



MAZAGON DOCK SHIPBUILDERS LIMITED

(Formerly known as Mazagon Dock Ltd.)

CIN : U35100MH1934GOI002079

(A Government of India Undertaking)

Shipbuilders to the Nation

Dockyard Road, Mazagon,

Mumbai 400 010.

INDIA

**Electrical Work for 2000T Hydraulic Press
in ALY & Making of Earth pits at various
locations of East Yard & Alcock Yard.**

VOLUME-IV

PREFERRED MAKE

&

TECHNICAL SPECIFICATIONS

INDEX		
Sr NO	Description	Page No
	ELECTICAL WORK FOR 2000T HYDRAULIC PRESS	
1	SCOPE OF WORK	3
2	MOULDED CASE CIRCUIT BREAKER (MCCB)	3
3	MINIATURE CIRCUIT BREAKER (MCB)	4
4	RCCB-RESIDUAL CURRENT CIRCUIT BREAKER	4
5	CABLES	4
6	CABLE END TERMINATION	5
7	CABLE TRAY PERFORATED TYPE	6
8	FITTINGS & FIXTURES	7
9	DISTRIBUTION BOARDS	10
10	GENERAL SPECIFICATION & REQUIREMENT OF EARTHING SYSTEM	10
	SUPPLY OF EARTHING SYSTEM	
1	SCOPE OF WORK	12
2	CODES & STANDARDS	12
3	TECHNICAL REQUIREMENTS	13
4	GENERAL CONSTRUCTION DETAILS	13
5	METHOD OF MEASUREMENT	15
	LIST OF APPROVED MAKES	
1	LIST OF APPROVED MAKES	16

1- SCOPE OF WORK

1. SITC of 150W LED flood light fixtures inside industrial shed on roof/ columns at height of approx. 15 m from floor level.
2. Supply, installation, testing and commissioning of PVC armoured Copper/Aluminium cable for power distribution by providing cable trays of appropriate sizes and necessary iron works..
3. SITC of MCCB panel board for welding power supply of work shop.
4. SITC of MCB Distribution Board for power distribution of Lighting DB, Grinder DB & Raw power DBs with proper rating MCB.
5. SITC of 90-100W LED Flood light fittings with necessary cabling and termination on columns complete with all accessories.
6. SITC of Metra plug/ tetra plug socket arrangements with required cables in Industrial shed.
7. SITC of Air Circulators on columns of the industrial shed structure with required cabling.
8. SITC of copper earth pits complete with all accessories and excavation.

DETAILED ELECTRICAL SPECIFICATIONS

A. MOULDED CASE CIRCUIT BREAKER (MCCB)

MCCB shall be Current Limiting and comprise of Quick Make - break switching mechanism, preferably Double Break Contact system, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.

All MCCB's shall be capable of defined Variable overload adjustment. All MCCB's up to 250 Amps shall have thermal magnetic releases and above 250 amps shall have microprocessor based release with adjustable magnetic short circuit pickup. Wherever MCCB with earth fault protection mentioned in BOQ, the protection shall be an integral part of the release with adjustable magnetic short circuit and earth fault protection with time delay. The trip command shall override all other commands.

MCCB's shall employ maintenance free double break contact system to minimize the let thru' energies and capable of achieving discrimination up to full short circuit capacity of downstream. The manufacturer shall provide both discrimination tables and let thru energy curves.

The breaking capacity of MCCB's shall be as asked for in the data sheet / SLD / schedule of quantities. The breaking capacities specified will be ICU=ICS i.e type-2. Co-ordination as per IEC-60947-2, 1989/IS 13947-2, 1993. The MCCB's shall be provided with rotary handle operating mechanism. The handle position shall give positive indication of 'ON', 'OFF' or 'Tripped' thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts. In case of 4 poles MCCB the neutral shall be defined and capable of offering protection. These breakers are equipped with Microprocessor trip units with adjustable thresholds and offer; Overload protection Short Circuit protection Phase Balance protection Suitability for

Isolation Overload Protection : adjustable, 40 settings from 0.4 to 0.8 In
 Tripping Class : settable; 10A, 10, 20 (IEC60947-4) Time delay(s) :
 adjustable, 6 steps from 5.8 to 21.8(s) Short Circuit Protection : adjustable, 6
 to 13 Ir(set current) Time delay (ms) : Fixed Instantaneous : Fixed at 13 Ir
 Phase unbalance : threshold >40% unbalance (IEC 60947-4.1) Time delay(s) :
 4 sec Fault Indications: Overload, Short circuit, Phase unbalance, mP
 malfunction (self-diagnostics) (The release shall have battery back-up so that
 indications will be available when breaker has tripped. Once reset, the
 indication goes OFF) Interlocking MCCB shall be provided with following
 interlocking devices for interlocking the door of a switchboard. a. Handle
 interlock to prevent unnecessary manipulations of the breaker. b. Door
 interlock to prevent door being opened when breaker is in ON position. In
 addition to the above and other features indicated elsewhere shall also be
 provided.

B. MINIATURE CIRCUIT BREAKERS (MCB)

- a) MCB shall be in 1, 2, 3 or 4, pole versions. MCB casing shall be made of self extinguishing, tropicalised material. MCB shall comply with IS 8828-1996/IEC 898-1995. It shall be suitable for use in frequency range 40Hz to 60Hz and shall accommodate AC/DC supply according to requirements. It shall have a trip-free mechanism and toggle shall give a positive contact indication. It shall be suitable for mounting on 35mm DIN rail/surface mounting.
- b) Line supply may be connected to either top or bottom terminals i.e. there shall be no line-load restriction. Degree of protection, when the MCB is flush mounted, shall be IP40. MCB shall be supplied with clamping terminals fully open. Contact closing shall be independent of the speed of the operator. The breaking capacity of the MCB shall be 10kA. The MCB shall be capable of being used as Incomer Circuit Breaker and shall be suitable for use as an isolator. In case of multiple MCBs in a single location (DB), it shall be possible to remove any MCB without having to disturb other MCB's in the vicinity.

C. RCCB - RESIDUAL CURRENT CIRCUIT BREAKER :

RCCB shall be available in 2 pole and 4 pole versions and threshold sensitivities of 30mA, 100mA, 300mA and current ratings from 25 to 63A. Rating and sensitivities shall be as per Bill of Quantities. RCCB shall comply with IS 12640-1988/IEC 1008. The short circuit withstand of the RCCB without the associated short circuit/overhead protection shall not be less than 3 KA. It shall be operationally independent of line voltage. The sensitivity thresholds (30mA, 100mA, 300mA) shall be of non-user adjustable type by construction.

D. CABLES:

- 1.1. Cables shall be capable of satisfactorily withstanding, without damage, during transportation to site, installation at site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected, when

operating under the climatic conditions prevailing at the site as indicated in this specification.

- 1.2. Cables shall be capable of giving satisfactory performance when laid in trays, trenches conduit, and ducts and when directly buried in the ground.
- 1.3. Cables shall be capable of operating satisfactorily under a power supply system voltage variation of $\pm 6\%$ and frequency variation of $\pm 2\%$.
- 1.4. Cables shall normally be laid under the following conditions
 - i. In air-ambient temperature of 40°C .
 - ii. In ground-ground temperature of 30°C .
 - iii. Depth of laying in ground – 750 mm or as per requirements.
 - iv. In conduits – space factor of not more than 60%.
- 1.5. PVC insulated cables shall be 1100 volt grade heat resistant type, whenever specifically mentioned.
- 1.6. FRLS cable for 11kv with ISI mark stranded aluminium/copper conductor, circular in shape conductor and insulator shielded, Screened, PVC inner sheathed, G.I. strip armoured PVC outer sheathed cable shall be 1100 volt grade heat resistant type, whenever specifically mentioned.
- 1.7. If shorter radius appears necessary, no bend shall be made until clearance and instructions have been received from the representative of MDL.
- 1.8. Wherever groups of H.V. and L.V. cables are to be laid along the same route, suitable barriers to segregate these cables physically shall be introduced.
- 1.9. Wherever cables crosses roads and water, oil, gas or sewage pipes or G.I. pipes, the cables shall be laid in reinforced spun concrete pipes. For road crossings the pipe for the cable shall be buried at not less than 1.5-meter depth (Pipe cost is not included in cable cost)
- 1.10. The armour of the cable shall be bonded to the earthing system of the station.
- 1.11. All new cables shall be megger tested before laying and after jointing is completed, all L.V. cables shall be megger tested and H.V./H.T cables (3.3 KV to 11 KV) pressure tested before commissioning. The voltage for pressure testing shall as per IS: 1255. 1100/650 Volts grade cables shall be tested by 1000 volts megger.
- 1.12. Cable cores shall be tested for:
 1. Continuity
 2. Absence of cross phasing
 3. Insulation resistance to earth
 4. Insulation resistance between conductors

Contractor shall furnish all testing kit and instruments with valid calibration certificates required for field-testing whenever asked by the MDL Site Engineer / Engineer's representative (without any extra cost for testing the cable).

E. CABLE END TERMINATION:

Providing cable end termination with suitable type cable gland and core termination by using tinned copper lugs/sockets.

Lugs/sockets shall be fixed to the core by crimping process. If necessary hydraulic compression tool and die shall be used for higher size cables as per instructions of the Engineer. The end and core termination shall be suitable for the armoured PVC insulated PVC sheathed cable of 1.1 KV/ 11kV grade with aluminium/copper conductors. One set of termination includes gland, lugs for cable cores and accessories.

F. G.I. CABLE TRAY PERFORATED TYPE:

1. Scope of work includes providing & fixing of hot deep galvanised sheet steel factory fabricated cable tray with accessories, wherever required / specified, of required sizes (18 SWG up to 300 mm including 300 mm wide tray, 14 SWG for 400-1000 mm wide trays), including providing removable 14 SWG thick G.I cover, knock out holes (two holes per meter) on both sides & fixing accessories, earthing with 8 SWG copper wire as required, including supports, bends etc. as per site requirement & detailed specification as below.
2. The G.I cable tray shall be of perforated type. Cable tray shall have suitable G.I cover plate which shall be fixed over base tray by self threaded screws of G.I cable tray & cover plate with accessories like vertical outside/inside elbow, reducer, bends etc. shall be thoroughly hot dip galvanized. Galvanizing shall be as per IS: 2629/4759. G.I coupler plates with hardware shall also be provided. The cable tray assembly combined with cover plates shall be properly earthed. All the other material shall be conforming to relevant IS codes.
3. For wall mounting arrangement, Z sections of G.I. of size 50mmx25mmx50mm & 14/16 WG, shall be provided as a support for fixing cable tray. These sections shall be fixed to the wall by coach screws or anchor-fasteners firmly. Cable tray shall be fixed on these Z sections by G.I nut bolts of suitable size. These Z sections shall be provided at a distance of one meter of cable tray.
4. For ceiling suspended type arrangement, 25mmx25mmx3mm thick G.I. angle support or combination of Z section & 8mm threaded G.I. rods, shall be provided for cable tray up to 300 mm wide. These supports shall be fixed to the ceiling by anchor-fasteners firmly. And for cable trays, from 300 mm up to 600 mm width, 40mmx40mmx5mm thick G.I angle support shall be provided which shall be fixed to the ceiling by anchor-fasteners firmly. Tier type or layered arrangement shall be done wherever possible, for very effective use of cable tray & Z sections.
5. Items / accessories / parts / hardware which shall be not specified but required for neat & proper completion of work, is considered as

part of specification. Re-instatement as original is also a part of scope of specification

G. FITTINGS AND FIXTURES:

1. LED Flood Light Fixtures :

Supply and installation of LED Flood light fixture

1.1 Enclosure Protection.

The design of the offered LED Lighting Fixtures shall be Type Tested for IP65 ingress Protection by a Govt./ Govt. approved/ NABL Accredited/ Internationally Accredited Lab. Vendor shall submit TYPE TEST report for IP65 Ingress Protection at the time of offer itself to prove the design of the offered LED lighting fixtures.

1.2 General Conditions

Following codes and acts with its latest amendments shall be applicable for this work:

- i) Indian Electricity Act, 2003 with amendments thereto if any
 - ii) Indian Electricity Rules, 1956
 - iii) CEA Regulations -2010
 - iv) Relevant standards of the Bureau of Indian Standards (IS Codes) /International standards
 - v) American Society of Testing of Materials (ASTM Codes).
 - vi) Other approved standards and / or Rules and Regulations related to the add subject matter of tender.
- a) Design, materials, and workmanship shall satisfy all the applicable standards, specifications and codes as applicable for LED Lighting Fixtures.
 - b) Scope of work as described in tender document is not limiting in so far as the responsibilities of Vendor is concerned and shall include carrying out all works and providing all facilities that are required for commissioning of LED Lighting fixtures complying fully with all requirements as envisaged, complete in all respect and satisfying all Performance and guarantee requirements as stated or implied from contents of tender document.

1.3 Following protection shall be provided in LED Lighting Fixtures:

- a) Over voltage both at Input and Output.
- b) Over current both at Input and Output.
- c) Short circuit
- d) Surge protection

1.4 Tests / Inspection

Inspection will be done in 2 stages.

Stage-1: Inspection of LED Modules before assembly.

Stage-2: After Completion of Assembly & Manufacturing to ensure performance.

- a) All standard tests on LED Lighting fixtures in accordance with the standards adopted & as per QAP shall be carried out at manufacturer's works so as to ensure efficient operation and satisfactory performance of all components / parts of LED lighting fixtures.
- b) Work is subject to inspection at all times and at all places by MDL
- c) Vendor shall carry out all instructions given during inspection and shall ensure that work is carried out according to relevant codes of practice & QAP
- d) Decision of MDL in regard to quality of work and materials and performance to specifications shall be final & binding on vendor. If any item is found not conforming to standards during test/inspection, the same shall be replaced /rectified by Vendor without any cost to MDL and shall be re- offered for inspection within reasonable period at factory test.

1.5 Warranty

- a) The offered LED Lighting Fixtures including the drivers shall be guaranteed for a minimum period of **60 Months**. During this period the lumen depreciation shall not exceed the permissible limit specified in the LM70 report of the lighting fixture. If it is found that the lumen depreciation is more than the permissible limit, the vendor shall replace the lighting fixture with no extra cost to MDL.
- b) The vendor shall have final and total single point responsibility for the design and performance of the LED lighting fixture, driver, control gear and all components supplied under this specification.

The supplier shall,

- i) Warrant that the LED lighting fixture, driver and all materials to be free from defects in Design, material and workmanship.
- ii) Warrant that the LED lighting fixture will satisfy the requirements of the intended use and be suitable for the application.
- iii) Agree to repair or replace any component under this warranty at site with prevailing model of same make, which proves to be defective during **guarantee period of 60 months**. The fixture shall have suitable mounting arrangement on poles/walls with extended portion of control gear and 2 nos. of sturdy 'U' shaped clamps. The fixture shall have suitable mounting, arrangement on wall with swan neck type G.I pipe up to control gear using 2 nos. of sturdy 'U' shaped clamps, complete with G.I. 16 SWG/1.62 mm junction box 100mmx100mmx75mm with fuse unit connector and 3x2.5 Sq mm multi strand copper wires from fitting to junction box in PVC flexible pipe with gland.

The charges for above accessories are included in the cost of the fixture except bracket.

2. Air Circulator

Supply and Installation of Air circulators suitable for Industrial application.

The Air circulators have to be of wall mounting type, to be erected on columns at the height and locations as per the given drawings/ instructions of the project engineer. All necessary support work for erecting the fan at the required height is to be carried out using high grade treated and painted Mild Steel.

Construction

- a) Aluminium alloy one piece blade
- b) Double ball bearing 90 deg. Oscillation
- c) Sturdy close mesh guard beautiful design
- d) Powerful heavy duty motor
- e) Sweep- 600 mm
- f) Single phase, 1440 rpm without speed regulator
- g) Power consumption less than 250 W
- h) Air delivery- Min 250 M³/min

H. DISTRIBUTION BOARDS: (incoming MCCB/MCB, outgoing MCB)

The DBs shall be suitable for operation on 3-phase/single phase 415/230 Volts, 50 cycles. The DBs shall comply with the addition of relevant Indian Standards and Indian Electricity Rules and Regulation.

Fabrication, supply, installation and commissioning of three-phase/single phase DB with neutral using C.R.C.A. sheet steel 18/20 SWG std. If 16/18 SWG/1.62/1.21mm is not available in market for approved makes by MDL. Distribution boards with front operated door, D.P & TPN switches with neutral link connectors for incoming and outgoing circuits. 'L' or suitable series miniature circuit breakers of appropriate rating mounted on DIN rail and enclosed in slotted lid type boards with PVC insulated wires of copper conductor for interconnection. The DB shall be mounted on angle iron frame with anchor fastener grouted in the wall as per specification. The cost is inclusive of interconnection with PVC insulated copper wires and sleeves / PVC flexible pipe, glands etc. in cost of DB. Charges for marine plywood and M.S angle iron frame are not included in the rate of DB. The SP, DP, TP MCB shall be as per Interconnection charges are included in cost of distribution board.

Vertical DB:

The vertical distribution board shall be three phase and neutral, sheet steel, powder coated double door type. One cover (door) shall be screwed for incoming and outgoing MCB's and as cover for protection of complete DB. DB shall be fitted with colour coated bus bar, neutral link, earth bar and DIN rail etc (Complete pre-wired DB). The TP & SP MCB's can be used for outgoing circuit as per the requirement of site.

I. GENERAL SPECIFICATION & REQUIREMENT OF EARTHING SYSTEM

:- Enclosures and frame work of all current carrying equipment and accessories, structural steel/columns shall be adequately earthed to a single earthing system, unless separate earthing systems are specifically stipulated. All electrical equipment shall be earthed at two distinct points.

Earth loads and risers shall follow as direct and short a path as possible. Suitable risers shall be provided as directed if equipment is not available when earthing is installed.

Earth Bus and Earth Continuity Conductor :

- i) Earth bus is a copper strip or flat of specified size interconnecting all earth electrodes.
- ii) Switchgears and Power Distribution Boards shall be earthed by a copper flat strip.
- iii) Panels, fused DBs and motors up to 30 KW rating shall be earthed by a continuity conductor, as specified. Minimum size of continuity conductor shall be 25 x 3 mm bare copper strip, soft drawn.

iv) Road Lighting Poles shall be earthed with Cu stranded wire conductor while for lighting and power wiring bare copper conductor shall be provided unless otherwise specified to use insulated conductor.

Earth Bus Station :

Earth Bus Station shall be provided to facilitate tapping of earth continuity conductor from earth bus/grid very conveniently. It will comprise of a 400 mm long 50 x 6 mm bare copper strips/flat fixed with rawl plugs/bolts securely on wall/column above floor level. Spacers of 20 mm to 25 mm shall be provided to keep the flat away from wall and facilitate connections of earth conductor for which 6 mm dia holes 8 to 10 numbers are provided with proper size brass nuts, bolts, and washers. Earth bus shall be connected to it

TECHNICAL SPECIFICATIONS FOR SUPPLY OF EARTHING SYSTEM

1.SCOPE OF WORK:

Design, assembling, testing, painting, supply, delivery at site with all related accessories as per the specifications as specified below. Compliance with the provisions of this specification shall not relieve the Bidder of the responsibility of furnishing apparatus and accessories of proper design, electrically and mechanically suited to meet the operating requirements under the specified service conditions and be suitable for the purpose of which they are intended.

2. CODES & STANDARDS

The design, material, assembling, inspection and testing shall comply with all currently applicable statutes, regulations and safety codes in the locality where the system will be installed. The equipment shall also conform to the latest applicable standards and codes of practice as mentioned below.

Sr.	Item	Relevant IS / IEC
1	Code of Practice for Earthing	IS 3043
2	Insulation Co-ordination Application Guide	IS 3716
3	Code of Practice for Protection of Buildings and Allied Structures against Lightning	IS 2309
4	Indian Electricity Rules, 1956	
5	Indian Electricity Act, 1910	
6	National Electrical Code	
7	Low Voltage Electrical Installations- Part 5-54: Selection & Erection of Electrical equipment- Earthing arrangement & protective conductors.	IEC 60364
8	Protection Against Lightning –Part 3: Protection of structures & life Hazards	IEC 62305

3. TECHNICAL REQUIREMENTS

3.1 The earth grid shall consist of main grounding grid conductors forming a closed ring network with required number of Rod type earthing stations connected to it to provide a common earth for electrical equipments and metallic structures. Two distinct connections shall be made from each earthing station to the main grounding/earthing mat through GI/Cu. flat.

3.2 Earthing system should offer a resistance of less than 2 ohms throughout the year. In places where Soil resistivity is more, total length of the earthing rod has to be increased by adding 1m length rods (one over the other) to achieve low and stable resistance value. In rocky places, multiple earth rods have to be installed and inter-connected to get the required value.

Minimum length for each earthing station to be 3 meters.

3.3 The earth bus in required numbers shall be installed in various plant open areas and rooms. Each earth bus shall be provided two distinct connections by GI/Cu flats / Cu. Flexible cable from the main grounding grid conductors available nearby. The plant/building equipment, metallic structures, tanks, etc. shall be brought to earth by providing two distinct connections between earth bus installed nearby and that equipments, tank, apparatus, etc

3.4 Solid Copper coated rods are recommended as earth electrode than a pipe due to the fact that solid rods have much longer life and can be easily driven by electric/hydraulic hammers. Copper has much longer life than all other materials as explained in IS 3043

4. GENERAL CONSTRUCTIONAL DETAILS

Pipe Electrode Earth Station

- a) Copper coated Solid steel Rods shall be made of high tensile low carbon steel rod, molecularly bonded with 99.9% electrolytic copper with minimum coating thickness of 250 microns as per IEC 62561 part -2: Requirement for Conductor & Earth Electrodes.
- b) The length of the earth rod shall be 1 meter at least or as per manufacturer's recommendation, so that driving into the ground is easier. For dry areas, length of the rods can go up to several meters by driving the rods one over the other.
- c) For all the installation minimum length of the earthing rods shall be 3 mts minimum by adding similar rods.
- d) Earth rods should be of diameter 20 mm minimum. Additional rods should be added without external couplers. The earth rods should have peg & bore arrangement or similar such arrangement so that additional rods are added without external couplers.
- e) Interconnecting Strips / Earthing Conductor: Copper coated steel strips / tapes should be used to interconnect different earthing rods as well as horizontal earthing (Ring earthing). These strips should have a coating thickness of minimum 70 microns.
- f) The earth resistance shall be maintained with a suitable soil treatment.
- g) The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible
- h) Connectors/fasteners for connecting Electrode with Earthing conductor/strip should be of Stainless Steel as it is compatible with all other materials viz

Copper, GI etc. Fasteners should be made of Stainless steel

EQUIPMENT EARTHING

All apparatus and equipment transmitting or utilizing power shall be earthed in the following manner. Copper/G.I. Earth strips/wires shall be used unless other-wise indicated

ELECTRICAL AND PERFORMANCE REQUIREMENTS

Power Transmission Apparatus

1. Metallic conduit shall not be accepted as an earth continuity conductor. A separate insulated continuity conductor of size 100% of the phase conductor subject to the minimum shall be provided.
2. Non metallic conduit shall have an insulated earth continuity conductor of the same size for metallic conduit. All metal junction and switch boxes shall have an inside earth stud to which the earth conductor shall be connected. The earth conductor shall be distinctly coloured (Green or Green / Yellow) for easy identification.
3. Armoured cable shall be earthed by two distinct earth connections to the armouring at both the ends and the size of connection being as for the metallic conduit.
4. In the case of unarmoured cable, an earth continuity conductor shall either be run outside along with the cable or should form a separate insulated core of the cable
5. Three phase power panel and distribution boards shall have two distinct earth connections of the size correlated to the incoming cable size. In case of single phase DB's a single earth connection is adequate

INSPECTION AND TESTING

1. The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3043.
2. The following earth resistance values shall be measured with an approved earth megger and recorded.
 1. Each earthing station
 2. Earth continuity conductors
 3. Earthing system as a whole
3. Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case.
4. Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed
5. All tests shall be carried out in presence of the consultant / client

5. METHOD OF MEASUREMENT

5.1 Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, chamber with cover etc. shall be treated as one unit of measurement.

5.2 The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.

1. Main equipment earthing grid and connection to the earthing station.
2. Connection to the switch board, power panels, DB etc

5.3 The cost of earthing the following items shall become part of the cost of the item itself and no separate payment for earthing shall be made.

1. Motors - earthing forming part of the cabling / wiring for the motors.
2. Isolating switches and starters should form part of mounting frame, switch starter etc
3. Light fittings - form part of installation of the light fittings
4. Conduit wiring, cabling - should form part of the wiring or cabling.
5. Street lighting - should form part of the street light poles

LIST OF APPROVED MAKES

Unless otherwise mentioned specifically only the following approved make / brands of various electrical accessories will be used. In case, there are two types of product under one brand name, then product having I.S.I mark shall be used. In case, the approved brands are not available in the market then, equivalent product conforming to relevant standards, as approved by the Engineer Incharge shall be used. The contractors should distinctly understand that it would not be their prerogative to insist on using a particular make/brand amongst the approved ones.

Sr. No	Item Description	Makes/Brand
1	Transevier	DLINK,CISCO, HP switches
2	Light fitting	Crompton, Philips, Havells, Bajaj,Halonix
3	HPMV lamp	Crompton, Philips, Havells , Bajaj,Halonix
4	Fans	Almonard,Crompton,Bajaj
5	Water heater (geyser)	Almonard,Crompton,Racold,Bajaj
6	Insect Killer	"Russel" Matrix M - Series
7	Flexible Cables	Polycab,RR Cable,Havells,Finolex,
8	FRLS cables	Rallison,Finolex,Polycab
9	G.I.Cable tray	Bravo Trays ,SV Metal
10	MCCB/MCB Vari-depth handle (Rotary handle)	Legrand,Havells,Schneider,L&T,Indo Asian
11	MCB Terminals	Elemex, Connectwell ,KEW, Bentec
12	MCCB spreaders link	Legrand,Havells,Schneider,L&T,Indo Asian
13	Indication LED	Teknic, L&T
14	Flameproof/Weatherproof Tube light fitting	Crompton Greaves,Sudhir switchgear,Bajaj,Baliga,FCG
15	Flameproof/Weatherproof Junction Box	Connectwell, Phoenix,Sudhir switchgear,Bajaj,Baliga,FCG
16	Flameproof/Weatherproof Single Phase Exhaust fan	FCG,Sudhir,Crompton Greaves,Bajaj,Baliga
17	Flameproof/Weatherproof MCB PLUG AND SOCKET COMBINED	FCG,Sudhir,Crompton Greaves,Bajaj,Baliga
18	L.T.Switchgear	
A)	Enclosed in sheet steel with H.R.C. fuses for 63A and above	L&T, Siemens,Schneider

	B)	Cast Iron with rewirable fuses	KEW, CPL, Kalki
	C)	Circuit Breakers (Moulded Case)	Legrand,Havell's, Schneider
	D)	Miniature Circuit Breakers	Legrand,Havell's, Schneider
	E)	Cubical Panel Switchgear Accessories	
	I)	TPN / DP Switches / Isolators	Legrand,Havell's,Schneider,L&T
	II)	Rotary CAM type, Selector Switch	Siemens, AEI, Kaycee
	III)	Start / Stop push Button stations	L&T, Siemens, Havell's
	IV)	Contactors	L&T, Siemens
	V)	Indicating Lamp	Siemens, Vaishno,Teknic
	VI)	Earth Leakage Circuit Breakers	Legrand,Havell's,Schneider,L&T
	VII)	HRC Fuse	Siemens, L&T, GE
19		Distrination Boards with MCB's	Legrand,Havell's,MDS,L&T
20		Cables	Polycab,Havell's,Finolex,RR Cable
21		Socket / Lugs	Dowells, Jainson,Braco
22		PVC wires	Polycab,Havell's,Finolex
23		Conduit	
	A)	M.S. Black and G.I. Conduit	Precision, Diamond, BEC
	B)	Rigid PVC Conduit and accessories	Precision, Asian, Diamond, BEC
24		PVC casing-n-capping and PVC casing-n-capping accessories	Precision, Modi's,Presto-plast
25		Screws	Precision Fastners
26		Piano switches flush mounting (5 to 15 A) / wall sockets & plugs (surface mounting), Modular switches (5 to 15 A) holder pendant / batten / angle, three plate ceiling rose (for 3 core twisted flexible wire), 30 A D.P. Ticcino type switch fuse with indicating lamp, bell push surface mounting, flush mounting	Legrand,Roma, Anchor
27		Wall Socket and plug Metal clad (ray roll type)	Legrand, Crompton Greaves,Havell's
28		PVC Boards	Presto-Plast ISI marked

29		Special Accessories concealed / decorative (plate switches)	Roma, Precision,CPL, Anchor
30		Two / Three core flexible wires	Polycab, Havells, Finolex
31		Storage Heater with thermostatic control	Almonard,Crompton, Racold
32		Lamps	
	A)	Flourescent, HPMV, HP/LP-SV, Halogen / MLL	Crompton, Philips, Havells
	B)	Halogen / MLL& Metal Halide	Philips, Crompton,GEC
	C)	CFL 8 to 24 W upto 36W, Groove type, pin type	Philips,Crompton, Anchor, Wipro, GE,Bajaj
	D)	LED	Crompton, Philips, Havells,Bajaj,Halonix
33		Fittings for flourescent HPMV lamps and LP / HPSV lamps with copper wound chokes and condensers. Bulkhead fittings, Duoflux / dispersive reflectors, flood light fittings. Recessed mounted CFL 36W & low watt. Fittings which use energy saving light source like CFL, TL-5 and LED.	Crompton, Philips, Havells,Bajaj,Halonix
34		Bell	
		Call Bell / buzzer	Anchor, Rider, Cona
35		Exhaust Fans / Pedestal Fans air circulators	Crompton, Almonard, Bajaj
36	A)	Ceiling Fans with double ball bearings	Crompton, Almonard, Bajaj
	B)	Table Fans wall mounting Fans / cabin fans	Crompton,usha
37		Terminal Block	Elmex, Everest, Jyoti
38		Meters: Ammeter & Voltmeter (Analog)	Automatic Electric, Meco
39		G.I. Pipes	Zenith, Diamond
40		Electronic Ballast	Philips, Asian
41		Fan's Electronic Regulator	Rider,Anchor, Cona
42		Flourescent Tube 28W T5 (4 ft or 3 ft or 2 ft)	Philips, GE, Osram
43		Cable Trays and its accessories	Legrands, Asian Anciliary Corporation