand-rail etc. of the building where electrical equipment are located will be connected to the nearby ground mat by earthing conductor. Electrical continuity will be ensured by bonding the different sections of handrails and metallic stairs.

The railway tracks within plant area will be bonded across fish plates and the rail tracks will be connected to grounding grid at different locations. The rail tracks leaving the plant boundary will be made electrically discontinuous from the rail tracks inside the plant area by providing suitable arrangements at fish plate joints.

The overhead crane rails will be grounded at both ends. In addition all joints will be bonded to provide electrical continuity.

The metallic sheaths, screens and armour of cables will be earthed at both switchgear/MCC/DB and equipment ends.

The flexible earthing connection of jumpering wire will be provided where flexible conduits are connected to rigid conduits to ensure continuity.

3.10 Jointing and Connection

All ground conductor connections below ground level will be done by electric arc welding with low hydrogen content electrode. The contact surfaces will be thoroughly cleaned to provide good electrical continuity.

The bending of the large diameter ground conductor where necessary will be done by gas heating.

The projected portion of riser/pigtail above ground will be coated with two coats of bitumen paints (anti-corrosive paints) with a minimum thickness of 1 mm after connection.

The connections between the riser/pigtail and earthing conductors (galvanised steel flats) and between the earthing conductors above ground level will be made by electric arc welding.

The portion of galvanised steel flats, which undergoes welding at site, will be coated with two (2) coats of cold galvanising anti-corrosive paint after welding.

The earthing connections to equipment grounding pads/terminals and some removable structures will be bolted type with GI bolts and nuts. The contact surfaces will be thoroughly cleaned (to free from scale, paint, enamel, grease, rust) before connection to ensure good electrical contact.

Equipment/structures ground connections will be coated with weather resistant paints/cold galvanising paints after proper checking / testing .

Whether specifically shown or not, all conduits, trays, cable armour and cable end box, electrical equipment such as motors, switchboards, panels, cabinets, junction boxes, lockout switches, fittings, fixtures, etc. will be effectively grounded.

3.11 Lightning Protection System

The main purposes of lightning protection system are to :

a) Provide protection to structures from lightning strokes.

b) Provide a low resistance-conducting path to lightning discharge.

Lightning protection will be provided as per IS: 2309 for TG area and other tall structures within the battery limit.

3.12 System Design

a) Air termination network with down conductors and earthing electrodes will be provided on the basis of IS Code of Practice.

b) Horizontal air termination will be so laid out that no part of the roof will be more than 9 meters from the nearest conductor.

c) Shielding angle for one vertical air termination will be 45 degrees. For more than one rod, shielding angle between the rods will be taken as 60 Degrees.

d) Down conductors will run along the outer surfaces of the building and will have a test joint about 1500 mm above ground.

e) An earth electrode will be provided at the connection point of the down conductor with the station ground.

f) Galvanised steel rods and flats will be generally used for air termination and connections. All connections will be welded type.

3.13 Air Terminations

The vertical air terminal rods will be installed at the roof of buildings covered under TG package for MCC/Switchgear roomsetc to protect these objects from lightning strokes.

The projected length of the Air termination rod will be as required to protect the object (on which the rod is fixed) from lightning stroke.

The air terminal rod will be properly fixed on the top of the building/structure to withstand very high wind pressure. In case the air terminal rod is embedded at the top of roof of building, the portion embedded inside the concrete will not touch the reinforcement bars and will be duly insulated from them.

All the vertical air terminal rods will be electrically connected together by means of horizontal conductors of size 50 x 6 mm galvanised steel flats.

Horizontal air termination (i.e. G.S. Flat conductor) will be so laid that no part of the rod will be more than nine (9) metres from the nearest roof conductor.

3.14 Shielding Masts

The shielding mast for lightning protection will be installed at the top of steel columns cap plates of the associated building.

The shielding mast will be made of galvanised steel rod and the height of the same will be decided considering the zones to be protected.

Each shielding mast will be connected to grounding grid by a down conductor 50 x 6 mm minimum. Galvanised steel flat run along the building column. In addition all building columns joints will be electrically bonded.

3.15 Down Conductors

Galvanized steel down conductors of suitable size will be connected with air terminal rod/horizontal conductor at the top of roof/structure and other end connected to the nearest 40 mm dia. mild steel rod riser from ground electrode.

Each down conductor will have an independent earth termination. In no case conductors of the lightning protection system will be connected with the conductor of grounding system above ground level.

The connection between each down conductor and rod electrode (by means of 40 mm mild steel rod riser) will be made via test link located at approximately 1500 mm above ground level.

The down conductor will be laid straight and sharp bends will be avoided as far as practicable. These will be cleared on outside of the building wall and column/structure at about 750 mm intervals unless stated otherwise in the drawing.

At all supports for down conductor along the column/wall of the buildings etc. the portion embedded inside the building concrete should not touch the reinforcement bars.

All exposed metallic parts of the buildings will be bonded to the down conductors. Such parts will include ladders, balconies, conduits etc.

The down conductors will be protected at the ground level against mechanical injury by means of non-metallic pipes, viz. PVC pipes filled with bituminous compound.

3.16 Electrodes (for Lightning Protection)

The electrodes will be 40 mm diameter 3000 mm long mild steel rod. These will be driven into the ground.

All the electrodes will be interconnected by means of one (1) 40 mm dia mild steel rod which will be laid under ground at a minimum depth of 1000 mm below finished grade level unless stated otherwise. This ground mats/electrode in turn will be connected to main grounding grid.

3.17 Riser (for Lightning Protection)

All risers connected to grounding mat will be 40 mm mild steel rods and will be projected 300 mm above grade level unless stated otherwise.

3.18 Jointing & Connection

All ground conductor connections below ground level will be done by electric are welding with low hydrogen content electrode.

The projected portion of riser above ground will be coated with two (2) coats of bitumen paints (anti-corrosive paints) with a minimum thickness of 1 mm after connection.

The joints in the lightning conductors will be kept to a minimum and there will be no joint in the underground portions of conductors.

All the joints will be done by arc welding process overlapping of the conductors at straight joints will not be less than 150 mm. The contact surfaces will be cleaned properly before jointing.

The portion of galvanised steel flats, which undergoes welding at site, will be coated with two (2) coats of cold galvanising anti-corrosive paint after welding.

The bolted joint of the test link will be covered with thick coating of bitumen paint after successful testing.

The air terminal rods and shielding mast will be coated with weather resistant anti-corrosive paint (zinc chromate followed by two coats of aluminium paint).

The steel to copper connection will be brazed type.

The lightning protection of inflammable liquid storage tanks wherever required, will be provided with horizontal conductors strung between tall poles covering the entire zones or with air terminal rods mounted on top of poles/structure. These horizontal conductors/vertical air terminal rods will be connected to rod electrodes, which in turn will be connected to station ground mat.

The sizes and materials of earthing conductors to be used in lightning protection system are listed below :

DESCRIPTION	SIZE	MATERIAL
a) Vertical Air Termination	20 mm dia Rod	Galvanised steel
b) Horizontal Conductor	i) 50 x 6 mm Flat ii) 25 x 3 mm Flat	-----do-----

DESCRIPTION	SIZE	MATERIAL
c) Down Conductors	i) 50 x 6 mm Flat ii) 25 x 3 mm Flat	------do-----
d) Ground electrode / riser	40 mm dia Rod	Mild Steel
e) Interconnection with earth mat	40 mm dia Rod	Mild Steel

Note: The above sizes are indicative only. Actual size will be arrived at as per design by the Contractor.

3. CONTROL PANEL

Control Panel

ATTRIBUTES / CHARACTERISTICS / ITEMS/ COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	GA, BOM ,Lay Out of components	Dimensions	Paint Shade/ Thickness/Adhesion	Component Rating/ Make / Type	Wiring	IR & HV	Review of TC for instruments	Accessibility of TBS/ Devices	Illumination	Functional Check for Control Element , Annunciation	Test as per IEC 1131 *	Routine & acceptance Tests as per IS 8623
Control Panel													

Note: 1) Detailed procedure of Burn-in and Elevated Temperature test will be as per Quality Assurance Programme in General Technical Conditions
2) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure along with relevant supporting documents.
*Applicable for PLC

4. Motors

Attributes / Characteristics / ITEM/ COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment

Plates for stator frame,end shield, spider etc.									
Shaft									
Magnetic Material									
Rotor Copper/Aluminium									
Stator copper									
SC Ring									
Insulating Material									
Tubes for Cooler									
Sleeve Bearing									
Stator/Rotor, Exciter Coils									
Castings, stator frame,terminal box and bearing housing etc.									
Fabrication & machining of stator, rotor, terminal box									
Wound stator									
Wound Exciter									
Rotor complete									
Exciter, Stator, Rotor, Terminal Box assembly									
Accessories, RTD, BTD,CT, Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc.									
Motor (IS 325 / 4722 / 9283)									

5. LT Transformer

Attributes / Characteristics / Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	Core Loss*, Hot Spote	NDT / DP / MPI	Voltage Ratio, Vector Gorup & Polarity	Make / Type / Rating / Model /TC / General Physical Inspection	WPS & PQR	Routine Test as per relevant standard	Measurement of capacitance & tan delta between winding	Routine Test
Enclosure door, H.V. & L.V. Cable Box / Flange Throat													
Copper Conductor													
Insulating Material													

CRGO Lamination & Built Core													
Bushing /Insualtor (IS:2544 / 5621)													
Gasket													
Off-Circuit Tap Cahnger													
Core Coil Assembly													
Marwilling Box													
WTI, Thermister, Terminal Connector													
Welding													
Complete Transformer (IS:11171)													

- Core Loss for first Job

Notes:

1) This is an indicative List of test/checks. The manufacturer is to furnsih a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalisation for all item.
2) All major Bought Out Items will be subject to approval.

9. LT Cables

Item / Components / Sub System Assembly \ Attributes / Characteristics	Make, Rating, Type & TC	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Hot set test (XLPE)	Lay length / Sequence	Armour coverage, Cross over, looseness, Gap between two armour wire/strip	Sequential marking/surface finish /cable	Tensile strength, elongation before & after ageing of insulation & sheath	Thermal Stability of insulation and sheath	Anti termite treatment test	Constructional / requirement as per NTPC	Routine and acceptance test as per Relevant Standard specification	FRLS Test
Aluminum (IS-8130)																
PVC Compound (IS-5831)																
XLPE Compound(IS-7098 Part-I)																
FRLS PVC Compound (IS-5831)/ASTM-D-2843/ASTM-D-2863 IEC-754 Part-I																
Armour wire/ Formed wire (IS-3975)																
Insulated Core																
Laid up core																
PVC Inner sheath																
Armouring																
Outer sheath																
Finish cable (IS-1554 & 7098 Part-1)/ASTM-D-2843/ASTM-D-2863 IEC-754 Part-I Swedish Chimney SEN SS 4241475 for (F3 category)/ Flammability test IEEE-383																
Wooden drum (IS-10418)																

- Not applicable for XLPE insulation

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major bought out Items will be subject to approval.

10. Control Cables

Attributes / Characteristics / Item / Components / Sub System Assembly	Make, Type, Rating, T.C	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Lay length/Sequence	Armour coverage, cross over, looseness, gap between two armour	Sequential marking/surface finish/cable length	Tensile strength, elongation before & after ageing of insulation & sheath	Thermal stability of insulation and sheath	Anti termite treatment test	Constructional feature as per Spec.	Routine & Acceptance test as per relevant standard & specification	FRLS Test
Copper Conductor (IS-8130)															
PVC Compound (IS-5831)															
FRLS PVC Compound IS-5831 ASTM-D-2843 ASTM-D-2863 IEC-754 Part-1															
Armour wire/ Formed wire (IS-3975)															
Insulated Core															
Laid up core															
PVC Inner sheath															
Armouring															
Outer sheath															
Finish cable (IS-1554) ASTM-D-2843 ASTM-D-2863 IEC-754 Part-1 Swedish Chimney: SEN SS 424-1475(F3 category)															
Wooden drum(IS:10418)															

Notes: 1.This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents

2. Make of all major bought out Items will be subject to approval.

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT: 2X500 MW NNTPS (TG)
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: Single Girder EOT Crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 1 of 5	BHEL NO: PE-V0-402-524-A100
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
`	***FOR EOT CRANE***												
1.0	**RECEVING INSPECTION**												
1.1	Structural-Plates/RSJ for Main Girders, End Carriages Trolley, Pulley, Gearbox housing , rope drum (if fabricated) etc.	Physical & Chemical	Major	Lab Analysis	100%	IS:2062 Gr. A or B / As per approved G.A.		MTC / Lab Report	_/	P/V	V	V	
1.2	Rope Drum (Seamless Pipe)	Chemical Mechanical	Major	Lab Analysis	1/pipe	Approved drg/DS ASTM A106 Gr A or B		Lab Report	_/	P	V	V	
		Flattening & Acid etching Test Surface defect	Major	Mech test Visual	1/pipe 100%	no cracks, pitting, rusting, damage ,etc		I.R.	_/	P	V	V	
1.3	Gears, pinions, shafts, axles & wheels (#)	Chemical& Mechanical,	Major Major	Lab Analysis UT	1/lot 100%	IS:2004 (45C8/55C8) (Relevant IS/appd drg) ASTM A388/NOTE 1		MTC I.R	_/ _/	P P	V V	V V	# If wheel, gears, pinions, shafts & axle diameter / thickness is equal to or more than 50 mm UT shall be carried out, ref & acceptance norm at S.no.1.4(UT of hook) to be followed
1.4	Hook	Chemical & Mechanical	Major	Lab Analysis	100%	IS: 15560 Related Std. As per appd. Drg./data sheet		MTC	_/	V	V	V	
		UT (above 50 mm dia)	Major	UT on shank portion only	100%	ASTM A388 / ASME Sec VIII Divn 2 – NOTE:1		MTC/ ALC/QCR /UT report	_/	P	V	V	

MANUFACTURER	CONTRACTOR	LEGEND: CLASS **A: Critical, B: Major, C: Minor**		DOC. NO.:
NAME & SIGNATURE		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		NAME & SIGN OF APPROVING AUTHORITY & SEAL

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT: 2X500 MW NNTPS (TG)
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: Single Girder EOT Crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 2 of 5	BHEL NO: PE-V0-402-524-A100
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record		Agency			Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
1.5	Wire Rope	Examination of report of breaking load Dimension & Type, construction	Major	Review of TC Measurement	100% 100%	IS: 2266 Appd G A drg	IS: 2266 Appd G A drg	Mfr's TC QCR	_/	P P	V V	V V	
1.6	Motors & cables. Brakes	Make/Type/Rating/ Routine test Make/ type / rating/ HV/IR functional test	Major	Visual / Measurement	100%	Appd drg/DS/Tech spec/Rel IS	I.R	STC	_/	P	V	V	For motor, ref. Note 2
1.7	Sheaves	Mech		Tensile & Hardness	1/lot	Approved Drg / Mfg drg		MTC	_/	P	V	V	
1.8	Limit switch, SFU, Relays, MCB, Fuses, Push buttons Etc Control transformer	Make/Type/Rating Functional /continuity Make , type, rating, input/output	Major	Review of TC	100%	Appd drg./DS/Scheme/NLC Spec./Manu.Std		QCR Routine TC/COC of mfgr	_/	V	V	V	
1.9	DSL	Make , type, rating, Dimension.	Major	Review of TC	100%	Appd drg./DS/Scheme /NLC Spec./ Manu.Std		QCR Routine TC/COC of mfgr.	_/	V	V	V	
2	**INPROCESS- INSPECTION**												
2.1	WPS,PQR & WPQ	Verification of approval				WPS,PQR & WPQ / Qualified by NTPC/ LLOYDS / EIL / TPL			_/	P	V	V	IN CASE OF NTPC/ LLOYDS / EIL / TPL QUALIFIED WELDERS AVAILABLE, REQUALIFICATION OF WELDER IS NOT REQUIRED
2.2	Assembled gear box	No load run test backlash & contact pattern, noise, vibration & oil temp rise (for oil lubrictd)	Major	Performance	100%	Apprvd drg/DS/Mfg std Noise 85dbA max, vibration 75 microns max, oil temp rise – 30 °C above ambient max			_/	P	V	V	

MANUFACTURER	CONTRACTOR	LEGEND: CLASS A: Critical, B: Major, C: Minor		DOC. NO.:
NAME & SIGNATURE		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		NAME & SIGN OF APPROVING AUTHORITY & SEAL

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT: 2X500 MW NNTPS (TG)
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: Single Girder EOT Crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 3 of 5	BHEL NO: PE-V0-402-524-A100
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
2.3	Welding of end carriage, Main Girder, Trolley , rope drum (if fabricated) etc.,	DPT of Welds(all)	Major	LPI	100% on butt&10% on fillet	ASTM E165 or Eq. / No crack or linear indication		I.R.	_/	P	V	V	
		RT of Butt weld	Major	RT	100%/10%	ASME Sec.VIII,Div.1, UW 51/52		RT film & report	_/	P	V	V	@RT-100%, for Butt weld in tension & 25% in compression. 100% RT on butt weld for fabricated rope drum
2.4	Hook	Dimension	Major	Measurement	100%	Mfr's drg / Related Std. As per appd. Drg./data sheet/		QCR	_/	P	V	V	
		Proof Load	Major	Load Test		IS: 15560	IS: 15560	QCR	_/	P	V	V	
		NDT after proof load	Major	LPI	100%	ASTME 165 or Eq. / No crack or linear indication		I.R.		P	V	V	
2.5	Gears, pinions, shafts, axles & wheels (#)	Hardness Surface Defect (after machining)	Major	DPT	100%	Approved Drg/ Data sheet ASTM E-165 No linear indication		MTC	_/	P	V	V	
3	**FINAL INSPECTION**												
3.1	Overall dimensions	Dimensions (span) level, alignment	Critical	Measurement	100%	Appd GA drg & IS: 3177/IS:3938		I.R.	_/	P	W	W	FUNCTIONAL CHECK OF PENDENT &
3.2a	Assembled Crane along with individual control panel & pendant station	Current & speed for Cross Travel & Hoisting, interlocking sequencing, inching operation, Limit switch operation	Critical	Measure /Verify	100%	Appd GA drg & IS: 3177/Appd data sheet		I.R.	_/	P	W	W	PANEL FOR SPECIFIC CRANE
		Deflection at SWL		Measurement					_/	P	W	W	
3.2b	Overload test at 125% of SWL	Holding capacity of brakes		Lifting from mid Air	100%	Appd GA drg & IS: 3177/ IS:3938/ Appd data sheet		I.R.	_/	P	W	W	

MANUFACTURER	CONTRACTOR	LEGEND: CLASS A: Critical, B: Major, C: Minor		DOC. NO.:
NAME & SIGNATURE		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		NAME & SIGN OF APPROVING AUTHORITY & SEAL

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT: 2X500 MW NNTPS (TG)
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: Single Girder EOT Crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 4 of 5	BHEL NO: PE-V0-402-524-A100
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
3.3	Control Panel & Pendant station	1. Make/type/rating of Bois. 2.IR-HV functional &interlocks 3.DOP by paper insertion for panel	Major Major do	Visual, Operational & Functional Measurement do	100% 100% 100%	Approved drawing / Data sheet / is: 3177 Paper should not go easily.		I.R.		P P	W W	W W	HV of power circuit at 2kV and control circuit at 1kV. IR of power & control circuit with 500V Meggar with acceptance norm of 0.5 Mega Ohm.
3.4	Painting	Examination – shade	Minor	Visual & measurement	100%	Customer's / Approved Painting Procedure				P	V	-	
		Dry Film Thickness	Major	Measurement	Sample					P	V	-	

NOTE1:'**' When back wall echo is set to 100% in sound area then,
a) defect echo shall not exceed 20%
b) Back echo shall be minimum 80% in any area

Note 2:- Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows : It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of NLC specific requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, starting KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.

MANUFACTURER	CONTRACTOR	LEGEND: CLASS A: Critical, B: Major, C: Minor		DOC. NO.:
NAME & SIGNATURE		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		NAME & SIGN OF APPROVING AUTHORITY & SEAL

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR
PROJECT: 2X500 MW NNTPS (TG)

PACKAGE : SINGLE GIRDER CRANES REV : 0 DATE : 22.12.14

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V Local Starter Panel	Vendor	BHEL	BHEL will provide one number 415 V supply feeders up to DSL for cranes
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	BHEL	
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	BHEL	
4	Equipment Earthing	Vendor	BHEL	All equipments metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL / customer.
5	Motors	Vendor	BHEL	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type tinned copper heavy duty lugs for power cables. 3 solderless crimping type heavy duty copper lugs for control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :**

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Erection and Commissioning spares.
d) Erection & Maintenance tools & tackles.
e) Electrical load requirement for crane
f) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
g) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
h) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:
Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

a) A copy of this sheet "Electrical equipment Specification " and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) List of Erection and Commissioning spares.
c) List of Erection & Maintenance tools & tackles.
d) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :
a) Specification AC/DC Motors
b) Data sheet of AC/DC Motors.
c) Load data format.

SPECIFIC ELECTRICAL REQUIREMENT

SL.NO.	PARAMETERS	UNIT	NLC
	MOTOR		
1	DESIGN AMBIENT TEMP	DEG. C	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, ± 10%
3	FREQUENCY WITH VARIATION	Hz	50 (+) 5% to (-) 3%
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	160 KW & below
6	SYSTEM FAULT LEVEL AND ITS DUARTION	KA	50kA, 1sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F or better and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		85%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.22 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	As per IS 12615
12	ACCEPTABLE NOISE LEVEL	DB	Noise level for all motors shall be limited to 85dB(A) at 1.5 m (in line with IS 12065)
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP-54 for indoor duty
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE
16	PAINT SHADE		DURING DETAIL ENGINEERING.
17	CRANE DUTY MOTOR AS PER IS3177		S4- Duty with 40% cyclic duration factorshall be considered. Motor operating through VFD shall be suitable for inverteer duty.

S. No.	Description	Data to be filled by successful bidder
A.	**General**	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	**Design and Performance Data**	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a Voltage	
6	b Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	**Constructional Features**	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	**Characteristic curves/ drawings** (To be enclosed for motors of rating ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE 2X500 MW NNTPS (TG)			SPECIFICATION : NUMBER : PE-TS-402-501-A001			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
		SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE 2X500 MW NNTPS (TG)	SPECIFICATION : NUMBER : PE-TS-402-501-A001
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01	SPECIFICATION : TITLE :
	SHEET 2 OF 2	SYSTEM	ITEM AC ELECT. MOTORS BELOW 55KW (LV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

VOLUME - IIB

SECTION – D

STANDARD TECHNICAL REQUIREMENTS

(MECHANICAL)

SINGLE GIRDER EOT CRANE

1.0.0 **SCOPE**

This specification covers the design, material, manufacture, assembly, inspection and testing at manufacturer works for single girder EOT crane. The equipment shall include all the accessories required for the trouble free operation.

The crane shall be complete with trolley and truck, wheels and axles, Drive mechanisms, Hoisting Drums, Brakes, Creep Speed Arrangement, Lifting tackles, Buffers, Electric Motors, Controls, Switch Board and cabling, horns, warning lights, Limit switches etc. Any item not mentioned herein but required to make the system complete for the satisfactory performance of the crane shall also be included.

2.0.0 **CODES AND STANDARDS**

The equipment to be supplied under this specification shall conform to the following codes and standards (latest revisions) unless otherwise specified hereinafter.

a)	IS 807	Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists
b)	IS: 3177	Code of Practice for Design of Overhead Travelling Cranes and Gantry Cranes other than steel work cranes
c)	IS: 2266	Specification for steel wire ropes for general Engineering purposes.
d)	IS: 4029	Guide for testing induction motor (for temperature rise)
e)	IS: 15560	Steel hooks for standard shank design
f)	IS: 1554 Part I	PVC insulated (Heavy-duty) electric cables for working voltages up to and including 1100 volts.
g)	IS: 325	Three phase induction motors.
h)	IS: 900	Code of practice for installation and maintenance of induction motors
i)	IS: 694 (Part-I)	Copper conductors PVC insulated cables for voltage up to 1000 V.
k)	IS: 434 (Pt I)	Copper conductors rubber insulated cables for voltage up to 1000V.
m)	IS: 691	Flexible trailing cables rubber insulated.
n)	IS 3043	Code of practice Earthing.
o)	IS: 3938	Electric Wire Rope Hoists.
p)	IS: 2147	Degree of protection provided by enclosures for Low voltage switchgear and control gear.
q)	IS: 1554	Polyethylene insulated PVC sheathed cables.

Indian electricity rules - 1956.

In the event of any conflict between the specification and standards mentioned above, the specification shall govern.

3.0.0 **SINGLE GIRDER EOT CRANE**

3.1.0 **DESIGN REQUIREMENTS**

3.1.1 The crane shall be designed in accordance with the latest edition of IS-3177/IS-807 & hoist block shall be as per IS-3938 and any other standard as referred there in and subject to any modification and requirement as specified herein after.

Class of crane mechanism shall correspond to that of the crane requirement and as specified elsewhere.

3.1.2 Safety devices should be provided with all equipment/parts covered under this specification.

3.1.3 Parts requiring replacement or lubrication shall easily be accessible without dismantling the other equipment or structures. All electrical cables shall be laid to comply with recognized standards and purchaser's requirements.

3.1.4 For welded construction such as bridge girders, end carriages, rope drum, gearboxes etc; steel shall be conforming to IS-2062 quality.

3.1.5 No cast iron part shall be used on the crane.

3.1.6 Guard shall be provided on crane to prevent the hoist ropes coming in contact with down shop leads. Guards of an approved design, which will push forward or off the track any object such as a person foot or arm, placed across it. Guards shall be attached to each end of the end carriages. Suitable guards shall be provided to revolving shafts, coupling etc.

3.1.7 All cables shall be clamped individually. All trailing cables shall be clamped with PVC or non-metallic clamp.

3.1.8 All wheels, couplings, open gear etc. shall be provided with covers.

3.1.9 All bolts except those with locknut shall be provided with grip lock nuts or spring washers.

3.1.10 Fasteners for pedestal blocks, motors, gearboxes etc. shall be easily removable from the top. Studs shall not be used as fasteners for mechanical items except for fixing covers.

3.1.11 Defects in the material like fractures, cracks, blowholes, pitting etc. are not allowed. Rectification of any such flaw is permissible only with the approval of the purchaser.

3.1.12 All parts of the crane shall be thoroughly cleaned of mill scales, rust or foreign matter and then painted as per the specification requirements

3.1.13 The crane shall be manufactured as per the tolerances specified below

a)	Span over LT wheels	± 3mm
b)	Diagonal on wheels	± 3mm
c)	Long travel wheel alignment	± 1mm
d)	Tilt of wheels or balancer axle	±1/1000mm(horizontal and vertical)
e)	Permissible variation in Speeds at full notch with rated load, voltage and frequency shall be as follows.	
	i) Travelling and traversing	±10%
	ii) Hoisting Lowering	±10%

3.1.14 Proper allowance shall be made for impact and wear in the design of the crane and in no case shall the factor of safety in any part be less than six (6), as per IS: 3177 based on the ultimate strength of the materials used at design duty.

3.2.0 **STRUCTURAL DETAILS**

3.2.1 Crane structure shall be designed in accordance with the latest edition of IS-807 after taking the following additions/deviations as applicable.

3.2.1.1 Black bolts shall not be used in the main structure of the crane. The calculated strength of other bolted joints in structural members shall not be less than net strength of member plus 25%.

3.2.1.2 The calculated strength of riveted joint or joints made by friction grip bolts in structure members shall be not less than the calculated net strength of the member.

3.2.1.3 Bolts used in shear shall be fitted in to reamed hole.

3.2.1.4 Transverse filled welding on load carrying member shall be avoided.

3.2.1.5 All butt welds on structural members subjected to tensile stress shall be X - rayed.

3.2.1.6 Fillet welding on load carrying members shall be avoided.

3.2.1.7 Plates, angles and other rolled section used in the load bearing members of the structure shall not be less than 6mm thick.

3.2.1.8 The cranes working out door or in corrosive environment, an allowance of 1.5 mm shall be added to the calculated thickness.

3.2.1.9 Minimum thickness of chequered plates for platform shall be over 5mm over plain. Chequered plates shall not be considered for strength calculations of load carrying member.

3.1.1.10 The material of construction of the major components shall be as specified in the specification/data sheet. Manufacturer are however free to use alternate material which are superior for the intended service. But in all the cases, prior concurrence of the purchaser is must.

3.2.2 **Girder / Beam**

3.2.2.1 The girder / beam shall be fabricated from rolled steel (Box section/ I-section) and shall be of adequate strength to withstand the rolling loads and other stresses it is subjected to. The design of the girder shall be in accordance with latest edition of IS- 807 with the following deletion / addition as applicable.

3.2.2.2 Minimum deflection of the bridge girder with safe working load shall not exceed 1/800 of span. The girder shall be cambered by an amount equal to the maximum deflection due to dead load plus one half the live load and trolley.

3.2.3 **End carriage**

3.2.3.1 End carriages shall be fabricated from rolled steel section or plates or as the case may be. End carriage shall be of ample strength to resist all stresses likely to be imposed on them under service conditions including collision with other cranes or stops.

3.3.0 **MECHANICAL**

3.3.1 Rope drums

Rope drums shall be of mild steel plate fabricated or of cast steel. All fabricated rope drums shall be stress relieved. The drum shall be so designed to take full length of hoisting rope in single layers. The end of the rope shall be anchored to the drum in such a way that the charger in readily accessible. Each rope shall have not less than two (2) full turns on the drum when the hook is at lowest position not taking into consideration the turns covered by the rope in charge. There shall be one spare groove for each rope lead when the hook is at the highest position. Each rope end shall be clamped with minimum two clamping wedges with at least two bolts on each clamping arrangement.

The pitch diameter of the drum shall be as per IS -3177 or as specified elsewhere. The depth of the grove shall not be less than 0.35 times the rope diameter. Each rope shall be clamped to drum with two clamp wedges with at least two numbers of bolts on each clamping arrangement.

3.3.2 Hoist ropes

Ropes of steel core as specified in Data Sheet – A/B shall be of right hand lay, of 6x36 construction of best plough steel having minimum tensile strength as 160-180 kg/mm2. Left hand lay wire ropes shall not be used (Reverse bend ropes shall be avoided as far as possible).

3.3.3 Rope sheaves

Sheaves shall be of cast steel. All sheaves shall be identical, however, exception may be made for equalizer sheave. Sheave groove shall be ground finished for getting increase rope life. Equalizer sheave shall be arranged to turn and swivel in order to maintain rope alignment under all circumstances.

3.3.4 Wheels

LT wheels shall be double flanged with tread to suit the rail. The wheels shall be capable of taking up misalignment in span as specified. Solid wheel shall either be of forged steel or as specified. The wheel shall be with hardness of BHN 300-350. Contact stresses between wheels and rails should be within permissible limits.

3.3.5 Buffer

Each End carriage shall be provided with buffer as per data sheet ‘A’. Buffers should be so located that removal is not required while changing wheels or bogies. Buffers shall have sufficient tension on energy absorption capacity to bring the unloaded crane to rest from the speed of 50% of the rated speed to zero speed.

3.3.6 LT drive

One pair of wheels in each end carriage shall be driven by motor through reduction gear.

3.3.7 CT drive

The CT mechanism of the electric hoist shall consist of 2pairs of wheels which shall be driven by motor through reduction gear.

3.3.8. Gearing

Spur and helical gearing shall normally be used for all motions. Worms and bevel gears shall not be used. First high-speed reduction shall be through helical gears. All gears shall be hardened and tempered and of alloy steel with machine cut teeth. Surface hardening of teeth is not acceptable. Gear teeth shall preferably be cut in metric module system. Gears shall be designed to meet requirement of crane duty as per IS: 3177. The ratings of gears shall be established as per IS: 4660.

3.3.9 Gear Box

3.3.9.1 All gears shall be completely covered and enclosed in oil tight casing & sealed with gasket.

3.3.9.2 The gearboxes shall be of mild steel or cast steel. All fabricated gearboxes shall be stress relieved.

3.3.10 Bearing

3.3.10.1 Ball and roller antifriction bearing of FAG, SKF, NBC, NORMA make shall be used throughout, except where specified otherwise. Rated life of ball and roller bearing shall be not less than total working life as per relevant codes. Life of bearing shall be calculated in accordance with manufacturers recommendations.

3.3.10.2 Provision shall be made for service lubrication of all bearings. Bearing enclosures shall be designed as far as possible to exclude dirt and prevent oil leakage.

3.3.11. Couplings

3.3.11.1 Motor shafts shall be connected to gear box input extension shafts through flexible gear coupling. Solid coupling shall be used for connecting intermediate lengths of long travel shafts, if applicable.

3.3.12 Lifting hook

Standard hooks shall be used unless otherwise specified. These hooks shall conform to the latest edition of IS 15560 as specified in the data sheet “A”.

3.3.13 Brakes

3.3.13.1 Selection and design of brakes shall be such as to meet the requirement. Electro mechanical brakes shall be provided for each motions. Brakes shall be designed to suit 150% FLT of motor for the hoist motion and 125 % FLT of motor for LT/CT motion. Brakes shall be provided as specified in Data Sheet ‘A’

3.4.0 **ELECTRICAL**

3.4.1 The scope of supply shall cover all electrical equipments comprising from Main isolating switch, down shop leads, trolley conductors, current collectors etc.

3.4.1.1 Main isolating Switch fuse unit shall be provided at 1.5M above the operating floor level at one end of bay length or in the middle as specified in the data sheet A. Supply of cable from switch to down shop leads shall be included in the bidder’s scope of work.. The switch shall be provided with Power ON Red indication lamp.

3.4.1.2 Run way conductors (Down shop leads) shrouded conductor as specified in the data sheet A shall have four conductors. One of the conductors shall be connected to earth grid for earthing connections of all electrical equipments on the crane and shall be connected to suitable collecting gear of earth conductor. Voltage drop across the down shop leads shall be less than 2%. Maintenance c

DSL shall be provided on crane if asked in Data Sheet 'A'. Sufficient allowance of min. 10% for wear & tear shall be considered while sizing the conductor. The runway conductors shall be supported on brackets and insulators.

3.4.1.3 The current collectors shall be of adequate current carrying capacity and shall maintain adequate contact pressure. Spacing between current collectors shall be such as to provide sufficient quenching area for sparks coming out of collectors surface. The collector system per conductor shall be top-running type having spring loaded CI/carbon metallic shoes to maintain adequate contact pressure.

3.4.1.4 The cable, supplying power to crane trolley / electric hoist shall be flexible trailing cable as per IS-9968 Part I (latest edition) and mounted on retracting supports (festoon type)

3.4.2 **DRIVE MOTORS**

3.4.2.1 Crane motors shall be totally enclosed, fan cooled and as per data sheet 'A'. The break down torque of the motors shall not be less than 225 percent of the full load torque with rated voltage and frequency applied and pull out torque shall not be less than 250% of the rated full load torque of motor.

3.4.2.2 Ambient correction factors as well as voltage /frequency correction factors depending upon the ambient temperature and voltage /frequency variation shall be applied to derate the motors. The minimum margin of 10% or as specified in the section C of specification shall be considered over the calculated rating of the motor. The protection class of the motors shall be as per data sheet A. Motors shall be tested at manufacturers works in accordance with IS-325/as per agreed Quality plan & Reports shall be submitted for approval. Motors shall comply with the requirement of IS-325-1978 or as per the motor specification if enclosed here with.

3.4.2.3 All the motors shall be provided with lifting lugs, two earth terminals of adequate size to accept the earthing conductors shall be provided at diametrically opposite points unless specifically designed For higher speeds, motors shall be capable of withstanding 2.5 times the rated speed.

3.4.3 **Limit Switch**

The hoist mechanism of the crane shall be provided with rotary type limit switch to open the control circuit and in order to prevent the crane hook from over hoisting and over lowering. One gravity type back-up limit switch of hand-reset type shall be provided. This switch shall operate in the event of failure of main limit switch if called for in data sheet "A".

Lever operated limit switches shall be provided at both ends of longitude travel and cross traverse. These limit switches shall be self reset type.

3.4.8 **Protective Panel / Controls**

3.4.8.1 The electrical protective panel shall be a cubicle fabricated from 2 mm thick sheet steel with lockable-hinged door. It shall be dust and vermin proof with degree of protection as IP-55 or as specified in data sheet A. All the equipment inside the panel shall have permanent identification. The panels shall be front connected type with front-hinged door for access to wiring and terminals. Engraved nameplate shall be furnished for all panels and also for the equipments and devices mounted there on.

The following minimum equipments shall be provided.

a) One triple pole air break type main contactor with thermal overload relay.

b) One triple pole main line connecting/disconnecting switch.

c) Switch fuse unit with D.O.L. starter for each motion.

d) Thermal overload relay for each drive. It shall be ambient temperature compensated and adjustable type.

e) Contactors, timer and auxiliary contactors.

f) Control transformer with fuses.

g) Indicating lamps to indicate the live condition of all three phases.

h) Other equipments as per supplier's standard practice. Air break contactors shall conform to category AC-4 duty. The contactor drop off voltage shall be between 45-50% of rated voltage.

i) All internal wiring shall be identified with numbering ferrules at both ends as per the relevant wiring diagram.

3.4.9 **Pendent Push button station**

It shall be suspended by wire rope to prevent pull on the cables. The following minimum push buttons key operated type.

a) Main" ON", "OFF" push button key operated and lockable in "OFF" position.

This push button will operate the main contactor.

b) Hoist and lower directions. (2Nos.)

c) Trolley travels both directions. (2 Nos.)

d) Bridge travels both directions. (2 Nos.)

e) Inching speed for hoisting & lowering

f) Inching speed for bridge motion.

g) Inching speed for trolley motion.

h) Creep speeds

i) Emergency stop push button (mushroom type).

j) Alarm bell push button.

3.4.10 **Grounding**

3.4.10.1 The crane structure, motor frame and all other electrical equipments shall be grounded in accordance with the Indian Electricity Rules. The connections from Crane Bridge to 4th conductor of down shop leads shall be by means of current collector.

3.4.10.2 The equipment fed by flexible cables shall be grounded by means of fourth core provided in the flexible trailing cable. Pendent push button station shall be earthed separately.

3.4.10.3 Red warning light 3 Nos. shall be provided at both ends of the gantry girder to indicate the aliveness of DSL.

3.4.11 **WIRING SYSTEM**

The supplier shall furnish all power, control and auxiliary circuit wiring of the equipment and the panel located on the trolley or bridge.

The wiring shall be complete in all respect to ensure the proper functioning of the equipment.

Power wiring to any motor shall be done with 1100V grade Cu conductor, PVC insulated / armoured /FRLS cable of suitable sizes as specified in Data Sheet A.

d) For selecting the cable rating, cable for power wiring, consideration shall be given to the motor duty, ambient temperature grouping and disposition of the cables voltage drop etc.

e) All control and auxiliary external circuit wiring shall be done with PVC insulated FRLS type 2.5mm stranded copper conductor.

f) Armoured cables or un-armoured running through the flexible conduits may be used for power wiring / control and auxiliary circuit wiring shall run through flexible conduits.

g) Each motor shall be wired independently. Power and control wiring shall be effectively separated.

h) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.

i) All wire termination to the panels shall be provided with clamp type connections screw. Type terminals with screw directly impinging on conductors are not acceptable.

j) Multi-way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring and outgoing.

k) Not more than two wires shall be connected to any terminal on either side of terminal block. If necessary number of terminals shall be jumped together to provide the wiring points

l) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.

4.0.0 **LOAD INDICATION:**

The crane shall have a permanent inscription of English on each side, readily visible from the ground level, stating the safe working loads in tonnes, year of manufacture, crane serial number and manufacturer's name.

VVVF specification:

1.0 General

a) This part of the specification describes the general requirements for the Variable Voltage Variable frequency Drives, herein referred to as AC Drives, for use with standard IEC design AC squirrel cage induction motors. The nominal values, the standard documents and the drive's minimum performance is defined in this part. **To avoid any mismatch between the motor and its control equipment, the AC Drive shall be capable of auto adjustment by automatic measurement of the motor parameters with/without motor rotation.**

b) Inverter construction and related devices:

Construction shall be divided in 3 broad sections. Section One converts AC Supply into DC supply. Section 2 Converts and controls DC supply into AC Supply with regulation. Section 3 shall be used for braking action of the motor and Dynamic Braking Unit (DBU) can be inbuilt or external depending upon the drive capacity. VVVF can be used in open loop (without external speed feed back) like in Travel motions. Chokes on input supply side are generally used in crane application for power regulation. Like all other electronic / electric devices VVVF drives are also protected by MCB / MCCB / Fuses. VVVF drives are sensitive to temperature and hence drive internal as well as external cooling fans are provided.

c) Programming of VVVF Drives.

VVVF drives shall be programmable and for that purpose detachable digital Operator display unit shall be supplied along with the VVVF having required buttons for setting the user constant, functions etc. The VVVF drive is to be fine tuned by matching the motor parameters and setting the parameters on full load.

d) VVVF drives shall be connected with power supply and these drives generate their own low voltage control supply. Potential free contacts shall be connected to this control supply and few programmable control terminals. Starting / stopping / set speeds operations of VVVF drive shall be achieved by above control connection.

e) VVVF shall give smooth control over acceleration and deceleration making the motion jerk free and using Variable voltage variable frequency limits the inrush current to the squirrel cage motors. VVVF provides controlled torque to the motor due to which crane operations are jerk free.

1.1 Experience

The Frequency Converter Manufacturer shall have adequate experience in frequency converter manufacturing and have adequate business volume in order to provide credibility in his commitments and a capability of long term support.

1.2 Local support

The Supplier shall have a permanent representative office with a trained and skilled support staff, in the country where the goods are delivered, in order to prove his commitment for local support and to provide a channel for communication.

The engineers employed by the Supplier's regional office shall be certified by the Manufacturer and provide start-up service including physical inspection of the drive, connected wiring and final adjustments, to ensure that the AC Drive meets the required performance.

The Supplier shall be able to give basic drives training to the Customer's engineers, preferably on the site. The training shall, as a minimum, include system concepts and basic troubleshooting.

2.0 Basic requirements for the AC Drives

2.1 General requirements

The AC Drive shall comply with National(country of origin) and International standards and the recommendations for electrical industrial control devices (IEC, EN, UL, NFC, VDE).

The AC Drive shall be of the most modern design, yet user friendly and be simple to install, commission and maintain. The AC Drive shall be able to start and control the speed of a standard squirrel cage induction AC motor. The AC Drives shall be : CE marked, conforming to European Low Voltage (73/23/CEE and 93/68/CEE) and EMC (89/336/CEE) Directives, UL/CSA marked according to UL 508C.

The AC Drives have to be built to comply with the IEC standards.

The AC Drive shall be a digitally controlled drive, using, at least, the Pulse Width Modulation (PWM) with flux vector control open loop(for travel).It shall have diodes / thyristors in rectifier and IGBT's in the inverter section in their entire power range, and it shall have the following minimum specifications.

Rated Input Voltages	380V -15% to 480V +10%, three-phase
Rated Input Frequency	50Hz +/- 5%
Output Voltage	0 – Input voltage, three-phase
Output Frequency Range	0 to 400 Hz
Acceleration / Deceleration Time	0.01 – 999s, adjustable, linear, with S, with U or customised shapes
Overload capability (Constant Torque)	150% of nominal current for 1min.
Operating ambient Temperature	-10°C up to 50°C(shall be derated suitably if not rated at 50°C)
Storage ambient Temperature	-25°C up to 70 °C
Maximum operating altitude	1000 m without de-rating, 1000…3000 (shall be de-rated suitably)
Max. Relative Humidity	95 %, without condensation and dripping water.
Main Protections	Over current, short circuit between phase, short circuit between phase and ground, input phase loss, output phase loss, motor overload, over speed, over voltage, under voltage, drive over temperature

The AC Drive shall be able to give a 100 % output current continuously in the above specified conditions. In order to ensure that the drive can provide the required output current in the specified ambient conditions, the Manufacturer shall inform the required derating, if the ambient temperature given in the project-specific specification is higher than rated ambient of the drive or if the installation altitude is more than 1000 m above the sea level. The de-rating factor shall be specified so that neither the lifetime of the AC Drive nor the unit's performance, overload capability included, nor the reliability of the AC Drive shall suffer.

3.0 User interface

3.1 General

The user interface shall be identical throughout the power range and type to avoid confusion amongst the users and need for training in several different units.

3.2 Inputs and outputs

A. At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:

Analogue Inputs : 1 x Programmable differential voltage input ± 10V,
1 x Programmable current input 0(4) - 20mA
1 x Programmable voltage input 0 – 10V
Analogue Output : 1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V
Logic inputs : 6 x Programmable logic Inputs isolated from the mains
Relay Outputs : 2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.

B. At least, it shall be possible to assigned the following functions to the I/Os:

Analogue input	**Analogue outputs**
Speed reference Summing reference	Motor current Motor frequency Motor torque Motor power
Logic input	**Relay or logic outputs (open collector)**
Forward Reverse Jog Preset speeds Reference switching Ramp switching Parameter sets selection Fast stop Freewheel stop + speed - speed External fault	Ready Drive running High speed attained Drive fault Frequency threshold attained Motor thermal state attained Torque or current limitation attained Brake control

3.4 Programming terminal

A. The AC drive shall have a keypad /display for programming and controlling purposes. An IP54 or IP65 remote mounting shall be possible at a distance of 10m.

B. Password protection shall be provided to avoid unauthorized tampering with the set parameters.

C. The programming terminal shall be able to display the commercial reference of the AC drive and of the options, the software version, the serial number

D. Direct keypad entry shall be provided to observe the following actual parameters. Any one of the following parameters or actual values shall be selected to be always displayed :-

i) Input Voltage
ii) Input Frequency
iii) Output Frequency
iv) Output Power
v) Output Current
vi) Motor Speed

The following parameters shall always be displayed during normal operation: -
i) Drive Status

The following drive control functions at least shall be available from the keypad :-
i) Run
ii) Stop
iii) Local / Remote selection.
iv) Forward/Reverse (if function enabled)
v) Accelerate
vi) Decelerate
vii) Parameter setting

3.5 Application programming

The AC Drive shall be designed for both simple and the most complicated applications, yet it shall be user friendly. It shall be possible to reset the parameter settings back to the original factory settings through the keypad.

3.6 PC Tools

The AC Drive Supplier shall have Windows based PC software available for monitoring and controlling the AC Drives, and the software shall be offered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software.

4.0 Software features

A. Restart

In the event of a fault trip due to over voltage, over current or loss of analogue signal, the AC DRIVE shall be programmable to attempt an automatic restart. For safety reasons, the maximum number of attempts shall be within a selectable time. If the fault does not clear after the attempts, the drive shall lock out.

B. Brake logic control

The AC Drive shall have a built-in function to control a mechanical brake in order to move the load in a smooth and safe way. The brake logic control shall be adapted to the different movements: travel, orientation.

5. Preferred makes:

As per bought out item list.

VOLUME III

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
																		ANNEXURE-II
ACW pump house (5T)		5 kW	U	1	0	D	S	NA	I		ACWPH							
DG room (8T)		7 kW	S	1	0	D	S	NA	I		DG room							

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.	402	ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE	2 X 500MW NNTPS TPP (TG)	NAME		DATA FILLED UP ON	
	SYSTEM	SINGLE GIRDER CRANE	SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

ANNEXURE-VI

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder shall submit the following drawings / documents along with their bid

a) Copy of Electrical Scope between BHEL & Vendor duly stamped

b) Electrical Equipment Specification for EOT Crane System duly stamped

c) Electrical load list

d) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in the format given under Vol-III (if applicable)

e) Un priced copy of price format indicating quoted/ not quoted against each row/column along with cost of withdrawal / price implication format for deviations.

f) Copy of pre-bid clarifications, if any, duly signed & stamped

g) Signed/ Stamped copy of Compliance cum Confirmation Certificate (Vol-III)

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" in section C and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.
For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

PRICE FORMAT						Rev 00	
2X500 MW NNTPS (TG) (Single Girder Crane)							
						ALL PRICES IN Rs	
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM	QTY	Ex-works price	ED with Cess @	CST / VAT	FREIGHT	Total F.O.R PRICE
1	2	3	4	5	6	7	8 =4+5+ 6 + 7
A.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing,painting supply/delivery duly packed at FOR site (NNTPS) including Erection and commissioning spares, maintenance tools and tackles, all accesories (isolating switch and Power Cable from isolating switch to DSL) for 5.0 T capacity Single Girder underslung EOT Crane of 11.3 m span, 5.0 m lift and 23 m baylength for ACWPH as per total scope defined in technical specification PE-TS-402-524-A001 taking into account all clarifications, confirmations and agreements till date.	2 no.					
B.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing,painting supply/delivery duly packed at FOR site (NNTPS) including Erection and commissioning spares, maintenance tools and tackles, all accesories (isolating switch and Power Cable from isolating switch to DSL) for 8.0 T capacity Single Girder underslung EOT Crane of 13.53 m span, 6.5 m lift and 24.9 m baylength for DG room as per total scope defined in technical specification PE-TS-402-524-A001 taking into account all clarifications, confirmations and agreements till date.	1 no.					
C.0.0	total (A.0.0 to B.0.0)						
NOTES	**Bidder to note that total price indicated above at A.0.0 and B.0.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.**						
	Total Lumpsum price in column-8 should match with summation of total prices as in [Column (8) of 3.0 of Annexure I]						
	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.						
	Crane & along with all its accessories shall be supplied in a single consignment to site.						
	Any deviation shall be strictly put in Annexure III (Deviation sheet) only.						

PRICE FORMAT (MAIN SUPPLY)							ANNEXURE-I
2X500 MW NNTPS (TG) (Single Girder Crane)							
						ALL PRICES IN Rs	
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM	QTY	Ex-works price	ED with Cess @	CST / VAT	FREIGHT	Total F.O.R PRICE
1	2	3	4	5	6	7	8 =4+5+ 6 + 7
1.00	**Break - up of Prices given in clause A.0.0 of Main price format**						
1.1	Total lumpsum price of 5T capacity single girder EOT crane of 11.3 M span, 5.0 m lift with all accessories for ACWPH	2 no					
1.2	Lump sum firm price for PVC Shrouded bus bar type DSL for 23 m baylength complete with all accessories.	2 set for 23 m of bay length					
1.3	Lump sum firm price for one (1) lot power cable from isolating switch to DSL including isolating switch and all accessories	two lot					
1.4	Lump sum price VVVF drive for hoisting motion	lot					
1.5	Lump sum firm price for Commissioning Spares as per Annexure-A	One Lot					
1.6	Total price for Maintenance tools and tackles as per Annexure B	One set					
2.00	**Break - up of Prices given in clause B.0.0 of Main price format**						
2.1	Total lumpsum price of 8T capacity single girder EOT crane of 13.53 M span, 6.5 m lift with all accessories for DG room	1 no					
2.2	Lump sum firm price for PVC Shrouded bus bar type DSL for 24.9 m baylength complete with all accessories.	for 24.9 m of bay length					
2.3	Lump sum firm price for one (1) lot power cable from isolating switch to DSL including isolating switch and all accessories	One lot					
2.4	Lump sum price VVVF drive for hoisting motion	One lot					
2.5	Lump sum firm price for Commissioning Spares as per Annexure-A	One Lot					
2.6	Total price for Maintenance tools and tackles as per Annexure B	One set					
3.0	**TOTAL (1.1 to 2.2)**						
NOTE	1.0 Bidder to note that there shall be no implication for change in lift and/or span upto1000 mm . 2.0 Any variation in length of DSL due to change in bay length will be adjusted based on unit rates arrived from 1.2.0 and 2.2.0 above						
	Date:_____						
	Bidder's / bidder's representative signature					Company Seal	

ANNEXURE-A

2X500 MW NNTPS (TG) (Single Girder Crane)

LIST OF COMMISSIONING SPARES

S.No.	Item	Quantity	Total ex-works price	ED including CESS	CST/VAT	FREIGHT	Total
1	2	3	4	5	6	7	8=4+5+6+7
A)	**Crane for ACWPH**						
1.0	Limit Switch	1 set					
2.0	Overload Relay	1 set					
3.0	Fuse Link	1 set					
B)	**Crane for DG room**						
1.0	Limit Switch	1 set					
2.0	Overload Relay	1 set					
3.0	Fuse Link	1 set					
	Total cost						

2X500 MW NNTPS (TG) (Single Girder Crane) **ANNEXURE-B**

List of Maintenance Tools & Tackles

Sl.no	Description	Unit	Total ex-works price	ED with Cess	CST /VAT	FREIGHT	Total
1	**2**	**3**	**4**	**5**	**6**	**7**	**8=4+5+6+7**
1	Complete set of ring spanners(Indicate sizes)	1 Set					
2	Complete set of screwdrivers (Min 6 nos , indicate size)	1 Set					
3	Adjustable Spanner	1 No.					
4	Insulated plier	1 No.					
5	Wrench spanner	1 No.					
6	Grease Gun	1 No.					
7	Oil Gun.	1 No.					
8	Hand Lamp.	1 No.					
9	Line tester	1 No.					
	TOTAL						
	Note: - The tools shall be supplied in one no. new tool box						
	1 No. = One No. of item for each crane						
	Date: _____						Company Seal

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:- 2X500 MW NNTPS (TG)

PACKAGE:- SINGLE GIRDER EOT CRANES

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATIO N/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.