

TECHNICAL SPECIFICATION For Electro-Mech Item

Item No. 1

Supplying submersible pump set for bore of 250mm/300 mm. dia having 3 phase motor capacity having below working at 3 Phase 400/440 volt 50 c/s AC Supply.

a) Capacity: 100 to 400 LPM.

b) Head range: 182 to 265 mtrs

c) Duty point: 220 mtrs

d) The pump shall have best efficiency at duty point & Suitable to 100 mm Delivery pipe e) Pump should have Minimum number of Stage and it should be Suitable for bore dia 300 mm Ø.

f) Supply 3 phase. 415 V, 50 Hz AC power

g) Method of starting: ATS

h) The guaranteed minimum overall efficiency of pump shall be as per the ANNEXTURE– ‘B’ attached herewith. The pump having overall efficiency less than the specified in ANNEXTURE-B shall not be accepted.

TECHNICAL SPECIFICATION OF SUBMERSIBLE PUMPSET

The Submersible pump set should be of sturdy construction to facilitate manual loading and unloading requirements. It should be repaired in workshop with ease and at minimum cost. It should meet all the basic hydraulic, electric and mechanical requirements needed. The pump should generally confirm to IS: 8034/ 1976 and the motor should confirm to IS: 9283/ 1979. The maximum efficiency is desirable at duty point. There should not be steep fall in efficiency in the range of +10 % and - 25 % of head variation. The guaranteed minimum overall efficiency of pump shall be as per the ANNEXTURE – ‘A’ attached herewith. The pump with minimum number of stages will be preferred.

Note -: The pump set to be offered shall have mixed flow type impeller and bowls (stage casing) mounted with nut bolt (spigot connection). The contractor shall have to give performance test of submersible pump set at manufacture works at his cost before despatch. The incidental expenditure shall be borne by the contractor.

PUMP: (Confirm to IS: 8034/ 1976)

a) Bowls

Fine grain cast Iron confirming to IS: 210 / 1978, Grade – FG 200, 2 % Ni C.I. and free from blowholes, stages inclusion and other detrimental defects. Bowls should be provided with renewable wearing rings suitable for lubrication by water and shall be of superior quality. Casing should be of hydraulically tested up to 1.5 tones shut off pressure.

b) Impellers

Impellers should be off closed type ensuring required performance and free of cavitations. The material will be bronze as per IS: 318, Grade: LTB - 3

c) Shaft

The pump shaft will be guided by bush bearings provided in each bowl. Shaft protection sleeve is to be provided below impeller shaft assembly. The material of shaft & shaft protection sleeve should be Stainless steel - AISI - 410 and shaft shall have 0.75 Microns surface finish.

d) Suction casing

The suction casing should be designed and shaped to minimise entry losses, eddy current and choking of foreign articles. It must be provided with suction strainer made from perforated bronze / stainless steel sheet of 3mm thickness.

e) Bearing Bush

The materials of bearing sleeve shall be of a lead tin bronze Grade: LTB-3, confirming to IS: 318/ 1962 or as per latest revision.

f) Casing wearing Rings:

The materials for casing wearing rings will be of lead tin bronze Grade: LTB-3, confirming to IS: 318 / 1962 or as per latest revision. For locking of wearing rings, setscrew may be fastened at suitable place.

g) Non return valve (NRV)

The design of NRV shall be of instant closing type, and no backpressure should develop

Which may adversely affect the pump set. NRV losses should not exceed 0.8 meter at rated flow.

MOTOR (Confirm to IS: 9283 / 1979)

The electric motor for submersible pump shall be of wet winding type, totally enclosed, squirrel cage, water cooled and water lubricated induction motor to be operated on 415 +10% and -15% voltage, 3 phase, 50 Hz, A. C. Power Supply. Motor Dia. should be 250 MM Dia. i.e. V10 / NB or equivalent type.

NOTE:

- a) The motor shall not get overloaded in the full range from full valve open to shut off.
- b) The motor should be suitable to with stand 10% margin over standard duty conditions.

For item No-1

The tenderer is required to furnish the following details: -

MOTOR :

- Brand/ Make Name :
- Motor Type :
- Motor Model :
- Type of Duty :
- Rated Output in KW/ HP :
- Ampere :
- Voltage :
- Method of starting :
- Speed (RPM) :
- Motor Efficiency :
- Power Factor at duty point :
- O. D. in MM (Max) of motor:

PUMP :

- Pump Type :
- Pump input at duty point :
- Specific speed in RPM :
- Nos. of stages :
- Discharge capacity (LPM) :
- Head in meter :
- Pump Efficiency at duty point :
- Overall efficiency at duty point :
- NRV/ Outlet/ Bowl Dia. :
- O. D. of bowl in MM :
- The pump offered should be capable to deliver _____ LPM @ _____ Mtr. of Total Head and further, must be able to deliver _____ LPM @ _____ Mtr.
- Lead Cable : 1 X 3 Core X 35 Sq. MM.
- Size of Flat Submersible Cable : 1 X 3 Core X 35 Sq. MM.
- Maximum current carrying capacity of above cable: _____ Amp.

PERFORMANCE CURVE :

- Discharge V/S Head
- Discharge V/S Power Input (KW)
- Discharge V/S Efficiency of pump and Overall Efficiency of pump - motor
- Submersible motor characteristics
- Material of construction should be given.

TESTING : (IS 11346 - Pump, IS 9283 - 1979 - Motor)

- Pump with NRV fitted.
- The firm has to produce the record for calibration of instrument for verification while inspection.
- High Voltage Test on wound stator
- Locked rotor test.
- No load running test by slip coil method.
- Measurement of resistance in ohms.
- Reduce voltage running test at 230 V in both directions.
- Temperature Rise Test.
- Measurement of Discharge at Duty point and at various Head.
- Measurement of Power, Current, Voltage, Frequency, and Power Factor.
- High Voltages Test on motor after pump test.
- Drying of cast components to avoid rusting. This is as per IS 8034.

Make: - As per approved vendor list.

Item No. 2: Providing and Erecting ISI marked PVC insulated PVC sheathed Flat flexible submersible copper cable. (J) 3 Core X 35 sq.mm

Make: As per approved vendor list.

Item No. 3: Supplying and erecting approved make 3 phase motor control panel (ATS) made from 16 G. CRCA sheet duly painted with epoxy power paint inside and outside with hinged doors and locking arrangement, consisting, of suitable switch of AC 23 duty with HRC fuses (Cat.III), starting and running contactors, overload relay, Automatic water level controller, Electronic timer with master timer CT operated Ammeter with selector switch, Voltmeter with selector switch, phase indicating lamps, single phasing preventer, water level guard, over load, start, run and stop push buttons, air cooled auto transformer with 60%, 70%, 80% tapping with required protection relays and control accessories. Panel to be erected on angle iron frame grouted on wall as directed. Contactors relays, timer etc. shall be of L & T Siemens / Cutler Hammer make. Suitable to above Pump-Motor Set. ATS from 81 to 90 HP.

Motor Control Panel (General):

Fabrication of floor mounted type dust vermin and water proof motor control panel made from 16 SWG MS sheet, duly painted by two coats of enamelled colour after thoroughly cleaning degreasing and applying of primer / powder coated (Siemens Grey) structure finish.

All compartments must be internally finished and closed cable entry and exits are to be provided where required with suitable cable gland. Panel type locks are to be provided with duplicate keys. All things are to be fastened by spot welding and are so designed to have sufficient and smooth working of the doors / shutters should be sealed by rubber gasket.

All nuts, bolts should be chromium plated.

Lowings at suitable place for better air circulation are to be provided to protect the panel from insect, dust and vermin.

All equipments / components / switchgears etc. to be housed inside, shall be mounted on separate detachable plates.

Final wiring diagram with ferrules number shall be submitted along with panel in two copies.

All internal wiring should be mounted in PVC channel shall be systematically and bunched circuit wise.

Overall dimensions of the panel are as indicated in general drawing.

All the switch gears shall be inspected by an Engineer from GIDC prior to dispatch. Any changes required during the execution shall be rectified by the supplier without any extra cost.

The complete internal wiring shall be made in copper conductor wires of suitable ratings and sizes. The wires used shall be of best quality. The push buttons, indicating lamps, MCCBs, Isolators, ammeters, CTS, Volt meters, fuses, connector strips shall be approved by Engineer from GIDC before using in the panel and should be only from the make indicated in table.

The supplier shall be fully responsible for any deviation from the specifications during execution and the rectification shall be carried out by the supplier as per instruction of Engineer from the GIDC without any extra cost.

1) Enclosures:

The control panel shall be dust vermin and water proof and fabricated from 16 SWG CR sheet. The control panels shall be pedestal type. All items inside the panel shall be mounted on minimum 16 SWG sheet base plates. All metal parts shall be thoroughly cleaned, degreased and made free from rust.

After application of zinc chromate primer, the control panel shall be stove enamelled with two coats of final paint / powder coated (Siemens Grey) structure finish. The colour shade of panel shall be as per IS: 631. The degree of protection shall be IP 44. The control panel must be of three compartments. It must be as per general arrangement drawing given herewith.

2) Wiring & Terminals:

Power and control wiring shall be done with PVC insulated copper conductor and shall be terminated with adequately sized compression type lugs for connection to the equipment terminals and terminal strips. Each wire shall be identified at both by ferrules. Not more than two wires to be terminated at one terminal end size of terminals be used keeping in view the components for which they are used, so that sufficient surface contact can be achieved. Screws and bolts should be used as per corresponding size and hole. Incoming & outgoing to be made at terminal bus only. Control wiring shall be done with 1.5 sq. mm copper wire only. It should be done to the satisfaction of the Inspection Authority.

3) Earthing

Two nos. of earthing terminal shall be provided for connecting the earth. All non-current carrying metallic parts of the equipment shall be earthed.

4) Moulded Case Circuit Breaker in First Compartment:

The control panel shall be provided with MCCB of 200 Amps. Capacity having minimum 50 KA rupturing capacity and with back up protection with HRC fuses of suitable ratings. The MCCB shall be used in upright position. It should not be in inverted position.

5) BUS BARS

Three phases & neutral bus bars shall be of Copper Strips only duly sleeved with heat-shrinkable colour sleeves. The bus bars should be mounted on proper insulators.

Second compartment

6) Contactors with 63 A MCB of suitable rating and capacitor:

Only APP type capacitor of 25 KVAR of L & T/ Saha Sprague make shall be provided as per the rating chart. A contactor of suitable rating AC 3/ 23 duty shall be provided. The capacitor terminals shall be connected to the motor terminals. The capacitor should be operated by the auto & manual push button suitable rating of the contactor and MCB base shall be provided. The rating of contactor and the MCB shall be as per the rating chart. Necessary wiring for control circuit and load circuit and arrangement for indicating lamp etc. shall be made.

7) Third compartment

The contactors shall be air break type having AC 3 duty rating. The coils shall be suitable for operation on 415 Volts. Current rating shall be 170 Amps, 70 Amps & 50 Amps, for RUN, MAIN and STAR contactors respectively.

8) Overload relay

Over load relay shall be 3 elements, positive acting ambient temperature compensated type inbuilt single phasing presentation mechanism and adjustable setting range to ensure protection against over load and single phasing. Over load relay should be provided considering 1.6 times the HP of motor.

9) Auto Transformer

Auto Transformer shall be air cooled type having three taping of 60 %, 70 % & 80 %. The same should be wound with copper wire. The size of the wires should be determined as per HP of the motor. Also the winding shall withstand the full load current for 30 seconds. Stamping of reputed make with "E" class insulation to be used. This should be also suitable for 6 starts per hour. Kordnoffer circuit as per ISS should be adopted in ATS panel. The auto transformer should be impregnated, for longer life. The percentage regulation shall not exceed 10 %.

10) Control Fuse

16 Amp X 415 Volts HRC type control fuses shall be provided for the control circuit.

11) Timer

A pneumatic / Electronic timer for change over should be provided and one master timer is to be provided in addition to main. This shall operate within 10 seconds when main timer fails to operate within 6 / 7 seconds.

12) Earth Leakage Relay

An Earth leakage relay of the range of 0.5 Amp to 2.5 Amp shall be provided along with CBCT in the control panel. This earth leakage shall have test and preset push button on the unit it self. A by pass toggle switch shall be provided on the door, to by pass the same in case of emergency. The ELR shall have 0.5 seconds time lag to avoid nuisance tripping.

13) Single Phasing Preventer

Single phasing preventer shall be operating on negative phase sequence principals and voltage sensing having 2/3 seconds time lag till avoid nuisance tripping. Under voltage and over voltage cut off 320 V to 480 V respectively shall be provided. A bypass toggle switch shall be provided on the door of panel to by pass the same in case of emergency.

Indicating Instruments (Door mountings)

14) Digital load smart manager:

It is flush mounting micro processor based instrument using advanced technology capable of measuring multiple electrical parameter in three phase system. It is specifically designed to simultaneously measure display and communicates several electrical parameters. These forms an ideal source for effective energy management, SCADA/ PLCs/ BMS etc., measure as many as 36 parameters on 23 display pages which are true RMS. The readings are displayed on three line bright LED display (Group of 12 digits RED 7- swg LED type, digit height 14.2 mm). It has a RS 232 or RS 485 out put port with MODBUS RTU protocol to communicate with PC.

15) Indicating lamps

Indicating lamps shall be of 22.5 mm diameter LED / Filament type for indication of R.Y.B. phases (red, yellow and blue). Moreover, indicating lamps shall be provided for indication of SPP (Healthy), (Green), overload (Umber), Start –Run position (Green) and ELR trip (Red). All indicating lamps should be suitably labelled on the door.

16) Time totalizer:

Time totalizer should be 6 digits, digital type, over counter, without rest facility shall be provided on the front door of the control panel. This shall be of 400 / 415 Volts.

17) Push buttons:

Red, green, yellow and black push buttons of 22.5 mm diameter shall be provided for stop, start, timer and O/L reset respectively. All push button should be suitably labelled on the door.

Note:

1 To prevent the damage on contactors, it is necessary to provide the incoming and outgoing terminals bus of proper rating and should be suitable for cable lugs. The terminal bus should be mounted on suitable insulators. The terminal bus is to be connected with copper links to contactors / OLR.

2 The contactors and over load relay should be of one make only.

3 The capacitor should be attached with latest test certificates from GEB / TPAEC

Tests and Inspections :

Following tests shall be carried out at the manufacturer's works, under his care and expenses at his own risk and cost.

- 1 Single phasing in each phase
- 2 Under voltage cut off at 320 V
- 3 Over voltage cut off at 480 V
- 4 Unbalanced tripping at 15% unbalanced voltage
- 5 H. V. Test at 2.5 K. V. for power circuit for 1 minute
- 6 H. V. Test at 1.5 K. V. for control circuit
7. H. V. Test between phases
- 8 Temperature Rise test on ATS as per IS:13947
- 9 Percentage Regulation Test not exceeding 10%
- 10 Magger Test
- 11 Functional Tests

Data sheet for Auto Transformer Type Control Panel:

Sr. No.	List of components	Rating	Quantity
	First Compartment		
1	Incoming terminal bus bars	Suitable rating	TPN
2	M. C. C. B. (50 K. A.) as main incoming	250 Amp.	1
3	Bus bars	Suitable rating	TPN
	Second Compartment		
4	Power factor Improvement capacitor (415 V)	35 KVAR	1
5	Contactor of AC-3 / 23 duty	63 Amp.	1
6	Push button – Auto & Manual		2
7	MCB	63 Amp.	1
	Third Compartment		
8	HRC control circuit fuses	16 Amp.	3
9	RUN contactor	225 Amp.	1
10	MAIN Contactor	165 Amp.	1
11	START contactor	50 Amp.	1
12	Overload relay	Suitable to HP	1
13	Pneumatic / Electronics Timer for change over	3-12 seconds	1
14	Master timer (Pneumatic / Electronics)	3-12 seconds	1
15	Current Transformers	200/5 or of suitable ratings	3
16	Single phase preventer with U / V and O / V cut off	Negative sequence type	1
17	Earth leakage relay with CBCT	0.5 Amp. To 2.5 Amp.	1

Sr. No.	List of components	Rating	Quantity
18	Air Cooled Auto Transformer	6 starts / hour and suitable to HP of the motor	1
19	Outgoing terminal bus	Suitable rating	3
	Door mountings		
20	Digital Load Smart Manager (LED) - 96 sq. mm for measurement of electrical parameters of pump motor set.	200 A, 500V	1
21	Time Totalizer (Hour counter, digital type)	400 / 415 V	1
22	Stop, Start and O/L reset push buttons	Red, Green, Black respectively	3
23	Timer bypass (Fail) Push button	Yellow	1
24	Toggle switch to bypass SPP and ELR	6 Amp	2
25	Indicating Lamps for R, Y, B, SPR, ELR, O/L, START, RUN and Capacitor	As per specify	9
	Body mountings		
26	Earthing Bolts	Suitable size	2
27	Lifting hooks	Suitable size	2

Note:

- 1) The contactors to be used inside the panel shall be of same make only. Using of different makes of contactors is not at all permissible.
- 2) The capacitors should be attached with test certificate from GEB / AEC
- 3) All indicating lamps and push buttons should be appropriately marked with labels and name plates on the doors showing its functions.

Equipment makes

Unless and until specified in writing only following makes shall be acceptable.

All switch gears shall be suitable for $415 \pm 6\%$ 50 Hz $\pm 3\%$ A.C. power supply.

Sr. No.	List of Items	Approved Makes (3 Phase A. C. supply)
1	M.C.C.B.	L&T/ EE/ CG - Schneider / Siemens / Elecon Clipse / Hevells
2	FSU / Isolator	L&T/ Siemens / CG - Schneider /GE / EE / HH-Elcon / Hevells
3	Contactor And O/ L Relay	L&T/ Siemens / CG - Schneider / ABB
4 a)	Pneumatic Timer	BCH
4 b)	Electronic Timer	Gelco / Elecon / Sun / / L&T
5	C. T.	A. E. / Meco / Ashmor or CPRI Test
6	Indicating Lamp	Vaishno / Rass / Teknic / Concord / IEC / Airon
7	Auto Transformer	C. P. R. I. approved / Tested as per ISI & ERDA
8	S. P. P.	Minilec / SUN / Gelco
9	E. L. R.	Prayag / OZR / Gelco
10	Push Buttons	L&T / Siemens / Rass
11	Toggle Switch	Vaishno / IEC / Jay or Reputed
12	Wires	Finolex /ISI Mark
13	HRC Fuse	EE / L&T / Jyoti / Standard / Siemens / Schneider / HH / Elecon / Hevells
14	Capacitor (APP)	L & T & Saha Sprague
15	Time Totalizer	GIC / L&T / Nishant / Kaycee / Hem / Gelco/ Nippen/ Meco
16	Glands	Brass Glands Siemens double compressed
17	Terminal Lug	Compression Type Dowell's / Jainson / ISI
18	Load Smart Manager	Nippen (SLM 34 LED)/ Meco/ Conzerve/ (EM6400) / Enercon

Note : Panel Manufacturer shall have to use same make for set of contactors and O / L Relay

Control Panel and Equipment shall confirm to following IS Specifications:

- a) IS: 13947* : General requirement of switch gear and control panel voltage not exceeding 1000 volts
- b) IS: 2705 : Specifications for current transformers
- c) IS: 13947* Degree of protection provided for switch board
- d) IS: 13947* : Contactor AC voltage not exceeding 1000 volts
- e) IS: 5124 : Code of practice for installation and maintenance of induction motor starter AC voltage not exceeding 1000 volts
- f) IS: 13947* (Part : ATS and motor starter for voltage not exceeding 1000 volts
I, II, III & IV)
- g) IS: 1248 : Indicating instruments
- h) IS: 13947* (Part : Specification for low voltage switch gears and control gears
I, II, III & IV-
1993)

Legend

ATS Control Panel for submersible pump

- T.T. : Time Totalizer
- P1, P2, P3 : Stop, Starter and Time push buttons
- TS1 and TS2 : Toggle switch to bypass SPP and ELR
(on unit is also acceptable)
- MCCB : Moulded case circuit breaker
- FSU : Fuse Switch Unit for capacitor
- L1, L2 L3 : RYB phase indicating lamp
- L4 & L5 : SPP (Healthy) and ELR (Fault) Indicating lamp
- L6 : Over load trip indicating lamp
- L7 & L8 : START and RUN indicating lamp
- L9 : Capacitor on line lamp
- P4 : Over load reset button
- SPP : Single phasing preventer
- C. F. : Control Fuse
- ELR : Earth Leakage Relay
- S, M & R : START, MAIN and RUN indicator
- T & MT : Change over Timer and Master Timer
- C. T. : Current Transformers for Ammeters
- O/L R : Over Load Relay
- ATS : Air Cooled Transformer
- MF : Main HRC Fuse
- CAP : Capacitor
- LSM : Load smart manager

Item No. 4 Providing & erecting approved make Four pole moulded case circuit breaker having breaking capacity/strength ICU of 35 K.A. at 415V. having normal current rating up to 250A. with variable thermal & magnetic release suitable to work on A.C.supply 50 c/s. with all internal connections & complete erected on polished wooden board/ in existing 16 G.M.S housing. ICS = 100% of ICU only. CAT III

Make: - As per approved vendor list.

Item No. 5 Supply of 100 mm diameter of HEAVY UPVC column pipe with coupler and wire locks in approximate length of 3.00 mtrs, 35 kg /cm² weight.

Make: - As per approved vendor list.

Item No-6 Supply of SS TOP & BOTTOM accessories with pump guard set suitable to item no.5 as directed by Engineer - in - charge with necessary plumbing as desired.

Make: - As per approved vendor list.

Item No. 7 Supplying & erecting G.I. bend for pipe connections suitable for 100 mm dia column pipe. (04 nos for bore well + 04 nos for UG sump).

Make: - As per approved vendor list.

Item No. 8 Supplying & erecting ISI Marked 100 mm dia G.I. Union for pipe connections suitable for 100 mm dia column pipe.

Make: As per approved vendor list.

Item No. 9 Providing and erecting ISI mark CI Double Flanged 100 mm sluice valve as per IS :14846 including all taxes, insurance ,transportation ,freight, charges ,octroi, inspection charges ,loading,un loading, conveyance to departmental stores ,staking etc. complete with ISI mark only . P.N,1.6 With hand wheel /cap operated (PD type Short Body) (2 no for Bore well+2no for UG sump)

Make: As per approved vendor list.

Item No. 10. Providing and erecting ISI mark 100 mm C.I Non Return valve including all taxes, insurance ,transportation ,freight, charges ,octroi, inspection charges ,loading,un loading, conveyance to departmental stores ,staking etc. complete with ISI mark only , IS 5312 ,PN-1.6 (1 no for Bore well+2no for UG sump)

Make: As per approved vendor list.

Item No. 11. Supply of erecting clamps with nut & bolts Clamp made from M.S. plate with 3 holes on either side with nuts & bolts of std. Make and suitable size 4"(Width)x 1.5"(Thickness)x 24" length flate suitable to 100 mm dia column pipe & 300 mm dia Borewell. (2 pair for bore well+ 2 pair for UG sump)

Make: - As per approved vendor list.

Item No. 12 Supply of all flanged, heavy duty CI Tee as per IS 1538/ 1986 specification suitable for use with G.I. column pipe of 100 mm dia. Size of C.I. Tee- 100 x 100 x 100 mm dia Supply of M.S. Blind blank flange having 15 mm thickness. With standard holes for 12.5 mm dia bolts.

Make: - As per approved vendor list.

Item No. 13. Supplying & erecting in earthpit of minimum bore dia. 225mm size approved make Safe Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free hot dipped G.I.Pipes having Outer pipe dia of 80 mm having 80-200 Micron galvanising, Inner pipe dia of 40 mm having 200-250 Micron galvanising, connection terminal dia of 14 mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications with chamber and heavy duty cover.(approved make OEM has to submit test certificate including value of earth resistance of installation. (A).For electrical installation up to 440 V length of pipe 1 Mtr back filling compound -1 Nos of bag of 15 kgs. (1 no for bore well + 1 nos for sump with pump house).

General:

All the non-current carrying metal parts of the electrical installation and mechanical equipment's shall be earthed properly. The metal conductor, trenching cables armor and sheath; electrical panels boards; lighting fixtures; and connected by means of specified earthing system. An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards; earth pin of the socket outlets and to any metallic wall plates used.

◆ Scope of work :

The scope of work shall be cover supply; laying; Earthing GI installation; connecting; testing and commissioning of:

1. Earthing station.
2. Earthing G.I./Aluminum/copper strips from earthing station to equipotential bar / Section pillar.
3. Earthing G.I./Aluminum/copper strips from earthing station to equipotential bar to lay feeder / Section pillar.
4. Bonding of Non- current carrying part and metallic parts of the electrical installation.
5. Earthing station to be provided shall comprise of earth Electrode of copper plate in earth pits, earth bus/grid of GI flats 25 mm x 6 mm and bare GI wires as earth continuity conductor.

◆ CODE AND STANDARDS.

The entire earth system shall conform to the following standards and rules as applicable.

1. IS 3043 – 1966 Code of practice for earthing.
2. Indian Electricity Act 1990.
3. Indian Electricity Rules 1956.

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Codes of practice in absence of Indian standard.

◆GENERAL REQUIREMENT :

1. GI flat 25 mm x 6 mm strips of specified size shall directly earth Neutral of the Transformer / section pillar.
2. 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 ELECTRODES IN EARTH PITS.

Plate Electrodes of copper shall be 600 X 600 X 3.15mm thick.

◆EARTH BUS AND EARTH CONTINUITY CONDUCTOR.

1. Earth bus is a copper strip or flat of specified size interconnecting all earth electrodes.
2. Switches and power Distribution Boards shall be earthed by a copper flat strip.
3. Panels fused DBs shall be earthed by a continuity conductor, as specified. Minimum size of continuity conductor shall be 6 SWG bare soft drawn.
4. Road Lighting poles shall be earthed with GI stranded wire conductor while for lighting and power wiring bare copper conductor shall be provided unless otherwise specified to use insulated conductor.

◆RESISTANCE TO EARTH:

The resistance to each earthing system shall not exceed 1.0 ohm to 3.0 ohm.

◆Earthing Station :

1. Plate Electrode Earthing:

Earthing electrode shall consist of copper plate not less than 600 X 600 X 3.15 mm thick, as called for in the drawings. The plate electrode shall be buried as far as practicable below permanent moisture level but in any case not less than 2.5 Mts. Below ground level. Wherever possible earth electrode shall be located as near the water tap, water drain or a down take pipe as possible, Earth Electrodes shall not be kept clear of the factory foundations and in no case shall it be nearer than 2 meters from the outdoor face of the wall. The earth plate shall be set vertically and surrounded with 150mm thick layer of charcoal dust and salt mixture 25mm GI pipe shall run from the main earth conductors shall be connected to the electrode just below the funnel, with proper terminal lugs and check nuts of copper/brass for copper plate. The funnel over the GI pipe and earth connections houses in a masonry chamber, approximately 350-mm length X 300 mm wide and 300mm deep. The masonry chamber shall be provided with a cast Iron hinged cover resting over a Cast Iron frame embedded in masonry.

◆INSTALLATION AND CONNECTION :

1. The plate/ pipe electrode as far as practicable shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

2. The plate / pipe electrode shall be kept clear of the building foundation and in no case; it shall be nearer by less than 2 M from outer face of the finished ground level. The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Char- coal dust and Salt mixture. 25mm. Dia. of G.I. pipe for watering shall run from top edge of the plate / pipe Electrode to the mid level of block masonry chamber.

3. Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe

4. The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.

5. The masonry chamber shall be provided with a cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

6. Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of India Standard IS 3043, Code of practice for Earthing Installation.

7. The earth conductors (Strips / Wires – copper / Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc plated screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

8. The earth conductors shall either terminate on earthing socket provided on the equipment shall be fastened to the foundation bolt and/ or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

9. Over lapping of earth conductors during straight through joints, where required, shall be of minimum 75mm long.

10. The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

◆ EARTH LEADS AND CONNECTIONS.

Earth lead shall be bare copper or galvanized steel 25mm x 6 mm sizes shown on drawings. At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.

The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

◆ 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 in the schedule B.

◆ POWER TRANSMISSION APARTUS.

1. Metallic conduit shall not be accepted as an earth continuity conductor A separate insulated/ bare earth continuity conductor of size 50 % minimum & maximum shall be provided.

Copper Aluminum G.I. Minimum (Sq.mm.) 2.54.06 Maximum 65100200

2. The earth continuity conductor to the drawn inside the conduit shall be insulated.
3. Non metallic conduit shall have an insulated earth continuity conductor of the same size as for metallic conduit. All metal junction and switch boxes shall have an inside earth stud to which the earth conductor shall be distinctly colored (Green or Green / Yellow) for easy identification.
4. Armored cable shall be earthed by two distinct earth connections to the armoring at both the ends and the size of connection being as for the metallic conduit.
5. In the case of unarmored cable, an earth continuity conductor shall either be run outside along with the cable or shall from a separate insulated core of the cable.
6. 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.

◆ UTILIZING EQUIPMENT :

1. All street light poles shall have an earth stud and be connected to the cable armoring using 6.5 sq.mm. Copper or equivalent unless shown otherwise. For street lighting poles planted in ground, 2.4 M long 6 SWG bare GI wire shall be coiled and buried with every fourth pole in addition to connection to cable armoring.
2. An equipment-earthing grid shall be established as shown in the drawing. All earth connections to all panels, DB's and equipment shall be connected to the nearest point of the earthing grid.

◆ TEST :

1. The entire earthing installation shall be tested per requirements of Indian Standard specification IS: 3043,
2. The following earth resistance values shall be measured with an approved earth megger and recorded.

Each earthing station	Earth continuity conductors.
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3. Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 to 3 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 Engineer Incharge /Electrical Inspector – if required.

◆ MODE OF MEASUREMENT:

1. Provision of earthing station complete with excavation, electrode, and watering pipe. Soil, treatment, masonry chamber with cast iron cover etc. shall be treated on unit of measurement
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.
 - a. Main equipment earthing grid and connection to the earthing stations
 - b. Connection to the weight board, power panels, DB etc

◆ 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. Isolating switches and section pillar shall form part of amounting frame, switch starter etc.
2. Light fittings form part of installation of the light fitting.
3. Conduit wiring, cabling shall form part of the wiring of cabling.
4. Street lighting shall form part of the street light poles.

Make: - As per approved vendor list.

Item No-14 Lowering of submersible motor pump set complete with required. Nos. and size of casing pipes erected by means of proper chain pulley block & pipe wrenches after checking of threads of each pipe with coupling to take the load of the pump set and pipe assembly filled up with water. Above 120 mtr & up to the depth as directed by Engineer-In-Charge

Make: As per approved vendor list.

Item No-15 Design, Supply, Installation, Testing, Commissioning of Full Bore 100 mm dia Electromagnetic flow meter with factory calibrated, Regular Power Operated, flanged connection, Flow sensor, Indicator, transmitter and totaliser with all accessories viz. (I) Flow Meter/ Sensor:DC pulsed type, IP 68 Protection, Flanged process connection as per IS 1538 or equivalent standard, SS304/ Metallic Alloy Flow Tube, SS316/ SS 316 L/ Hastelloy Sensor, SS316/ Hastelloy Grounding Ring/ Inbuilt Grounding Electrode, Neoprene/ Polyurethane/ Hard Rubber/ Rilsan lining, SS304/ Die Cast Aluminium/ Carbon steel with Anticorrosive Paint Coil Housing with Junction Box, CS flanges.(II) Flow Transmitter/ Converter (Remote Field Mounted):Microprocessor based, Modular design, 2 line LCD for indication of actual flow rate, forward, reverse, sum totaliser display, $\pm 0.5\%$ accuracy at 0.3 to 4 m/sec velocity, 4 to 20 mA with HART/Modbus output, one scalable pulse, one statusoutput, IP 67 protection, Die cast aluminium/ polycarbonate/ SS316 with Anticorrosive Paint/ PU finish with glass window enclosure, Inbuilt EEPROM and Data Logger, 20 meters cable length for sensor to transmitter communication etc alongwith wall mounted/ stand ounted cabinet.

Make: - As per approved vendor list.

Item No-16 Design, Supply, Installation, Testing, Commissioning of Bourdon Type Pressure Gauge, $\pm 1\%$ accuracy, Direct bottom 1/2" NPT (M) process connection, IP 67, Glycerine filled, SS304 Case with Bayonet Type Bezel, SS316 L Bourdon Tube, SS 316 Movement material, Aluminium dial with black graduation on white background, Micro Zero adjustable pointer, neoprene gasket, Blow out disc, shatter proof glass, SS tag plate etc as per IS 3624. 100 mm Dial Size (0 to 21 Kg/cm²)

Make: - As per approved vendor list.

Item No-17 Providing & erecting 12.5 Hp Open well horizontal mono block pump set having 3 Phase 400/440 Volt having 1530 to 950 in LPM @ 24 to 40 mtr Mtr head suitable for 80/100 mm dia delivery pipe. Cat. II

- i) Discharge capacity range =1530 LPM to 950 LPM (1 Working + 1 Standby)
- ii) head range = 24 to 40 Mtrs.
Duty point =30 mtr
- iii) Impellers : SS (Stainless Steel)-410
- iv) Delivery size : 80/100 mm dia.

Make: - As per approved vendor list.

Item No-18 Providing and erecting ISI marked PVC insulated PVC Sheathed Flat flexible Submersible copper cable approved make of following Size. (C) 3 Core x 4 Sq. mm

Make: As per approved vendor list.

Item No-19 Supplying & erecting approved make motor control cubical panel (STAR-DELTA) made from 16 G. CRCA sheet duly epoxy powder painted inside and outside with hinged doors and locking, arrangement consisting of suitable size of ON- OFF isolator (AC - 3/23duty) main fuses, single phasing preventer, indicating lamps for R- Y - B phases, overload relay, Automatic water level controller, Ammeter, Voltmeter each with two way selector switch incoming, wires duly socket crimped, main contactor & overload relay, start - stop push buttons, to be erected on angle iron frame grouted on wall as directed. The isolator, overload relay & contactors will be of L & T, Siemens or BCH make only. (D) S/D up to 15 HP

Make: - As per approved vendor list.

Item No-20 Providing & erecting weather proof, dust & vermin proof, floor mounted front operated indoor type cubical panel board having IP-64 protection made from 14 SWG thick CRC M.S. sheet for outer body & doors, 16 SWG thick CRC M.S.sheet for internal partitions with necessary supporting angles, flats including cutting, bending, drilling, welding, riveting with internal partitions & cable alley as per requirements & instruction of engineer-in-charge with erection of supplied switch gears, BUSBARS, with suitable size of inter connecting PVC copper wire / copper-aluminium strips, rubber grommets, rib, bakelite control fuses for measuring instruments, earth bus & earth bolts, foundation flange - bolts-base Plates, sufficient nos. of hinged doors, handles with locking arrangement and rubber gasket complete. The Panel shall be painted with epoxy powder coating. (The rates excludes the cost of switchgears, bus bars, inter connecting mains & Copper Aluminium strips, meters, Fuses etc. The dimension shall be measured excluding base beams) The panel shall be supplied with following approved manufacturers with following size. (B) The standard companies switch gear shall be used and only manufacturers at CPRI approved factory and shall be certified by that company whose switch gears are used after fabrication for beneficial use locally fabricated panel box with 350 mm depth

Make: - As per approved vendor list.

Item No-21 Supplying and erecting triple pole & neutral 440V / 500V panel mounting Copper Busbars with four equal Nos. of electrolyte bus having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulating tape for phase sequence of following current carrying capacity, erected with necessary bus bar supports /insulators, main cable socket to each bar, erected in existing cubical panel with necessary connections.(A) Suitable for 200 Amp. Capacity.

Make: As per approved vendor list.

Item No-22 Supplying and erecting approved make 3 Phase Digital Ammeter & Voltmeter having 3.5 digit LED display 0 to 750 AC volt range for volt meter and 0 to 1000 A for A-meter erected on existing panel board with all connection wiring and manufacturer calibration certificate..

Make: - As per approved vendor list.

Item No-23 Supplying and erecting approved make set of indicator lamps of LED type lamp, lens cover, Bakelite holder complete erected with necessary connections.

Make: - As per approved vendor list.

Item No-24 Supplying and erecting APP type capacitor suitable for 415 v 50HZ 3 phase AC power supply with earthing terminals and test certificate.

Make: - As per approved vendor list.

Item No-25 Providing and erecting XLPE(IS:7098)(I)-88 ISI armored cable multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables (D) 3 x 1/2 core x 70 Sq. mm (35 Sq. mm 1/2 core)

Make: Finolex / Jainson/ Good Cab /AVOCAB/EMGEE or As per approved vendor list.

Item No-26 Providing and erecting LT CT with bar primary 50/05 to 1000/05 ration 15 VA burden erected in existing CRCA box duly secured with insulating material connected to the meter coil.

Make: - As per approved vendor list.

Item No-27 Supplying and erecting approved make PF meter having 150 mm dia balanced and un balanced load to work with provided CT 100/5 amp to 400/5 Amp ration and other accessories complete erected in MS box and connected to circuit by PVC copper core leads.

Make: - As per approved vendor list.

Item No-28 Supplying and erecting approved make single phasing preventer in MS enclosure with wiring up to 20 HP.

Make: - As per approved vendor list.

Item No-29 Miniature circuit breaker single pole 6A to 32A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. Confirming to IS 8828/1996 with ISI Mark cat-III

Make: - As per approved vendor list.

Item No-30 Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 35 KA. at 415 V, having normal current rating up to 250A. with variable thermal & magnetic release suitable to work on A.C. supply 50 c/s. with all internal connections ,spreader tinned copper & complete erected in existing 16 G.M.S. housing.. ICS=100% of ICU only Cat III.

Make: - As per approved vendor list.

Item No-31 Supplying ISI Marked (Embossed) following size of Heavy duty “C” Class G.I . Pipe & erecting as directed by Engineer-in-charge with necessary plumbing as desired. (G) Nominal 100 mm dia mtr.

Make: - As per approved vendor list.

Item No-32 Supplying & erecting Mild Steel heavy duty Flanges with rubber packing and hardware materials for pipe connections suitable for Nominal Dia : 100 mm dia.

Make: - As per approved vendor list.

Item No-33 Lowering of 12.5 hp submersible motor pump set complete with required. Nos. and size of casing pipes erected by means of proper chain pulley block & pipe wrenches after checking of threads of each pipe with coupling to take the load of the pump set and pipe assembly filled up with water.

Make: - As instruction by Engineer In- Charge.

Item No-34 CABLE GLANDS & CABLE LUGS

Supply and fixing heavy duty flange type brass cable glands with rubber ring for suitable size PVC armoured cable complete with out going tails, insulating tape etc. for following size of cable..

- (a) 3.5 core 70 sq mm.
- (b) 3 core 35 sq mm for gland.
- (c) 3.5 core 70 sq mm for lugs.
- (d) 3 core 35 sq mm for lugs.

Make: - As per approved vendor list.

Item No-35 SITC of 7 Mtr. Long 70 mm Top X 135 mm bottom dia, 3 mm thickness with 225mm X 225mm X 16mm base plate, Supply and Installtion of 4 nos. 4 - M20 Bolts and 600mm long J-Bolt. (4 Nos. Per St. Lght Pole or Above Foundation) Hot Dip galvanised octagonal type Streetlight Pole complete without Bracket & incl. foundatin and accessories with following specifications.(a) Overall length of pole : 7.00 mtrs. (b) Height above ground level : 7.00 mtrs. (C) Length of section - Out side dia. & Wall thickness Bottom : 135 mm, Top : 70 mm..

APPLIABLE CODES AND STANDARDS:-

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacturer may propose equipment/materials conforming to alternate codes or standards. However, the provisions of this specification shall supersede the provisions of these alternate standards in case of any difference.

ASTM A36M Standard Specification for Carbon Structural Steel

ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings of Iron and Steel Products

ASTM A143 Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
 ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 ASTM A215 Martensitic Stainless Steel and Alloy Steel Castings for Pressure Containing Parts Suitable for High Temperature Service
 ASTM A239 Standard Test Method for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
 ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
 ASTM A320 Alloy-Steel Bolting Materials for Low Temperature
 ASTM A351 Austenitic Steel Castings for High Temperature Service
 ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 PSI Minimum Tensile Strength
 ASTM A354 Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners
 ASTM A370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 ASTM A384 Standard Practice for Safeguarding Against Warpage and Distortion during Hot-Dip Galvanizing of Steel Assemblies
 ASTM A385 Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip)
 ASTM A394 Standard Specification for Carbon and Alloy Steel Nuts
 ASTM A490 Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints
 ASTM A537 Pressure Vessel Plates, Heat Treated, Carbon-Manganese Silicon
 ASTM A572 High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
 ASTM A588 Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-inch (100 mm) Thick
 ASTM A633 Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates
 ASTM A673 Standard Specification for Sampling Procedure for Impact Testing of Structural Steel
 ASTM A687 Standard Specification for High-Strength Non-Headed Steel Bolts and Studs
 ASTM A577M Standard Specification for Ultrasonic Angle Beam Examination of Steel Plates
 ASTM A578M Standard Specification for Ultrasonic Straight Beam Examination of Plain and Clad Steel Plates for Special Application
 ASTM E165 Standard Test Method for Liquid Penetrant Examination
 ASTM E709 Standard Guide for Magnetic Particle Examination
 ASCE 72 Guides for Design of Steel Transmission Pole Structures
 AISC Manual of Steel Construction, 9th Edition
 AWS D1.1 Structural Welding Code, Steel
 AWS D10.9 Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
 NEMA TT-1 Tapered Tubular Steel Structures
 ISO 630 Standards for Structural Steels
 ISO R657 Recommendation for Hot-Rolled Steel Sections
 ISO 1459 Metallic Coatings - Protection Against Corrosion by Hot Dip Galvanizing - Guiding Principles
 ISO 1460 Metallic Coatings - Hot-Dip Galvanized Coatings on Ferrous Materials - Gravimetric Determination of the Mass per Unit Area
 ISO 1461 Metallic Coatings - Hot Dip Galvanized Coatings on Fabricated Ferrous Products - Requirements
 ISO 3575 Continuous Hot-Dip Zinc-Coated Carbon Steel Sheet of Commercial, Lock-Forming and Drawing Qualities
 ISO 4997 Cold-Reduced Steel Sheet of Structural Quality
 ISO 4998 Continuous Hot-Dip Zinc-Coated Carbon Steel Sheet of Structural Quality
 ISO 7413 Hexagon Nuts for Structural Bolting, Style 1, Hot-Dip Galvanized (Oversize Tapped) - Product Grades A and B - Property Classes 5, 6 and 8 3.44

ISO 7417 Hexagon Nuts for Structural Bolting - Style 2, Hot-Dip Galvanized (Oversize Tapped) - Product Grade A - Property Class 9
IS 875 part 3 1987
IS 2629/IS 2633/IS 4759
CIE (International Commission on Illumination) and
All applicable Codes, Regulations, Standards, and relevant Authorities

Structural Design:-

The general design and dimensions shall be as closed as possible to the Drawings attached and certified by a registered Mechanical Professional Engineer;

The Octagonal Pole with bracket arm shall be designed to withstand the maximum wind speed of 47m/sec. The maximum stress at wind speed of 47m/sec shall not exceed 80% of the strength of steel. The pole shall be suitable for wind loadings as per IS 875 part 3 1987.

Wind Loads shall be obtained using the design wind pressure as obtained by the following formula as specified in BS EN 40-3-1:-

$$q(z) = \delta \times \beta \times f \times Ce(z) \times q(10)$$

Where:

$q(z)$ is the characteristic wind pressure in N/m² for any particular height above ground, z (m)

$q(10)$ is the reference wind pressure

δ is a factor depending on the column size

β is a factor depending on the dynamic behaviour of the column

f is a topography factor and

$Ce(z)$ is a factor depending on the terrain of the site and height above ground z . Under normal site conditions, the terrain category shall be selected as category III and $Ce(z)$ shall be taken as 1.78.

When a site is located at a very exposed area and subjected to an extremely high wind pressure, the terrain category and the value of $Ce(z)$ to be adopted shall be agreed with LTA.

$$q(10) = 0.5 \rho \times (Cs)^2 \times V_{ref}^2 \text{ N/m}^2$$

Where:

ρ is the air density and shall be taken as 1.25 kg/m³

Cs should be taken as $\sqrt{0.92}$ for a mean return period of 25 years

V_{ref} is defined as the 10 minutes mean wind velocity having a mean return period of 25 years and shall be taken as 20.6 m/s.

The structural design of the pole shall be verified by calculation in accordance with BS EN 40-3-1 and BS EN 40-3-3 with partial load factors Class B and maximum deflection Class 2. Particular attention is drawn to the reinforcement of the door opening which is a highly stressed zone. This must be clearly identifiable in the structural calculation.

The detail of top loading i.e. the weight and area of top luminaries are worked out based on this consideration. Maximum deflection of the pole shall meet the requirement of BS 5649: part 6 1982.

The pole shall be made from CR/HR sheet and shall be hot dip galvanized as per IS 2629/IS 2633/IS 4759 and ASTM 123 standards with minimum coating thickness of 85 micron.

Poles shall be continuously tapered OCTAGONAL cross section, presenting a good and pleasing appearance and based on proven design conforming to international standards, to give an assured performance, and reliable service.

Construction:

- 1) Poles shall be fabricated from special steel plates, 3mm thick, conforming to ASTM A 572 Gr 50 or equivalent with mechanical properties, cut and folded to form an octagonal section and welded as below:
 - a. Minimum yield strength - 355 N/mm²

- b. Minimum ultimate tensile strength - 490 N/mm²
 - c. Max. ultimate tensile strength - 620 N/mm²
 - d. Silicon content of the steel shall be less than 0.06% to assure a better and lasting quality for galvanizing and Certificate for the Zinc used for galvanizing should be submitted along the order.
- 2) Pole shall be made in single section.
 - 3) The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding. The welding of pole shaft shall be done by Submerged Arc Welding (SAW) process using state of the art process.
 - 4) The procedural weld geometry and the workmanship shall be exhaustively tested on the completed welds. Welding shall be checked by using ultrasonic testing methods also. Poles shall be provided with base plate, which shall be free from any lamination or incursion. The welded connection of the base flange shall be fully developed to the strength of the entire section.
 - 5) All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing 4 foundation bolts. This base plate made of Mild Steel / Fe 410 conforming to IS 2062 and shall be fillet welded to the pole shaft both inside and outside.
 - 6) Structural steel for bearing plate and top cap shall comply with the applicable requirements of ASTM A36 or equivalent with minimum yield strength of 250 N/mm². The top section fits into the bottom section to form the pole..
 - 7) Pole shaft, bearing plate and top cap shall be hot-dipped galvanized after fabrication, including all drilling, cutting and welding. The poles shall be hot dip galvanized in single dipping method as per ASTM A 123 AND 153 standards with the minimum average thickness of coating shall be 0.086 mm, equivalent to 610 g/m².
 - 8) Weld material shall be compatible with the material of the pole as defined by American Welding Society.
 - 9) The welding shall be carried out confirming to approved procedures as per qualified GMAW process approved by duly qualified by third party inspection agency. The welders shall also be qualified for welding the octagonal shafts.
 - 10) Poles seam welding shall comply with the latest edition of EN 1011-2 by automatic continuous welding process.
 - 11) The base plate shall be welded to the bottom of the pole before dipping in the galvanizing bath. The base of the pole shall be complete in all respects with base plate before hot dip galvanizing internally and externally as per ASTM A 123 AND 153.
 - 12) The Octagonal Poles shall be in single section (upto 12 mtrs). There shall not be any circumferential weld joint. However, the pole with length of 12 mtrs. and above shall be of 2 sections with telescopic fitment with minimum overlap of 1.5 times the diameter.
 - 13) Upper and lower sections shall overlap each other by 1.7 (±20%) times the diameter of the immediate lower section and shall be easily assembled on site by using simple tools without welding. The supplier shall provide a mark on the finished pole indicating the overlapped position of 1.75 X diameter.
 - 14) No cutting or welding shall be allowed on the pole after hot dip galvanizing.
 - 15) The poles shall be suitably designed for ground and flange mounting. The J-bolt size shall be of 20 mm diameter and of stainless steel grade SS 316. Each individual J-bolt shall be complete with washers and nuts (the washers and nuts quantity shall be recommended by the pole supplier) and they shall be of the same stainless steel grade as the J-bolt.
 - 16) For flange mounted pole, the concrete foundation shall be exposed 50-100mm above the finishing turf level.
 - 17) For flange mounted pole concrete foundation that is abutting the edge of cycling track / footpath, it shall be flushed with the finishing track / path level. The nuts and J-bolts shall be covered / plastered with cement.

- 18) Same stainless steel grade washers or nuts can be placed below the base flange for balancing purposes. The two (2) nuts on top of each J-bolt are meant for tightening and locking purposes.
- 19) To fill up the gaps between the foundation and the base plate of the lamppost, pressurised, flowable high strength non shrink cementitious grout shall be used.
- 20) Mounting details including all data, calculations, imposed loads and forces and dimensional drawings for the foundations required for the poles shall be endorsed by a registered Structural Professional Engineer.
- 21) The soil bearing capacity at the site shall be ascertained so that the foundations can be correctly designed.
- 22) For poles with One / two or more sections, the lower and upper sections shall have a thickness of minimum 3.0mm. The bracket arms shall have a minimum thickness of 2.5mm. The base plate shall have a minimum thickness of 3.0mm.
- 23) Every section of the poles shall be made in such a way that only one (1) sheet of steel plate is used to form an octagonal pole. Welding shall be carried out along one edge of the poles only;
- 24) The Octagonal Poles shall be bolted on a pre-cast foundation with four foundation bolts for greater rigidity.

Design of Pole Door and Locking System:-

- 1) A door shall be provided with a locking device over the door opening of each pole as shown in the Drawings. The triangular locking device shall be made of stainless steel as specified in the Drawings. The locking device shall be properly assembled. The triangular bolt shall be jammed at one end so that it will not be dislodged when it is fully opened.
- 2) Pole doors shall be flushed with the poles with no gap between pole and door to prevent ingress of water.
- 3) An adequate door opening (Minimum Size of door is 250 mm X 65 mm) should be 1500 mm above from the bottom of the Pole at a convenient location. or as per the site requirement and as approved by Engineer in charge.
- 4) A hole of 20mm diameter shall be provided at approximately 500mm below the top edge of the top section. This hole shall come with a tight-fit rubber stopper to prevent water from entering the pole.
- 5) The opening shall be such that it permits clear access to the inside of the pole. The door opening shall be hinged type complete with a close fitting, vandal resistant and shall be weather/dust proof to ensure safety of inside connections.
- 6) The door shall be flush with the exterior surface and shall have suitable screw / allen key type locking arrangement.
- 7) The pole door shall be hinged at the top. The hinges shall have minimum opening of the door of 180 degrees.

Baseboard :-

- 1) During installation, a cut-out unit will be installed inside the poles by means of three (3) M12 25mm long screws.
- 2) A fixing device, which could be a perforated plate made of hotdipped galvanised steel shall be fixed in the pole directly facing the pole door as part of the pole. The cut-out unit shall be mounted directly onto the fixing device. The fixing device shall be able to cater for different types of cut-out units.

- 3) Alternatively, a baseboard made of hot-dipped galvanised steel shall be provided and mounted in each pole for fixing of cut-out unit.

Earthing Terminal:-

- 1) An earthing terminal in the form of a bolt made of stainless steel material shall be provided close to the door opening of each pole and inside the pole. In addition, it shall have substantial contact surface for the attachment of an earthing lead. Two (2) suitably sized washers and two (2) nuts shall be provided for each bolt. Each pole shall provide with four (4) bolts. The bolts, nuts and washers shall be made of stainless steel.
- 1 There shall also be suitable arrangement or welded a cleat of size 40 x 40 x 4 mm for providing pole earthing with necessary 8.0 S.W.G G.I earthing wire. The item includes 1 No. of 63 Amp backelite sheet 12 mm thick HYLAM make terminal plate and 1 No. of DP 6 -32 Amp MCB with DIN rail (B series) with rupturing capacity ≥ 10 KA, per fitting. for the purpose of earthing.
- 2 The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.
- 3 Provision shall be given inside this door for fixing the electrical terminals and allied accessories and Suitable plate shall be provided for cable gland support.
- 4 Poles shall be pre-drilled and supplied complete with pole top cap and base plate.
- 5 The maximum design unit stress shall not exceed the minimum yield stress as stated in this specification for the particular application and types of loads, including overload capacity factors.
- 6 Bolts, nuts and locknuts for top cap, bearing plate and earthing nut shall be steel Grade 4.6 and shall comply with the applicable requirements of ASTM A307 and ASTM A 563 or equivalent and hot-dipped galvanized in accordance with the requirement of 01-SDMS-01 with minimum average coating thickness of 0.053 mm, equivalent to 381 g/m².

Protection against Corrosion: -

Individual sections of the pole, base plate and bracket arm shall be protected against corrosion by hot-dipped galvanisation internally and externally in accordance with the latest edition of BS EN ISO 1461. All welding works shall be done before the galvanisation.

- (a) No zinc flux shall be left inside the pole or bracket arm after galvanisation. The presence of these impurities can pose a problem in the installation of pole internal wiring.
- (b) The treatment prior to galvanisation shall include degreasing, pickling, rinsing and fluxing.
- (c) The minimum average zinc coating weight shall be 610 grams per square metre.

Extra Protection against Corrosion at the Pole Base: -

- (a) A coat of bitumen shall be applied internally and externally to the base section on top of the galvanised coating by means of dipping. It shall be applied over the length of the planting depth and for a distance of 200mm (and not more than 250mm) above the planting depth. The total length to be applied with the bitumen coating shall be shown in the following table. A circular

marking shall be made on the poles during manufacturing to indicate the level of the planting depth.

- (b) The bitumen used shall conform to the latest edition of BS 4147 or ASSHTO M190-70.
- (c) The bitumen shall be heated in a tank to a temperature of approximately 220°C before dipping.
- (d) The dry film thickness of the bitumen coating shall be at least 762µm.
- (e) A layer of lime powder shall be applied to the bituminous coating for easy handling of poles.

Aesthetic Appearance of the Finished Surface: -

- (a) The poles and bracket arms shall be of prime finish and good uniformity; i.e. free from injurious defects, such as blister, flux and non-coated spots, white rust, peeling of bituminous paint coating, etc.
- (b) The galvanising and bituminous appearance of poles and brackets supplied shall not be inferior to the sample submitted for evaluation. If in the opinion of LTA that the galvanising and bituminous finish of the poles and brackets is inferior to the sample supplied, LTA shall have the right to reject the inferior poles or the entire lot.

Pole internal wiring: -

An adequate length of XLPE/PVC sheath cable, 3-core, 2.5mm² rated at 600 / 1000 Volts, shall be provided for the connection between the fuse cut-out unit and the lantern. The cables shall be properly supported to prevent undue strain on the cable terminations. The cable colour identification shall comply with the latest IEC/IS requirements.

The cables shall be manufactured to the latest edition of IEC 60502-1.

Fabrication: -

- 1) Shearing and cutting shall be performed carefully and all portions of the work shall be finished neatly. Copers and re-entrant cuts shall be filleted before cutting.
- 2) All forming and bending during fabrication shall be done by method that will prevent embrittlement or loss of strength in the material being worked.
- 3) All welding operations shall be done in accordance with the American Welding Society, AWS D1.1.
- 4) Bolt holes as specified in the applicable drawings shall be punched or drilled. Holes may be punched when the material thickness does not exceed the diameter of the hole. Holes of any diameter may be drilled. Holes shall be cylindrical, perpendicular to the pole shaft, free of burrs, and clean cut without torn or ragged edges. The use of burning torch for cutting holes will not be permitted.
- 5) Extra holes for the purpose of lifting or other than those specified in the drawings shall not be permitted.
- 6) All pre-drilled holes shall be provided with durable ultra-violet resistant, plastic plugs.
- 7) Steel pole shall be provided with M12 earthing nut at the location specified in applicable drawing. Hot-dipped galvanized M12 x 30 mm long hexagonal bolt with washer shall be screwed on to the earthing nut.

- 8) Steel poles shall be provided with detachable top cap and base bearing plate. Flat bar with drilled and tapped hole to suit M12 bolt shall be welded to the top and bottom of the pole for attaching the top cap and base bearing plate, respectively. Hot-dipped galvanized M12 x 30 hexagonal bolts and washers shall be provided for attaching the top cap and base plate.

- 9) The following tolerances shall apply:

Width or Diameter - The tolerance on the width or diameter of the section shall be $\pm 4\%$ (per BS EN 40-2) of the width or diameter or ± 5 mm for A/F diameter

Thickness - The tolerance on the thickness of the material shall be ± 0.22 mm of the thickness (per BS EN 10051).
 $\pm 0.5\%$ for overall length

Pole Dimension	Requirement of GIDC
HEIGHT (Min.)	7 meter
O.D.TOP (Min.)	70 mm
O.D. BOTTOM (Min.)	135 mm
THICKNESS (Min.)	3 mm
BASE PLATE (Min.)	250 x 250 x 16 mm (PCD 240 mm)

± 2 mm for center-to-center distance between holes

± 0.5 mm for diameter of pre-drilled holes

Straightness of the pole shaft shall be within 1 mm/m and without any twist. The completed poles shall not deviate from straightness by more than an amount calculated at the rate of 3mm per metre (per BS EN 40-2). This also applies to the complete poles and bracket assembly.

The detail dimensions of pole are follows: -

Pole drawing from manufacturer must be get approved from D.E.E (M&E)/ Engineer Incharge of concerned department.

The Hot Deep Galvanized Top mounting bracket shall be supplied along with the Octagonal Poles for installation of the luminaries

The HDG Decorative bracket same as per Pole Manufacturer shall be fabricated having the design to be approved by the Department/Engineer-in-charge. Suitable arrangement shall be provided at the top of the street light pole for fixing of street light fixtures. MS Plate to be welded at the bottom of the pole and the necessary earthing termination bolt and the cable entry for the Luminaries etc shall be provided at proper distance for fixing of junction box.

The installation of pole shall be done as per direction of Engineer-in-charge at distance of approx. 25 mtr between two poles or as per site requirement or as per luminaire design data requirement in ZIG-ZAG / Single or Double Side/ Central Verge pattern.

Special care shall be taken while erection of poles so that these are not strained or damaged during erection and are firmly stayed till the foundation are secured, as per instruction of Engineer-in-charge and as per drawing.

The alignment of all the pole and the height shall be in one line so that from the distance it looks in one line. The material shall not be dispatched without prior inspection by the inspecting authority appointed by the department or DEE (M&E) GIDC, Mehsana.

1.12 Type Test: -

All materials shall be type tested in accordance with the latest standards in this specification.

All sample poles and bracket arms shall be submitted to a accredited testing laboratory for the following tests:

- (i) Dimensional and Weight Measurements of pole & bracket;
- (ii) Horizontal Deflection Type Test (per BS EN 40-3-2: 2000): The serviceability & structural test loads for the verification test are the characteristic dead and wind loads specified in clause 3 & 4 of EN 40-3-1 : 2000.

1.13 Serviceability requirements:-

The temporary horizontal deflection of the lantern connection caused during the load test by the incremental load due to the horizontal forces corresponding to the test load shall not exceed the value given in Table 3 of BS EN 40-3-3 class 2 [Max horizontal deflection $0.06(h+w)$]

h - is the nominal height of the lighting column (in mm) as defined in EN 40-1

w - is the bracket projection (in mm) as defined in EN 40-1.

1.14 Structural requirements:-

For steel lighting columns the residual deflection after removal of the test load shall be no greater than 10% of the deflection caused by the test load.

1.15 Application of forces:-

Horizontal forces shall be applied to act so that the moments caused at the critical sections in the column are at least equal to the moments resulting from the test loads. At all other points the moments shall be not less than 95% of the moments resulting from the test loads.

The horizontal forces shall be applied in stages by means of at least five (5) approximately equal incremental loads up to the test load. At the test load the horizontal deflection of the lantern connection shall be measured and entered in the test report.

After unloading from the horizontal deflection test, the residual linear horizontal deflection shall be measured and recorded.

- (iii) The position of the door relative to the direction of the horizontal loading shall be in the most onerous position allowed in design and the position shall be stated. Where a bracket is used the position of the bracket projection relative to the position of the door shall be stated.
- (iv) Before carrying out the tests, the lighting column may be loaded once and then unloaded provided that the applied load does not exceed 50% of the test load.
- (v) Galvanising Test: The poles and brackets shall be subjected to the galvanising thickness test as laid down in the latest edition of BS EN ISO 1461.
- (vi) Bitumen Test: The bitumen coating on the pole base shall be subjected to thickness test as laid down in the latest edition of BS 4147 or ASSHTO M190-70.
- (vii) Material Test: Steel material used for the manufacturing of poles and brackets shall be subjected to test for compliance with the latest edition of BS EN 10025 Grade S 275 JR. The test method and the reference standards shall be subjected to the approval of GIDC.
- (viii) Welding Test: All welded portions of the pole and bracket shall be subjected to a relevant welding test. The supplier shall state the reference standard and the strength of the welded joint together with the tender. The reference standard shall be the latest relevant British Standard. The reference standard and the strength of welded joint shall also be subjected to the approval of GIDC.
- (ix) For longitudinal seam weld, the reference standard shall be the latest edition of EN 1011-2; i.e. by transverse tensile test where results shall not be less than 60% of specified minimum value of parent material.
- (x) Mechanical Property Test: The accredited testing laboratory for this test shall cut off a small piece of steel plate of adequate size from the base of the sample poles.
- (xi) The tensile strength and yield strength of the sheet metal shall be measured. The test results shall comply with the limits specified in the latest edition of BS EN 10025 Grade S 275 JR steel as follows:

Particular	BS EN 10025 Grade S 275 JR
Tensile strength	($t < 3$) 430 - 580

	($3 \leq t \leq 100$) 410 – 560
Yield strength	Yield strength

- (c) Test report for the above shall be submitted by the supplier/manufacturer together with the batch delivered. Otherwise, the batch of delivery will not be acceptable.

1.16 Batch Testing: -

- (a) For each batch of delivery, the supplier shall submit samples to the accredited testing laboratory for testing and inspection on the quality of the products. The delivery will not be accepted by GIDC unless the sample passes the batch tests.
- (b) For every batch delivery, the number of sample to be tested shall be in accordance to the latest edition of EN ISO 1461.
Following the completion of all tests, two certified copies of the test reports shall be submitted to GIDC for review and approval.

1.17 Full-scale Loading Test (Vertical Testing)

When GIDC desires full scale loading tests, it shall be as stated in the Data Schedule. The Supplier shall then include in his proposal, as a separate item, the cost of the tests.

Full scale loading test shall be in accordance with the applicable standards. The Supplier shall submit for approval by GIDC diagrams showing the proposed scheme for applying and measuring loads and determining deflections of critical points.

1.18 Deflections (During Pole Test).

Pole deflections under load shall be measured and recorded. Deflection readings shall be recorded for the “before-load”, “load-on” and “load-off” conditions as well as at all intermediate holds during loading. All deflections shall be performed to common base readings, such as the initial positions, taken before any test loads are applied.

A no-load deflection reading shall be taken five minutes after the removal of the maximum test load, the reading shall not exceed the allowable deflection (5% of the exposed length).

The Supplier shall furnish a full and comprehensive report of each pole test and shall include detailed diagrams and tabulation showing values and methods of load application and deflection records of each load test, photographs of test set up and description (with photographs) of all failures, if any.

Include mill test reports of the material used and the results of any tensile tests of specimens cut from any members, which failed during the testing program. Particular emphasis shall be placed on the determination of the mechanical properties of the material.

1.19 Acceptance Test: -

The Supplier, upon receipt of written acceptance from GIDC for the satisfactory performance of the pole loading tests, may start fabrication of the steel poles.

Pole manufacturer should have valid full scale type test certificate for octagonal street light pole for any height upto 12mtr issued within last 2 years by reputed testing facility like CPRI or NABL Accredited Test Laboratory and if not available than fresh Type test of pole should be carried out in presence of GIDC Officials and Material testing/Inspection charges of shall be borne by the supplier.

1.20 Pole label:-

- (a) Comes in one-piece for ease of on-site application: White-retro reflective sheeting as the background and roll laminated with red-coloured cast vinyl film on top.

- (b) The Cast-Vinyl Film shall be of Pantone colour code 187c and have a thickness of 0.05mm, with pressure sensitive adhesive designed for permanent graphics.
- (c) The White retro-reflective sheeting shall comply to Type 11 sheeting of ASTM D4956 - 11a.
- (d) The whole piece of label shall have a minimum warranty of Fifteen (15) years from the sheeting manufacturer. Quality audit must be performed by the sheeting manufacturer to ensure proper fabrication and conformance to specification.
- (e) Each pole label has to be silkscreen printed with the Sheeting Manufacturer's initials as well as the year of manufacture on it. The silkscreen printed initials / year of manufacture should not affect the visibility of the label and therefore should be kept at a size lesser than 3mm x 10mm to be printed at the bottom of the alphabets / numerals.
- (f) The overall dimension of the label shall be 60mm x 110mm. The four (4) corners of the label shall be curved. The height of the alphabets / numerals within the label shall be 100mm.
- (g) All lighting poles shall be conspicuously numbered using two (2) sets of pole label and a round sticker bearing a black arrow against a yellow background that indicates the direction of the lighting control box. Samples of the number labels shall be submitted to GIDC for approval.

1.21 Warning arrow label:-

- (a) The label shall have black arrows with yellow background. The width of the label should be 300mm and go around the entire pole.
- (b) The whole piece of label shall have a minimum warranty of Fifteen (15) years from the sheeting manufacturer. Quality audit must be performed by the sheeting manufacturer to ensure proper fabrication and conformance to specification.
- (c) Each label has to be silkscreen printed with the Sheeting Manufacturer's initials as well as the year of manufacture on it. The silkscreen printed initials / year of manufacture should not affect the visibility of the label and therefore should be kept at a size lesser than 3mm x 10mm to be printed at the bottom of the label.

1.22 Marking:-

Each pole shall be provided an aluminium name plate of with 80 mm x 80 mm or Suitable nameplate riveted to the shaft at the location specified in applicable drawing. All markings shall be legible and so applied to remain legible under normal handling and installation practices. The rivets used to fix the name plate must be of non-rust type.

Nameplate shall include, but not limited to the following information:

- GIDC Monogram
- GIDC – Estate name
- Pole Type
- Height of Pole:
- Pole Ultimate Load
- Pole Dimension (A/F Top/Bottom/Thickness)
- Pole Weight
- GIDC Work Order Number
- Pole Number
- Batch Test Number
- Manufacturer's Name or trademark
- Year of manufacturing
- Place of Manufacturing
- Made in:

PACKING AND SHIPMENT: -

In addition to the packing and shipping requirements, the following shall be fulfilled:

As bitumen coating shall be applied internally and externally to the base section of the poles, extra care shall be taken during the transportation and storage to prevent the poles from being dirtied by the bitumen coating. The two sections of the pole shall not be stored inside one another. The poles shall be packed for transportation and storage in such a way that the clean galvanised surfaces are not side-by-side, below or above the bitumen coating. Wrapping of the bitumen portion with newspapers is not acceptable, as the removal of the latter will pose a problem. The protection of the bitumen from smearing the non-bitumen part of the poles shall be such that it could be easily removed during erection.

The material used for strapping the poles together during the delivery shall be of non-rust type. This is to prevent rust from appearing at the straps due to weather if stored for a long period.

The poles shall be stacked with spacers and blocks in order to avoid damages of zinc coating during the loading and transportation. Poles shall be delivered in bundles of 6 poles with the arrangement of 2 layers, with 3 poles per layer, and strapped at four (4) locations of equal distances with the use of steel straps size 31 mm x 0.8 mm (min.) and necessary wood separators, padding or cushion material underneath the steel straps.

Wooden separators shall be provided between the horizontal and vertical layers of poles to avoid scratches and to facilitate slinging.

Bundled poles shall be so arranged such that the earthing hardware are not disturbed during normal handling.

Reasonable care shall be exercised in the handling and shipment of steel poles. Any expense incurred due to the careless handling and shipment of steel poles shall be considered as a legitimate back charge against the Supplier.

GUARANTEE: -

The vendor shall guarantee the steel pole against all defects arising out of faulty design or workmanship or defective material for a period of Five year from the date of installation or 7 years from date of delivery. GIDC certificates for date of commissioning shall be accepted.

The manufacturer shall have to give fifteen-year warranty of all items against manufacturing defect from the date of Supply.

The manufacturer shall have to give design life certificate for 25 years for poles.

If no exceptions to this specification is taken and no list of deviations is submitted, it shall be deemed that, in every respect, steel pole offered shall conform to this Specification. GIDC interpretation of this Specification shall be accepted.

SUBMITTALS: -

In addition to documentations specified as above , the following shall be submitted by the vendor/manufacturer:

Design information and drawings to be supplied with the proposals:

- a) Detailed drawings of steel pole showing the complete dimensions identification marks, number and location of pre-drilled bolt holes, details of pole top cap, bearing plate, hole plastic plug, earthing nut and marking plate.
- b) Detailed drawing/procedure for bundling of poles.
- c) Details of anti-corrosion coating

Submittals required following award of contract:

- a. Drawings for final GIDC approval shall be submitted prior to start of manufacturing. Supplier shall furnish all final drawings in original or Mylar tracings as well as on digital format.
- b. Manufacturing schedule, progress report and test schedules.
- c. Test reports including, but not limited to, the following:

- Certified mill test reports for all material.
- Certified welding reports.
- Impact property test reports showing that the materials used in the structures meet the impact properties.
 - Test reports on coating thickness, nuts & bolts and reports on dimensional checks.
 - Report of all structure testing, when required, including photos, diagrams, loading trees, etc.

Requirement from Pole Manufacturer: -

1. The Bidder should purchase pole from original manufacturer or their sole selling agents / authorized distributors / authorized dealer with specific authorization. – Authority Letter.
2. Detailed technical literature/catalogue shall be submitted along with the tender.
3. The Pole manufacturer should be in the business of Pole for at least last 5 years. Copies of order to be submitted as a proof for the same.
4. Valid IS license from Manufacture give the proof.
5. The manufacturer shall have to give design life certificate for 25 years for poles.
6. The pole manufacturing & galvanizing facility/ unit shall be ISO 9001: 2000, ISO 14001 & 18001 OSHAS certified to ensure consistent quality & environmental protection.

Testing :-

The manufacturing unit shall have in-house pole testing facility for validation of structural design data. The pole testing facility shall conform to ASTM A239/BS EN 40-3-2-2000 part 3-2.

The manufacturer of poles shall have the following in house facilities:

- (i) Galvanizing of poles shall be done in house.
- (ii) All relevant testing facilities to check the poles.
 - a) Ultrasonic weld Testing.
 - b) Magnetic Particle testing for weld.
 - c) Galva Micron Testing.
 - d) Dimensional Testing of product.
 - e) Weight Measurement equipment.

Note:

1. All the materials supplied shall have manufacturer's test certificate.
2. Bidder shall have to mention the make of the materials to be supplied.
3. Technical specifications with manufacturer's literature shall be attached along with technical bid. – Drawing to be given.
4. The specifications mentioned above are minimum requirements of the Owner; bidder can quote for higher specification for better performance & life span.
5. Material testing/Inspection charges of shall be borne by the supplier/Bidder, if any testing will be asked by the Owner.

Make: - As per approved vendor list.

Item No-36 Providing and fixing of heavy duty Double Compression type Brass Cable Gland with rubber ring suitable for 2 x 4.0 Core x 10 Sq. MM PVC Insulated Alu. Armoured cable complete with outgoing tails, insulating taps etc. - (2 Nos. Glands Per Sintex Box on St. Light Pole)

Make: - As per approved vendor list.

Item No-37 Providing and fixing of Solderless Crimping Type Aluminium Lugs (4 Nos. per termination) conforming to IS suitable for 1 x 4.0 Core x 10 Sq. MM PVC Insulated Aluminium Armoured cable tail complete erected with insulating materials for each termination. evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. - (2 Nos. Termination Per St. Light Pole)

Make: - As per approved vendor list.

Item No-38 Providing & erecting 240 V MCB double pole switch for lighting Load (B Curve) having 10 KA breaking capacity & confirms to IS : 8828 in existing box having following capacity.(A) 6 to 32 Amp. Cat.III - (1 No. Per St. Lght Pole)

Make: - As per approved vendor list.

Item No-39 Providing and erecting Funnel Pipe type earthing having 150 cms.long and 2.5 cms. dia. galvanised iron pipe with coupling and buch buried in specially prepared earth pit complete with necessary 8 SWG earth wire and required size HOT deep Galvanised iron strip for earthing of Street light pole using proper clamp with using salt and charcoal / coke as required for pipe type earthing. (1 Job Per St. Light Pole)**Make: -** As per approved vendor list.

Make: - As per approved vendor list.

Item No-40 Providing and erecting Street Light pole bracket comprising main B Class MS pipe of 4.2 cm/require outside dia. complete with suitable B Class M.S. sleeve tubing of approx. 45cms.length and suitable for 76.5 mm /80mm / required size of pole top having sufficient fasteners for fixing the brackets and having spread of 1.0.mtr. length with 100 deg.with vertical plane (Boom angle should be 10 Degree) & suitable welded stays, reducer and with check nuts complete painted with one coat of Red oxide / PU base primer and two coats of Aluminium / PU paint. paint with following nos of arms. SINGLE Arm Bracket 1.0 mtr

Make: - As per approved vendor list.

Item No-41 Supplying and erecting 60 Watt LED street light fittings with High power White LEDs wattage of 1 Watt and above assembled on single MCPCB, efficiency more than 130 lm/w and corrosion free High pressure die cast aluminum housing with smooth finish powder coated and heat sink extruded aluminium with diffuser and Polycarbonate optics/ lenses with company mark/name engraved or embossed 120 to 300 V,Power Factor more than 0.95, THD < 10 %, CCT 5000 K to 5700K, Uniformity ratio >0.45, Luminaire efficiency> 85 lumens/watt . LED driver efficiency > 85 %. CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/ LG/BridgeLux (U.S.A.) make LED used for luminaire. (Each fittings required LM-79 & LM-80 certificates) -(Cat- III)

Work shall be carried out as per the description of the item and as per instruction of engineer in charge.

The sample shall be got approved before execution.

This specification is for technical and general requirements design, development, manufacturing, testing and S.I.T.C. of energy efficient LED luminaire complete with all accessories, LED lamps with suitable current control driver circuit and required optics including mounting arrangement for streetlight going to use at the site.

CODES & STANDARDS: -

- IS: 513 Cold-rolled low carbon steel sheets and strips
- IEC 60529 Classification of degree of protections provided by enclosures (IP Codes)

- EN 55015, CISPR15 Limits and methods of measurement of radio disturbance characteristic of electrical lighting and similar equipment.
- IEC 62031 LED modules for general lighting-Safety requirements
- The luminaries shall conform to norms on transient voltages, voltage dips and fluctuations as per EN 61547 Equipment for general lighting purposes–EMC immunity requirement
- EN 60929 Performance, AC supplied electronics ballast for tubular fluorescent lamps performance requirement.
- IEC 60598-2-1 Fixed general purpose luminaries
- IEC 60598-1 Luminaries - General requirement and tests
- IEC 61000-3-2 Electro Magnetic compatibility (EMC) - Limits for Harmonic current emission – (equipment input current ≤ 16 A per phase).
- IEC 60068-2-38 Environmental Testing: Test Z- AD: composite temperature/ humidity cyclic test
- IEC 61347-2-13 Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules.
- IS 10322 Specification for the luminaries
- The luminaries shall comply with IS 10322 for functional, photometric and safety requirements. The fixture shall conform to safety standard EN 60598.
- IS 4905 Method for random sampling.
- LM 79 LED luminaire photometry measurement.
- LM 80 Lumen Maintenance
- IEC62384 DC or AC supplied electronic control gear for LED modules performance requirements
- IEC/ PAS 62612 Self-ballasted LED lamps for general lighting services- Performance requirements.
- IEC 62471 - Photo-biological safety of lamps and lamp systems.
- RoHS (Reduction of Hazardous Substances).
- The luminaries fitted with LED source shall be CE and ISO certified to ensure quality of the LED source.
- ANSI C.78.377.2008 - Specifications for the Chromaticity of Solid State Lighting Products.
- IESNA LM- 79-08 - IESNA Approved Method for the Electrical and Photometric. Measurements of Solid State Lighting Products.
- IESNA LM-80-08 (Recommended)- IESNA Approved Method for Measuring Lumen Maintenance of LED Lighting Sources.
- UL Standards (Latest Approved) –
 - 8750 Light Emitting Diode (LED) Light Sources for use in Lighting Products.
 - 1598 Luminaries.
 - 1012 Power Units other than Class-2
 - 1310 Class-2 Power Units
 - 2108 Low Voltage Lighting Systems.

ENVIRONMENTAL CONDITIONS: -

The LED streetlight is to be used at the in city of Tarabh GIDC Area. It is located in part of Gujarat.

It is well connected with rails & roads, situated on all type roads, Railway and nearby road is NH 48c. The average atmosphere conditions during the year are mentioned below. The equipment shall be designed to work in such environmental conditions:

- Maximum ambient air temperature: 50° C
- Minimum ambient air temperature: 5° C
- Max. Relative humidity: 70%
- Average Rainfall: 30 inches
- Atmosphere: Clean and Sunny at times in certain areas.

CONSTRUCTIONAL FEATURES:

General:

Luminaire shall be made of die cast aluminum / extruded Alunimiam body with powder coated finish having safety.

The casing of the lighting luminaries shall be made of pressure die cast aluminium coated with epoxy polyester powder coat single. The driver unit must be accessible and if need be replaceable easily and with minimum use of tools.

The casing made of non-corrosive aluminium having high conductivity shall have external surface designed in a manner so as to act as an efficient heat sink to extract heat generated at PN-junction of a LED. Efforts shall be made to install the fittings on the required street light pole without compromising on the performance of the LEDs or luminary.

The Fixture manufacturer shall perform solder point temperature (Tsp) measurement and compute junction temperature (Tj). The manufacturer shall show the proof that the junction temperature shall not go beyond the LED manufacturer's maximum junction temperature for long term lumen maintenance (i.e., 70% of the original value of lumen output after 50000 hours of operation).

Lumen intensity distribution shall be available according to following standard: EN 13032-1, EN 13032-2 and EN 15193.

The lumen output at end of lifetime shall be supplied as well as initial lumen output, with temperature at which the lumens are rated.

Test result shall be provided to indicate adequate thermal performance for the long term operation of the LED's at an operating temperature (Ta) of not less than 35°C in accordance to relevant local or international standards. The LED junction temperature shall be maintained at or below manufacturer's recommendation.

The rated LED life L70/B20 shall be more than 50,000 hours at LED operating at (Ta) 35°C.

The fixture manufacturer shall furnish proof that the LEDs that have been offered and used in the fixture have White Point stability data ((Min. 10000 Hours) as per IESNA's LM80-08, done at high ambient temperature 85°C and solder point temperature of 85°C.

The fixture manufacturer shall furnish proof that the LEDs that have been offered and used in the fixture have been tested to IEC 62471 for safety requirements.

Heat sink used should be aluminum extrusion having high conductivity. Heat sink should be integrated within luminaire and efforts shall be made to keep the overall outer dimensions optimum such that it permits sufficient heat dissipation through the body itself so as to prevent abnormal temperature inside the luminaire and consequential damage to cover, gasket material, LEDs, lenses and drivers.

The luminary shall be provided with a built-in external heat sink as well as an aluminium MCPCB printed circuit board, designed in such a way that the heat generated within the LED source is efficiently dissipated to the surrounding atmosphere without abnormal rise in temperature. Any debris build up shall not degrade heat dissipation performance of the luminaries. A lighting luminaire fitted with an assisted cooling system is not acceptable.

LED must be mounted on Metal core PCB with suitable large area surface by means of fins to dissipate the conduct heat. The fins must be exposed to ambient flowing air.

The assembly and manufacturing process for the LED source assembly in modules/arrays shall be designed to assure all internal components are adequately supported to withstand sudden impacts and mechanical shock and vibration from high winds and other sources.

All luminaries shall be provided with toughened glass of min. 0.8 mm thickness of sufficient strength. UV stabilized Poly carbonate material is also acceptable. High efficiency prismatic diffuser/Lens under the LED chamber to protect the LED and luminaries shall be provided.

No part shall be constructed of polycarbonate unless it is UV stabilized.

Material used for the lens of LED source shall be of toughened glass, heat resistant and shall not undergo discoloration during lifetime of the LED source. It shall conform to ASTM specifications for the materials. Any discoloration observed in the lens shall be considered a failure under warranty clause.

All luminaries shall be provided with acrylic / polycarbonate / glass diffusers and/or aluminized reflectors and/or lenses to provide proper road lighting distribution.

Toughened and/or tempered glass of sufficient strength may be provided under the LED chamber to protect the LEDs and luminaries.

The LED lens shall be UV stabilized and shall be capable of withstanding ultraviolet (direct sunlight) exposure for a minimum period of 60 months without exhibiting evidence of deterioration.

The finish of the fixture shall be powder coated and of grey colour.

The luminaire shall provide efficient uniform illumination.

The luminaire shall be assembled without any glue so that it is fully recyclable and environmentally friendly. Final assembly of the luminaire shall be done by manufacturer in an ISO-14001 certified factory.

The luminaries shall be capable of operating normally in ambient temperatures from -20°C to 50°C maintaining junction temperature below 100°C and heat sink temperature below 60°C, ensuring efficient thermal management of the luminaire.

The manufacturers shall ensure that the fixture is designed in such a manner that it conducts the heat away from the LEDs as efficiently as possible. The design shall ensure that the junction temperature is kept as low as possible during operation. Thermal management shall be in such a way that Luminary shall have trouble free operations from -20 °C to +50°C. The following tests shall be done to determine efficient thermal Management.

The minimum IK protection of optic cover shall be IK 08. The test material certificate shall be provided.

The fixture shall be designed in such a manner that it is easy to handle and install, is not too large and unwieldy, is of robust construction, light weight and conforms to minimum IP66 class of protection for outdoor use. Luminary's manufacturer should submit IP test report from Govt. Accredited Test Lab / R&D Labs.

Suitable number of LED lamps shall be used in the luminaires. The manufacturer shall submit the proof of procurement of LEDs from OEMs at the time of testing.

Suitable reflector/ lenses may also be provided to increase the illumination uniformity and distribution.

The electrical component of the LED and LED driver must be suitably enclosed in hermetically sealed unit.

The connecting wires used inside the luminaire, shall be low smoke halogen free, fire retardant-beam cable and fuse protection shall be provided in input side.

The material used in the construction of driver printed boards; driver enclosure etc. shall be non-flammable and heat resistant. Also, all the PCBs in the system shall be coated to prevent any corrosion.

Design of the thermal management shall be done in such a way that it shall not affect the properties of the diffuser.

The equipment should be compliant to IEC 60598-1, IEC 62031 and IEC/PAS 62612 depending on the type of luminary.

The LED Module(s), Driver gear, etc. shall be designed in such a way so that temperature of heat sink shall not exceed 70° C.

The driver module on board circuitry shall include voltage surge protection to withstand High-repetition noise transients as stated in Section 2.1.6 of NEMA Standard TS-2/ 1992.

The Entire LED lamps should be driven by minimum 2 or more numbers of the driver circuits. The entire power supply to the LED Lamps should be divided among the drivers, thus each driver controlling a group of LED lamps if required for Higher wattage of LED Fitting.

All the material used in the luminaire shall be halogen free and fire retardant confirming to standard.

The LED fitted lighting fittings shall operate at 50 Hz +/- 5 % Hz AC over a voltage Ranging from 100V to 300V with a power factor > 0.95 in a 3-wire distribution system. The total power consumption in the LED lighting fixture shall not exceed the total guaranteed power consumption including power consumption in the electronic circuit of the driver for that particular application over the entire voltage range given in clause. Driver output DC Voltage shall be less than 60V DC complying to safety extra low voltage compliance.

Low voltage compliance:-

The fluctuations in line voltage shall have no visible effect on luminous intensity of the LED luminaries. The operating voltage of the luminaries shall be 230V. All parameters measured at this voltage shall stand valid for the entire operating voltage range of 100- 300V.

Total harmonic distortion (THD) of current and voltage induced into the AC power supply by an LED lighting source shall not exceed 15% for current and 5% for voltage. Harmonic Generation shall be as per EN61000-3-2 and EN61000-3-3 / IEEE 519.

The lighting luminaries shall withstand the following tests.

- a. HV test of 10 KV
- b. IR test of 500V
- c. Product shall cut off its supply when voltage exceeds 300V and regains its normal working @ 230vac

The output circuit shall have short circuit and open circuit protection inbuilt to the driver unit.

The infrastructure for Quality Assurance facilities to verify/ test/ prove above specifications must be available at the manufacturing facility. The compliance shall be indicated clearly in the tender itself.

All fasteners must be of stainless steel.

All glands inside/ outside luminaire must be metallic

Heat sink must be thermally connected to MCPCB/ LED light source.

High power and high lumen efficient LEDs suitable for following features shall be used:-

The LEDs shall be of reputed make such as CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/ Bridge Lux (U.S.A.).

LED module/ array shall deliver at least 70 % of initial lumens, when installed for a minimum of 50,000 hours

The rated LED life L70/B20 shall be more than 50,000 hours at LED operating at (Ta) 35°C.

The working life of the lamp at junction temperature of 85° C (max) at operating current shall be more than 50,000 working hours of accumulative operation and shall be suitable for continuous operation of 24 hours per day. These features shall be supported with datasheet.

To enhance the secondary optics of the fixture, suitable Acrylic Optical Lenses shall be used.

The Correlated Color Temperature (CCT) of the LED fixture shall be in the range of 5700±300K °K.

The luminaries shall ensure a CRI of minimum 80.

The Uniformity Ratio (E_{min} / E_{avg}) shall be minimum of 40%.

The LED luminaries shall produce constant lux level in the voltage range of 100V to 3000V. Voltage variations/ fluctuations in the specified voltage range shall not impinge upon the lux level it produces.

The life span of the LED source including its Driver shall be minimum or greater than 50000 hours.

The P/N junction temperature of individual LED must not exceed 100°C. High Thermal conduction must be achieved by use of silicon heat conductive greases and adhesive.

LED Light must be constructed to achieve the average illumination of LUX as required by PART 8 : ROAD LIGHTING as per National Lightng Code SP 72 : 2010 with Latest Amendments OR latest edition of CIE 136 (International Commission on Illumination) and all applicable Codes, Regulations, Standards, and relevant Authorities or better without glare at the ground level/ working level for the all the Utility Plants roads with the Uniformity Ratio (E_{min} / E_{avg}) of minimum of 40% and tranverse ratio (E_{min}/E_{max}) of 0.4 as per relevant to the employers requirement.

All fasteners must be of stainless steel and rust free.

LED must be mounted on heat sinking conductive bars if any with suitable large area surface by means of fins to dissipate the conducted heat. The fins must be exposed to ambient flowing air.

Heat sink used should be aluminium extrusion / high pressure die cast aluminium having high conductivity. Heat sink should be integrated within luminaire and efforts shall be made to keep the overall outer dimensions optimum such that it permits sufficient heat dissipation through the body itself so as to prevent abnormal temperature inside the luminaire and consequential damage to cover, gasket material, LEDs, lenses and drivers.

The electrical component of the LED and LED driver must be suitably enclosed in hermetically sealed unit.

In addition, LEDs should be PWM dimmable control with future provision for power line communication modem or other standard communication system which shall be able to communicate with electronic drivers or similar type of lighting controllers and operate without generating excessive heat. All the LEDs should be “on” while dimming.

The luminary should be provided with in-built power unit & electronic driver. The luminary should be so constructed to ensure that the drivers shall be of modular type that can be easily replaceable, if required.

The luminaries shall conform to IEC 60598 or equivalent standard. The driver should comply with IEC 61347-2-13, IEC 61547, CISPR-15; and 61000-3-2. The supplier should submit luminary test report conforming to the specified standards.

Light Distribution shall be of Cut Off/ Semi Cut Off type. xix. Each lighting fixture shall be provided with an earthing terminal suitable for connecting 2.5 sq. mm (1 core of the 3Cx2.5 sq. mm copper-PVC cable to be used) copper stranded conductor.

Applicable standards:

The standards and code of practices referred to below shall be the latest editions including all official amendments and revisions.

General safety requirements: IS 1913 - for luminaries

Luminaries for street lighting: IS 10322 - electric cables

Current waveform for the LED drivers should meet relevant national and international standard. xxii. Electronic components IC (Integrated circuit) shall be of industrial grade or above.

Metallic film/ Paper/ Polyester Capacitor shall be rated for a sustained operating temperature of 105° C.

The construction of PCBs and the assembly for components for PCBs should be as per IS standards.

Adequate heat sink with proper thermal management shall be provided.

Lumen maintenance report as per LM 80 guidelines shall be produced for the power LEDs used.

Thermal management shall be in such a way that LED soldering point temperature shall not go beyond 75° C.

The LED luminaries shall be free of glare.

LED DRIVER specification used for streetlight:-

Current waveform should meet relevant nation and international standard.

LED Driver shall withstand voltage of 440 V for 1 minute and restore normal working when normal voltage is applied.

The life of the driver should match life of LED luminaire.

Maximum Temperature rise $\leq 30^{\circ}\text{C}$ @ 45°C Tamb. with safety margin of 10°C .

The driver should comply to CISPR 15 for limits and methods of measurement of Radio Disturbance characteristics

The equipment should comply to IEC 61547 for EMC immunity requirements

The control gear should be compliant to IEC 61347-2-13, IEC 62031 and IEC 62384 as per the requirements.

The driver of the luminaires should have Short Circuit, Over Voltage, Over current, Over temperature, Under Voltage, String Open protections.

The driver should be supplied with PWM based dimmable controller.

The electronic components used shall be as follows:-

IC (Integrated circuit) shall be of industrial grade or above.

Metallic film/ Paper/ Polyester Capacitor shall be rated for a sustained operating temperature of 105° C.

The resistors shall be preferably made of metal film of adequate rating. The actual rating versus loading shall be by a factor of 3.

The junction temperature of the Switching devices such as transistors and MOSFETs etc. shall not exceed 125° C (allowing thermal margin of 25° C).

The protective cum adhesive coating used on PCBs should be cleared and transparent and should not affect colour code of electronic components or the product code of the company.

The construction of PCBs and the assembly for components for PCBs should be as per IS standards.

POWER (PRICE) LOADING: -

Power (Price) loading shall be calculated based on followings: -

Rated power input of LED streetlight luminaire shall be guaranteed performance figure. Luminaries shall be designed according to “Fixed” parameters mentioned elsewhere in the tender to achieve Guaranteed Rated Input Power.

PENALTY:-

1. If guaranteed rated power input at fixed parameter is not achieved during the test at site. Corporation shall have (1) the right to accept the luminaires & shall have right to charge penalty for that or (2) also right to reject the luminaires.

2. It should be very clearly noted that performance parameter i.e. guaranteed rated power input must be achieved according to the fixed parameters. No allowance shall be permitted to alter fixed parameters. No relaxation in this regard is permitted.

Particulars and Details to be submitted by the bidder:

In order to properly assess and due diligence on submissions, the Bidder should provide following information on the quality and photometric of proposed luminaries.

1. General Description

Following details of the proposed luminaire shall be submitted as per Annexure: D

2. Electrical specifications

Electrical ratings of the proposed luminaire product shall be submitted in Annexure: D.

3. LED chip and driver information

LED chip and driver information of the proposed luminaire product shall be submitted in Annexure: D.

1. Photometric information to be submitted as per Annexure: D.

2. Design:-

Dialux design should be submitted of the product to be Given.

IES Files of the design also to be submitted for the verification.

Latest LM79 max 2 months old to be submitted.

TESTS & CERTIFICATES:-

i. Design Qualification Testing shall be performed by the manufacturer or an independent testing lab hired by the manufacturer on new LED module/ array designs and when a major change has been implemented on an existing design.

ii. The bidder shall submit manufacturer's test certificates complete with verification of Design Qualification Testing details by an independent testing authority.

iii. The Luminaire manufacturer must show proof that the LEDs they use have been tested and approved to IESNA's LM80. The manufacturer must be able to provide the test data set to establish the authenticity and genuineness of the LEDs.

iv. Tests conducted on LED luminaires are classified as:

a) Type test,

b) Acceptance test,

c) Routine test and

d) Mock-up test.

Type Test: -

Type test certificates for both the luminaires shall be provided with the technical-bid.

These Test shall be carried out to prove confirmation with the requirements of specification and general quality/ design features of the unit. In case of any change in Bill of Material or design of unit, complete type test shall be repeated. If any sample fails in any of the type tests, fresh samples shall be taken and tested. If any sample again fails in that test, the whole lot shall be rejected. The selected fixtures from the lot shall be type tested from the ERDA/CPRI/UL.

Acceptance Tests: -

These tests are carried out by an inspecting authority at the supplier's premises on sample taken from a lot for the purpose of acceptance of a lot. Acceptance tests shall not be carried out from particular size from the lot on which type tests have already been conducted. Recommended sampling plan is given below.

Routine Tests:

These tests shall be performed by the manufacturer on each complete unit of the same type and the results shall be submitted to the inspecting agency, prior to offering the lot for acceptance test. The firm shall maintain the records with traceability.

Mock up Test:

The successful bidder shall provide proposed LED lamp and luminaries on three consecutive poles as demonstration to prove the suitability of the fittings matching with the requirement in regards to lux level, quality of illumination for professional, objective & impartial review jointly by the bidders team along with team of GIDC Engineers. This shall be carried prior to submission of detail design for approval.

Sample size and criteria for conformity:

The luminaries shall be selected from the lot at random. In order to ensure randomness of selection, procedures given in IS 4905-1968 (Reaffirmed 2001) may be followed.

Sr. No.	Description of test	Prototype Test	Type Test	Acceptance Test	Routine Test
1	Visual and Dimensional check	Y	Y	Y	Y
2	Checking of documents of purchase of LED	Y	Y	Y	Y
3	Resistance to humidity	Y	Y	--	--
4	Insulation resistance test	Y	Y	Y	Y
5	HV test	Y	Y	Y	Y
6	Over voltage protection	Y	Y	Y	--
7	Surge protection	Y	Y	Y	--
8	Reverse polarity	Y	Y	Y	Y
9	Temperature rise Test	Y	Y	--	--
10	Ra(Colour Rendering Index) measurement test	Y	Y	--	--
11	Lux measurement	Y	Y	Y	Y
12	Fire retardant Test	Y	Y	--	--

13	Test for IP 67 protection	Y	Y	Y	--
14	Environmental tests	Y	--	--	--
15	Reliability Test	Y	--	--	--
16	Life Test	Y	Y	--	--
17	Endurance Test	Y	--	--	--
18	LM-79	Y	Y	Y	Y

Method of Testing: -

Visual and Dimensional Check:

The unit shall be checked visually for all dimensions as per approved design and drawing.

General workmanship should be good; all the components properly secured and sharp edges shall be rounded off. Check the marking and quality of the workmanship visually. Check the rating and make of electronic/ electrical items.

Checking of documents of purchase of LED

Check Document of purchase of LED lamps of approved sources viz. CREE/OSRAM/PHILIPS Lumileds/NICHIA/SEOUL/BRIDGELUX (USA) make LED used for luminaire.

Resistance to humidity test

This is carried out by suspending the painted panels in corrosion chamber maintained at 100% RH and temperature cycle of 42 to 48° C for 7 days and examining it for any sign of deterioration and corrosion of metal surface.

Insulation resistance test

The insulation resistance of the unit between earth and current carrying parts shorted together shall not be less than 2 MΩ when measured with 500 V megger.

HV test

Immediately after insulation resistance test, an AC voltage of 1.72 KV rms (1500 + 2 x rated voltage) of sine wave form of 50 Hz shall be applied for one minute between the live parts and frame. There shall not be any kind of break down, flashover or tripping of supply.

Over voltage protection

The LED Driver Shall be cut off once voltage exceeds 310V +/- 10 VAC. It shall be reconnected when supply comes within limit.

Surge protection

It shall withstand a surge of 10 kV at the input terminals for all types.

Reverse polarity

The Luminaire shall withstand polarity reversal. It shall be operated with reverse voltage for 5 minutes at maximum value of voltage range. At the end of this period, the supply shall be made correct polarity and Luminaire shall operate in a normal way.

Temperature rise Test:

Temperature rise Test shall be conducted at 100 V ~ with full load. The temperature rise shall be recorded by temperature detectors mounted at the specified reference points on the body of semiconductors, capacitors and other components as agreed between purchaser and manufacturer. The maximum-recorded temperature under worst conditions shall be corrected to 55° C and compared with maximum permissible temperature (for power devices at junction). Under loading conditions as specified above, the corrected temperature of the power devices shall have a safety margin of minimum 10°C. Temperature at junction shall not exceed 100° C when corrected to 55° C. The Luminaire shall also be subjected for short time rating after continuous loading to ensure the temperature rise is within the permissible limit. The maximum temperature rise of the electronics devices on the PCBs shall be in limit for industrial grade components suitable for 85° C environment. In case of exceeding limit, use of MIL-grade component shall be considered keeping RDSO informed.

Ra (Colour Rendering Index) measurement test:

The lumen is the unit of luminous flux, which is equal to the flux emitted in a solid angle of one steradian by a uniform point source of one candela.

The initial reading of the chromaticity co-ordinates x & y shall be within 5 SDCM (Standards Deviation for Colour matching) from the standardised rated value as per Annex: D of IEC 60081- 1997.

The initial reading of the general colour-rendering index (Ra) shall not be less than the rated value decreased by 3.

The lumen maintenance of the lamp shall not be less than 80% of the initial lumen after 20,000 burning hours and 70% of the initial lumen after 50,000 hours. The initial lumen will be taken after 100 hours aging.

Photometric test shall be conducted as per Annexure: B of IEC 60081-97.

The lumen maintenance test shall be done as per Annexure: C of IEC 60081-97.

Fire retardant Test:

Fire Retardant test shall be conducted as per IEC 60332-1 of the wire used in the luminaires.

Test for IP 67 protection:

This test shall be conducted as per IEC 60529.

Environmental tests (Prototype Test) :

The Luminaire shall meet the following tests as prescribed in IEC-60571.

- (i) Dry heat test.
- (ii) Damp heat test
- (iii) Test in corrosive atmosphere
- (iv) Combined dust, humidity and heat test

Reliability Test:

The reliability can only be determined in actual service. However, the following tests shall be carried out on the prototype to simulate as close as possible, the service conditions.

There shall be no failure during this test.

The light unit shall be mounted in an oven maintained at 45° C.

- (ii) The light will be operated at the specified maximum voltage and at 45° C for a period of 100 hours.

Photometry Test: -

The test shall be carried out for Total Luminous Flux, Luminous Intensity Distribution, Electrical Power, Luminous Efficacy (calculation), Color Characteristics- Chromaticity, CCT & CRI etc. as per IES LM 79.

The following tests and measurements shall be conducted to verify the LED photometric data:

- (a) Iso lux Diagram;
- (b) Coefficient of Utilisation curves;
- (c) Polar Lighting Distribution Diagrams.

Manufacturer shall be having full glass photogonio meter in their own facility. LM79 should be witnessed by GIDC Engineer.

Life Test

The lumen maintenance & life test shall be done as per IES LM 80 for LEDs.

Endurance Test

The Luminaire shall be kept “ON” with input voltage of 250 V ~ for 200 hours. After this the Luminaire is subjected to 20,000 cycles of “ON” and “OFF”, each cycle consisting of 3 seconds “ON” and 10 seconds “OFF” period. Luminaire should survive this test. Test is to be continued for 20,000 cycles, followed by performance test.

The luminaire should be tested as per IEC 60598-2-3: 2002 standards and following test reports should be submitted: -

- (i) Heat Resistance Test
- (ii) Thermal Test

- (iii) Ingress Protection Test
- (iv) Drop Test
- (v) Electrical/ Insulation Resistance Test,
- (vi) Endurance Test,
- (vii) Humidity Test,
- (viii) Electrical and Photometric Measurements Test Report (IES LM 79)
- (ix) LED Lumen Maintenance Test Report (IES LM 80)
- (x) Vibration test as per ANSI.

Note :- 100% lot for the given streetlight order will have to manufactured, 2 random samples will be selected by GIDC officials from the whole lot. Testing to be done at ERDA/UL/HYPHYSIS/NABL. If testing fails, whole lot gets rejected.

Safety:

The Luminaire shall comply with the safety requirements as per IEC 61195.

All Tests defined for acceptance other than LM 79 and LM 80 are allowed to carry out at Manufacturer works. The offered LED streetlight luminaires must have passed IES LM 79, IES LM 80 from UL/ ERTL laboratory only and attested copies of the test certificates must be attached.

IES file of the tested product will be compared with the design submitted after order and both should match.

One (1) copy of all test certificates and reports certified by accredited laboratories shall be furnished to GIDC.

INFRINGEMENT OF PATENT RIGHTS

GIDC shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of the components, used in design, development and manufacturing of these light luminaires and any other factor which may cause such dispute. The responsibility to settle any issue rises with the manufacturer.

MARKING:

The following information shall be distinctly and indelibly engraved on the housing:

Client's name – GIDC – Vapi GIDC Notified Area

Year of manufacture

Batch Number

Serial Number

Name of Manufacturer (Engraving only, stickers not allowed)

Rated wattage and voltage (input)

LED Make

Input frequency

Marking Like CE, CB.

GUARANTEED TERMS & CONDITIONS: -

In addition to meeting the performance requirements for the minimum period of 60 months, the manufacturer shall provide a written comprehensive guarantee against defects in materials and workmanship for the modules/ arrays for a period of 60 months after acceptance of the modules/ arrays. Replacement modules shall be provided promptly after receipt of modules that have failed at no cost to the Owner.

The bidder shall stand guarantee for full replacement of the luminary due to any failure in 5 years, from the date of purchase. Failures shall include failure/ deterioration of LEDs in terms of performance like guaranteed luminous efficiency, high junction temperature, and abnormal lamp lumen depreciation, deterioration in LED including its lens, driver unit and quality of light. The vendor shall replace the entire LED module/ array of the defective luminaire with new module /array free of cost immediately.

In the event of single LED source getting defective, the entire array/ module shall be replaced by the bidder by the new fittings.

The bidder shall stand guarantee against lumen depreciation beyond 20%. Vendor shall ensure that LED module/ array shall deliver at least 70% of initial lumens, when installed for a minimum of 50,000 hours, failing which bidder shall carry out necessary rectification free of cost to the entire satisfaction of GIDC.

The bidder shall maintain appropriate level of inventory in India for immediate replacement of a defective/ malfunctioning luminary/ LED module/ array/ driver etc.

WARRENTY: -

Bidder shall have to offer the following minimum warranty:

The LED Light Fixture supplier / manufacturer shall provide a warranty against all defective materials and workmanship up to five (5) years after the date of Completion of the Works certified by GIDC.

The Deed of extended warranty shall be submitted upon the acceptance of the LED Light Fixture.

Provide a five year on-site replacement warranty covering warranty covering material fixture finish and workmanship. To in clued transportation, removal, and installation of new products.

Provide five year replacement warranty for defective or non starting LED source assemblies and all drivers

Provide a five year warranty for luminaries exhibiting inadequate lumen maintenance at the end of the warranty period in compliance with the following table :

L 70 lifetime claim	Min.Lumen maint @ 5 Year
30,000 Hours	92.50%

A	50,000 Hours	85.50%
	1,00,000 hours	80.00%

Luminaire dirt depreciation (LDD) factor may be included in the above calculation, such a value be determined by mutual agreement between GIDC and the manufacturer, consistent with local ambient environmental conditions and practice

A luminaries dirt depreciation (LDD) factor may be included in the above calculation, such a value be determined by mutual agreement between GIDC and the manufacturer, consistent with local ambient environmental conditions and practice

A monitoring programme to implement above will be determined by mutual agreement between GIDC and the Bidder. The Costs of the monitoring programme over the five year warranty period will be borne by the bidder, unless agreed otherwise by GIDC and the Bidder.

The warranty shall cover all LED light sources (Packages or modules/arrays) including but not limited to the LED die, enclosure, and phosphor if the expected life of the luminaire system is not maintained net of LDD, the bidder shall replace the light source(s) and /or luminaries as needed.

Photometric information

The proponent needs to submit the following photometric

1. Photometric modeling results, preferably within a LM79 report, from an independent accredited laboratory showing generic candlepower traces and isocandela plots for the proposed luminaries' product.
2. Photometric information data and diagrams that model the luminance flux distribution of the proposed luminaire referencing the site characteristics given in above. The proponent should consider the following during the modeling exercise
3. Such modeling should verify that the products proposed luminaire will meet Indian Roadway lighting standard IS 1944, which specifies average luminance (E_{avg}) and uniformity (E_{min}/E_{avg}) for roads at the above sites.
4. Use industry accepted, standardized software like Dialux for the above modeling while modeling, a maintenance factor of 0.8 should be used
5. Note the proponent needs to submit a soft copy of the IES file of the proposed luminaire along with the bid Lumen maintenance statement
1. The proponent must submit a lumen maintenance statement that estimates how many operating hours can be expected from the proposed luminaire product until its light output declines to 70% of its initial output (L70) given the specific climatic character, including extremes of temperature and high humidity, associated with the than local condition.

2. The lumen maintenance statement should also clearly explain that how or what method was used to determine the rated life time
3. Describe in details the thermal management how th physical and thermal design of the luminaire will prevent the LED chips from overheating on extremely hot days
4. Other trials of pilot projects submit information and contacts for other relevant trials in which the proponent's proposed luminaire product or similar products sold by the agency have been tested in the field
5. Such information should include LM80 report for the LED chip package employed in the product illuminance measurements, if available, taken over a minimum of two years of operation fromm pilot project the proposed luminaire product, or a similar luminaire product, in the field

Luminaire specification – others

The provide information and certifications

- 1 Requirements, Tests, and Certifications specified in IS 10322
- 2 Specifications such as ISI and CII
- 3 Specifications IP 66

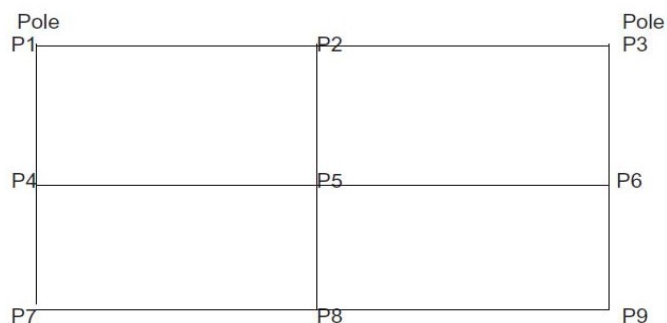
Note: Tenderer must have to submit following information regarding the LED manufacturer compulsory.

1. Since how many years the LED manufactures have manufacture same type LED Fixtures?
2. In last 5 years how many nos. Same type LED Fixture supplied in Govt., Semi Govt. And Corporates by the LED manufactures.
3. Annual turn over of the LED manufactures of the last 5 years with all supporting documents with and without LED Fixtures.

MEASURMENT OF WORK:-

Testing / Sampling of Lower Promenade Lighting: The Sampling should be required for Lighting on all the different stretch of the Lower Promenade. The method for sampling should be as per CIE norms - 1976a (Nine point Method) & the taken results should be reported separately & required to be approved by the relative authorities of the client before further execution of the same stretch. The type of lighting fixtures will be finalized based on the same results along with its aesthetical suitability on the roads. No extra cost shall be paid for the process to the bidder; it is the responsibility of Manufacturer to coordinate with all the required concerns & vendors for sampling & takes the approval of the same from the authorities of client & architects.

9 point method Field Measurements:-



Basics:

- Divides the section between two poles into 4 quadrants of equal size
- Measures the Lux levels at four corners of each quadrant
- Takes the average of each quadrants
- Finds the average of the all the four quadrants

Sr. No	Quadrant	Average of the quadrant
1	Q1	$(P1+P2+P4+P5)/4$
2	Q2	$(P2+P3+P5+P6)/4$
3	Q3	$(P4+P5+P7+P8)/4$
4	Q4	$(P5+P6+P8+P9)/4$
	Average	$(Q1+Q2+Q3+Q4)/4$

Recurrence	Points	Factor
Points taken only once	P1/P3/P7/P9	$(P1+P3+P7+P9)/16$
Points taken twice	P2/P6/P8/P4	$2(P2+P6+P8+P4)/16$
Points taken four times	P5	$4((P5)/16$

$$\text{Average Lux levels} = (((P1+P3+P7+P9) + 2(P2+P6+P8+P4) + 4((P5)) / 16)$$

$$= ((P1+P3+P7+P9)/16 + (P2+P6+P8+P4)/8 + (P5)/4)$$

(Bidder must read carefully and Submit the detail as Required by Annexure – D.)

Particulars and Details to be submitted by the bidder:

In order to properly assess and due diligence on submissions, the Proponent should provide following information on the quality and photometric of proposed luminaries.

LUMINAIRE SELECTION CRITERIA

DESIGN PARAMETERS: -

It is defined as Performance Parameters and Fixed parameters as below: -

PERFORMANCE PARAMETERS: -

All the luminaires shall be finalised based on the performance requirement as below: -

Table # 1

Type of existing luminaire	Rated Wattage of existing luminaire	Rated Input Power of LED luminaire (max.)
-NA -	-NA -	90 W

Table # 2

Sr. No.	Parameter Data/ Details of LED	For luminaire
		60W
1	Mounting Height (Vertical Distance of luminaires from the floor level)	7.0 m (Approx.)
2	Width of the road	4 m
3	Average spacing	25 m
4	Measured Average Illumination Level(Based on the maintenance factor of 0.80)	20 lx or more
5	Tilt Angle (wrt to road surface)	0° to 15°
6	Min. Uniformity Ratio (Emin/ Eavg)	0.4
7	Min Transverse Uniformity Ratio(Emin/ Emax)	0.3
8	Correlated Colour Temperature	4100° K to 6200° K (ANSI Binning)
9	Colour Rendering Index (min.)	80
10	Illumination Regulation	<5% (wrt Ta & LineVoltage

Note: - Above performance parameter and fixed parameters (1, 3 and 4) shall be proved during on Site testing.

Illumination Level:

The detailed calculation with uniform distribution including the lux distribution curve/ graph/spatial distribution shall be submitted in support of the dimensions selected and variation thereof. The luminaire shall be so designed that the illumination level shall be evenly distributed and shall be free from glare.

Design for the GIDC – Estate Road

Sr. No	GIDC- Estate specification requirement		Bidder confirmation	
	Equivalent LED Source (Input Power) Including driver power in Watts	Average Illum. Level reqd. on road carriageway with LED luminaire (Lux)	Equivalent LED Source (Input Power) Including driver power in Watts	Average Illum. Level reqd. on road carriageway with LED luminaire (Lux)
1	90 W	15 or More		
2	120 W	20 or More		

TESTING AND DOCUMENTATION

Performance Characteristic	Methods of Measurement	Required Documentation	Bidder to Confirm
Integral LED Lamp Efficacy: Light Output Input Power	IESNA LM-79-2008 ANSI C82.2-2002	Laboratory test results must be produced using the specific modules/ arrays and power supply combination that will be used in production.	
Power Factor	ANSI C82.77- 2002	Laboratory test results must be produced using the specific modules/ arrays and power supply combination that will be used in production	
Lumen Maintenance (L70) for LEDs	IESNA LM-80-2008	LED manufacturer test results for Minimum 6000 hour lumen maintenance data for the LED packages/arrays/modules used in the integral LED lamp. Lumen maintenance data must meet at least the following conditions: - Collected at LED case or solder point temperature (Ts) equal to or greater than the verified TMP temperature of the integral LED lamp; and- Measured at a forward drive current equal to or greater than the drive current applied to the LEDs in the integral LED lamp.	

Colour Rendering Index	ANSI C78.377-2008 IESNA LM-79-2008 CIE 13.3-1995 IESNA LM-58-94	Laboratory test results must be produced using the specific modules/ arrays and power supply combination that will be used in production	
Chromaticity & Correlated Colour Temperature	ANSI C78.377-2008 IESNA LM-79-2008 CIE 15 : 2004 IESNA LM-58-94 IESNA LM-16-93	Laboratory test results must be produced using the specific modules/ arrays and power supply combination that will be used in production	
Colour Spatial Uniformity and Colour Maintenance	IESNA LM-79-2008 CIE 15 : 2004 IESNA LM-58 IESNA LM-16 IESNA LM-80	Self Certification	
Audible Noise	Class-A sound rating: Power supply not to exceed 24 dB	Self Certification	
Integral LED lamp Warranty		Provide copy of the actual three-year manufacturer warranty included in the packaging	
Safety of LED Lamps	UL 8750	LED manufacturer test results of the safety test report with a general coverage statement.	
Test certificates	ERTL / CPRI/MNRE / NABL Accredited Laboratory	The bidder shall furnish test certificates certifying performance of the integral luminaries' for the tests mentioned as below: a) Insulation resistance test b) HV test c) Over Voltage Protection test d) Surge Protection test e) Reverse polarity test f) Temperature rise test g) Fire Retardant test h) Photometric tests i) IP class test j) Power Consumption	

Make: - As per approved vendor list.

Item No-42 Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kV grade ISI marked copper wires of following size to be erected as directed FR PVC insulated ISI Marked Stranded Copper cable having Conductor 3 Wire 2.5 Sq. MM., 3 core round PVC sheathed in existing pipe/ in street light pole erected with 2.5 Sq. MM. copper conductor FR PVC insulated stranded wire of green colour for earth continuity.

Make: - As per approved vendor list.

Item No-43 Providing, laying, erecting ,testing & commissioning of 1 x 4.0 Core x 10 Sq. MM, XLPE (IS: 7098 (i) - 88), ISI Mark, Armoured, Multistranded, Aluminium Conductor suitable for

1.1 kV grade to be laid at depth 90 Cms under ground or to be laid on wall with necessary clamps or in existing cable trench/ pipe at road crossing or on floor and making the ground as per original. - For Streetlight between two poles & Service Connections..

SCOPE

This section shall cover supply, installation, connection, termination, testing and commissioning of medium voltage cables. The cables shall be installed either underground or on cable tray, or on cable support, or in purpose made built up trench or any other method as indicated in the relevant drawing & as per instruction of Engineer- In-charge.

In this work the cable shall be required for providing power connection to the street light pole.

The copper flexible cable shall be provided for connection from the pole box to the luminaries and it shall be of ISI marked only and approved list of make.

1. CODES AND STANDARDS

1.1 The design, manufacture, testing and supply of the brand new cables under this specification shall comply with the latest revisions including amendments of the following standards. IS: 1554-I: PVC insulated heavy-duty cables for working Voltages up to 1100 Volts.

IS: 3961-II: Recommended current ratings for cables.

IS: 8130 : Conductors for insulated cables.

IS: 583 : PVC insulation and sheath of electric cables.

IS: 10810: Test procedures for cables.

IS: 10418: Specification for drums for electric cables.

IS: 7098 - I: Specification for cross linked polyethylene Insulated

PVC sheathed cables for working voltages up to and including 1100 volts.

IS: 3975: Mild steel wire, strips, and tapes for armoring of cables.

2 GENERAL

2.1 MV cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, specifications, relevant Indian standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written in the drum.

2.2 The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

3 MATERIAL

The MV cables shall be XLPE insulated Aluminum / Copper conductor armored cable conforming to IS: (IS: 7098 (i) - 88) laid in trenches, ducts and underground as shown in drawings of SOR of R&B Department, Electrical Dn..

4 TECHNICAL REQUIREMENTS

4.1 Power cables shall be 1100 volts grade, multi core constructed as per IS: (IS : 7098 (i) - 88) as follows.

4.1.1 Stranded aluminum / copper conductor

4.1.2 Extruded PVC insulation cores laid up

4.1.3 Extruded PVC inner sheath

4.1.4 Galvanized steel wire armored

4.1.5 Extruded PVC outer sheath

4.2 Conductor shall be hard drawn aluminum / copper wires grade H2 as per IS: 8130

4.3 Insulation shall be of XLPE type - A as per IS: 7098-1-88 and its latest version.

4.4 The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground-buried installation with uncontrolled back fill and chances of flooding of water.

4.4.1 Cables shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transit operating conditions.

4.4.2 The cable should withstand the system fault current with insulation screen / armor insulated at one end. Bidder shall furnish calculations in support of capability of cables for 3 phase fault. Armor shall be designed to withstand the earth fault currents. The current carrying capacity of armor shall not be less than the earth fault current values of the system.

4.4.3 Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables and also the marking of ISI MARKED & property of GIDC.

4.4.4 Cables shall be supplied in non-returnable wooden drums as per IS: 10418. Both ends of the cables shall be properly sealed with PVC / rubber caps so as to eliminate ingress of water during transportation, storage and erection.

5 INSPECTION

5.1 All cables shall be inspected upon receipt at site and checked for any damage during transit.

5.2 While selecting cable routes, corrosive soils, ground surroundings sewage effluent etc. shall be avoided, where this is not feasible, special precautions as decided by the Engineer In charge particularly for HV cable installations, shall be taken. Street lighting and service line to each pole should have separate route.

6 LAYING METHODS

6.1 Cables shall be laid direct in Doubled walled corrugated pipes.

6.2 Joint in the cable through out its length of lying shall be avoided as far as possible and if unavoidable, prior approval of site Engineer shall be taken. If allowed, proper straight through epoxy joint shall be made without any additional cost. A loop of one Mtr. Of each length of cable shall be left near each street light pole. Also a

loop of one meter shall be provided on both end of the cable. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying. During the preliminary stages of laying cables, consideration should be given to proper location of the joint position so that when the cables are actually laid, the joints are made in the most suitable places. As far as possible, water logged locations, carriage ways, pavements, proximity to telephone cables, gas or water mains, inaccessible places, ducts, pipes, racks etc., shall be avoided for joint position.

7 LAYING DIRECT IN GROUND

7.1 General

7.2 This method shall be adopted where the cable route is through open boundary, along roads lanes etc., and where no frequent excavations are encountered and where re excavation is easy possible without affecting other services.

8 TRENCHING:

8.1 Width of trench:

The width of trench shall first determine on the following basis.

8.1.1 The minimum width of trench for laying single cable shall be 35 Cms.

8.1.2 Where more than one cable is to be laid in the same trench, in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables, except where otherwise specified shall be at least 20 Cms.

8.1.3 There shall be a clearance of at least 15 Cms between axis of the end cables and the sides of the trench.

8.2 Depth of Trench:

The depth of trench shall be determined on the following basis.

8.2.1 Where cables are laid in single tier formation, the total depth of trench shall not be less than 90 Cms. for cables up to 1.1 KV and 120 Cms. for cables above 1.1 KV

8.2.2 When more than one tier of cables is unavoidable and vertical formation of laying is adopted, depth of trench in above shall be increased by 30 Cms for each additional tier to be formed.

8.3 Excavation of trenches:

8.3.1 The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided complying with the requirements of the manufacturer.

8.3.2 Adequate precautions should be taken not to damage any existing cable(s), pipes or other such installation in the proposed route during excavation. Wherever bricks, tiles or protective

covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer In charge.

8.3.3 If there is any danger of a trench collapsing or endangering adjacent structures, the sides should be well shored up with timbering and / or sheeting as the excavation proceeds. Where necessary, these may even be left in places when back filling the trench

8.3.4 Excavation through lawns shall be done in consultation with the staff of the department

8.3.5 The bottom of the trench shall be a leveled and free from stone, brickbat etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 8 Cms in depth.

8.4 Laying of cable in trench

8.4.1 At the time of issue of cable for laying, the cores shall be tested for continuity and insulation resistance

8.4.2 When the cable has been properly straightened, the cores are tested for continuity and insulation resistance and the cable is then measured. The ends of all lead sheathed cables shall be sealed with solder immediately. In case of XLPE cables moisture seal tape shall be used for this purpose.

8.4.3 Cable laid in pipe in a single tier formation shall have a covering of clean, dry sand of not less than 15 cms above the base cushion of sand before the protective cover is laid.

8.4.4 In the case of vertical multi-tier-formation after the first cable has been laid, a sand cushion of 30 Cms shall be provided over initial bed before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30cms as stated above. The top most cable shall have final sand covering not less than 15 Cms i.e. 7.5 CMS below & 7.5 CMS above the cable before the protective cover is laid.

8.4.5 At the time of original installation, approximately 5 Mtrs. of surplus cable shall be left on each end of the cable and on each side of underground joints (Straight through / Tee / Termination) and at entries and places as may be decided by the Engineer in charge. The surplus cable shall be left in the form of a loop. Where there are long runs of cable length, loose cable may be left at suitable intervals as specified by the Engineer In charge.

8.4.6 Unless otherwise, specified, the cables shall be protected by second class bricks of not less than 23 Cms. x 10 Cms. x 7.5 Cms. (Nominal size) protection covers placed on top of the sand, (Bricks to be laid breadth wise) or the full length of the cable to the satisfaction of the Engineer In charge. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and projects at least 5 Cms. over the sides of the end cables or as per drawing.

9 BACK FILLING

- 9.1 The trenches shall be then back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 30 Cms. Unless otherwise specified, a crown of earth not less than 50 mm in the center and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of earth however should not exceed 10 Cms. so as not to be a hazard to vehicular traffic. The temporary re-installment of roadways should be inspected at regular intervals, particularly during the wet weather, and any settlement should be made good by further filling as may be required. After the subsidence has ceased, trenches cut through roadways or other paved areas shall be restored to the same density and material as the surrounding area and repaved to the satisfaction of the Engineer In charge.
- 9.2 Where road turns or lawns have been cut or kerbed stones displaced, the same shall be repaired and made good except surfacing. Asphalted to the satisfaction of the Engineer and all surplus earth or rock removed to places as specified.

9 LAYING IN PIPES / CLOSED DUCTS

- 9.3 In locations such as road crossing, entry to pump house on poles, in paved areas etc. cables shall be laid in pipes or closed ducts.
- 9.4 Stoneware pipes, G.I., C.I. or spun reinforced concrete pipes shall be used for such purposes. In the case of new construction, pipes as required, shall be laid along with the civil works and jointed as per the instructions of the Engineer In charge. The size of the pipe shall be as per schedule B for more than one cable. These pipes shall be laid directly in ground without any special bed except for SW pipe which shall be laid over 10 cm thick cement concrete 1:5:10(1 cement: 5 coarse sand: 10 graded stone aggregate of 40 mm nominal size) bed. No sand cushioning or tiles need be used in such situations. Unless otherwise specified, the top surface of pipes shall be at a minimum depth of 1.0 m from the ground level when laid under roads, pavements etc. Where steel pipes are employed for protection of single core cables feeding AC load, the pipe should be large enough to contain both cables in case of single-phase system and all cables in the case of poly phase system.
- 9.5 Pipes for cable entries shall slope downwards and suitably sealed to prevent entry of water. Further, the mouth of the pipes at the road-crossing end shall be suitably sealed to avoid entry of water.
- 9.6 All chases and passage necessary for the laying of service cable connections to street poles shall be cut as required, and made good to the original finish and to the satisfaction of the Engineer In charge.
- 9.7** Cable grips / draw wires and winches etc. may be employed for drawing cables through pipes or loose ducts etc.

10 TESTING

- 10.1 Prior to laying cables and prior to energizing the cables, following tests shall be carried out
- 10.1.1 Insulation resistance test between phases, phase to neutral and phase to earth.

10.1.2 Continuity test of all the phases, neutral and earth continuity conductor.

10.1.3 Sheathing continuity test.

10.1.4 Earth resistance test of all the phases and neutral.

10.2 All cables before laying shall be tested with a 500 volts magger for 1.1 KV grade or with a 2,500 / 5,000 volts magger for cables of higher voltages.

10.3 All cables shall be subjected to above-mentioned tests during laying, before covering the cables by protective covers and back filling and also before the jointing operations.

All tests shall be carried out in accordance with relevant Indian standard code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipments, and Labour for conducting the above test and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the representative of the Corporation and results shall be recorded in prescribed forms.

Make: As per approved vendor list.

For Item No. 44 & 45.

Item No-44 Providing & laying of approved make 50 MM Nominal OD Doubled Walled Corrugated Pipes (DWC) of polyethylene (conforming to IS 14930 - II) with necessary connecting accessories like coupler, Tee, L - Bow, etc. of same material at required depth (90 cms) including excavation for laying of cable below ground/ road surface for enclosing cable and back filling the same to make ground as per original & as per instruction of Engineer In charge - for Streetlight Cable of 1 x 4 core x 10 Sq. MM and Service cable of 1 x 4 core x 10 Sq. MM. (25 Mtr Per Between two Pole)

Item No-45 Providing & laying of approved make 90 MM Nominal OD Doubled Walled Corrugated Pipes (DWC) of polyethylene (conforming to IS 14930 - II) with necessary connecting accessories like coupler, Tee, L - Bow, etc. of same material at required depth (90 cms) including excavation for laying of cable below ground/ road surface for enclosing cable and back filling the same to make ground as per original & as per instruction of Engineer In charge - for Streetlight Cable of 1 x 4 core x 10 Sq. MM and Service cable of 1 x 4 core x 10 Sq. MM. (2.5 Meter per Pole) **LAYING METHODS**

- Pipes shall be laid direct in ground / closed ducts, in open ducts or on surface depending on environmental conditions.

TRENCHING:

Width of trench:

The width of trench shall first determine on the following basis.

- The minimum width of trench for laying single cable shall be 35 Cms.
- Where more than one cable is to be laid in the same trench, in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables, except where otherwise specified shall be at least 20 Cms.

- There shall be a clearance of at least 15 Cms between axis of the end cables and the sides of the trench.

Depth of Trench:

The depth of trench shall be determined on the following basis.

- Where cables are laid in single tier formation, the total depth of trench shall not be less than 90 Cms. for cables up to 1.1 KV and 120 Cms. for cables above 1.1 KV.
- When more than one tier of cables is unavoidable and vertical formation of laying is adopted, depth of trench in above shall be increased by 30 Cms for each additional tier to be formed.

Excavation of trenches:

- The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided complying with the requirements of the manufacturer.
- Adequate precautions should be taken not to damage any existing cable(s), pipes or other such installation in the proposed route during excavation. Wherever bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer In charge.
- If there is any danger of a trench collapsing or endangering adjacent structures, the sides should be well shored up with timbering and / or sheeting as the excavation proceeds. Where necessary, these may even be left in places when back filling the trench
- Excavation through lawns shall be done in consultation with the staff of the department
- The bottom of the trench shall be a leveled and free from stone, brickbat etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 8 Cms in depth

Laying of pipe in trench as directed by engineer in charge.

In locations such as road crossing, entry to pump house on poles, in paved areas etc. cables shall be laid in pipes or closed ducts.

Stoneware pipes, G.I., C.I. or spun reinforced concrete pipes shall be used for such purposes. In the case of new construction, pipes as required, shall be laid along with the civil works and jointed as per the instructions of the Engineer In charge. The size of the pipe shall be as per schedule B for more than one cable. These pipes shall be laid directly in ground without any special bed except for SW pipe which shall be laid over 10 cm thick cement concrete 1:5:10(1 cement: 5 coarse sand: 10 graded stone aggregate of 40 mm nominal size) bed. No sand cushioning or tiles need be used in such situations. Unless otherwise specified, the top surface of pipes shall be at a minimum depth of 1.0 m from the ground level when laid under roads, pavements etc. Where steel pipes are employed for protection of single core cables feeding AC load, the pipe should be large enough to contain both cables in case of single-phase system and all cables in the case of poly phase system.

Pipes for cable entries shall slope downwards and suitably sealed to prevent entry of water. Further, the mouth of the pipes at the road-crossing end shall be suitably sealed to avoid entry of water.

All chases and passage necessary for the laying of service cable connections to street poles shall be cut as required, and made good to the original finish and to the satisfaction of the Engineer In charge.

Cable grips / draw wires and winches etc. may be employed for drawing cables through pipes & loosed ducts etc.

BACK FILLING

- The trenches shall be then back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 30 Cms. Unless otherwise specified, a crown of earth not less than 50 mm in the center and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of earth however should not exceed 10 Cms. so as not to be a hazard to vehicular traffic. The temporary re-installment of roadways should be inspected at regular intervals, particularly during the wet weather, and any settlement should be made good by further filling as may be required. After the subsidence has ceased, trenches cut through roadways or other paved areas shall be restored to the same density and material as the surrounding area and repaved to the satisfaction of the Engineer In charge.
- Where road turns or lawns have been cut or kerbed stones displaced, the same shall be repaired and made good except surfacing. Asphalt to the satisfaction of the Engineer and all surplus earth or rock removed to places as specified.
- Pipes for cable entries shall slope downwards and suitably sealed to prevent entry of water. Further, the mouth of the pipes at the road-crossing end shall be suitably sealed to avoid entry of water.
- All chases and passage necessary for the laying of service cable connections to street poles shall be cut as required, and made good to the original finish and to the satisfaction of the Engineer In charge.

Cable grips / draw wires and winches etc. may be employed for drawing cables through pipes & loosed ducts etc.

Make: - As per approved vendor list.

Item No-46 Supplying & erecting MINI SECTION PILLAR 60 x 30 x 45 cms fabricated from 16 Gauge thick joint legs M.S. Sheet with angle iron legs 45 cms long made from 35 x 35 x 5 mm thick. Joint less M.S. Angle with cable clamps to be buried in ground to have appropriate erection to work Uniform Until erected with cement concrete foundation and 45 cms high bricks work finishing with plaster etc. hinged double door with 3" x 4" vision panel covered with Mesh & V. panel overlapping with flap for meter reading internally supported on both side, with internal and outside looking arrangement with lock and keys in duplicate 35 x 35 x 5 mm M.S. Angle of Two Nos. one is welded and other with nut and bolt for erecting backlite sheet. Painting the Section Pillar inside and outside with three tank powder coated paint.. Section pillar roof should be without joint with water leakage proof & tested as per IP 55 test & followed by IS 2147 of 1962

Make: - As per approved vendor list.

Item No-47 Supplying and erecting bakelite sheet 12mm thick HYLAM make on existing angle iron frame.

Make: - As per approved vendor list.

- Item No-48** Supplying & erecting approved make Digital time switch having lithium cell 6 years operative and operate battery backup 1 channel day clock with 14 memory programmer, suitable to operate on 240V + 5%, 16A with, floating contacts Minimum switching setup time 1 minimum & LCD display. Also comprised permanent ON/OFF switching. Programming switches & housed in fire proof thermoplastic enclosure & transparent cover erected as required with necessary connection erected as directed.
- Make: -** As per approved vendor list.
- Item No-49** Providing & Fixing of 4 pole 440 V 40 A power contactor for time switch complete erected as per direction CAT-III.
- Make: -** As per approved vendor list.
- Item No-50** Providing & Fixing of approved make 415 V four pole MCB for lighting load (B Curve) having 10 KA breaking capacity confirming to IS - 8828, with enclosure having capacity of 40 A.Cat-III.
- Make: -** As per approved vendor list.
- Item No-51** Supplying & erecting funnel type earthing having earth plate of following size burred in specifically prepared earth pit 3 mtr. below ground with 40 kg. charcoal and salt with alternate layers of charcoal & salt, 20mm.dia. G.I. pipe with Funnel with a wire mesh for watering & bricks masonry block, C.I. Cover complete as per para 7.3 of IS 3043 with necessary length of double Galvanised Iron / copper earth wire No 6 SWG bolted with lug to the plate and covered in 12 mm dia. G.I. pipe 2.5 mtr long complete connected to the nearest switch gear with end socket as per direction & duly tested by earth tester confirming to IS (As per drawing) with following specification (C) with 60 x 60x 0.315 cms. Copper earth Plate.
- Make: -** As instruction by Engineer In- Charge.
- Item No-52** Drilling of Road without breaking the road surface for laying of cable [A] up to 100 mm bore dia.
- Make: -** As instruction by Engineer In- Charge.
- Item No-53** Making trench in soft soil of suitable width of 90 cm deep for laying cable or locating the fault all over the run and back filling the same and making the surface as normal ground.
- Make: -** As instruction by Engineer In- Charge.
- Item No-54** Point wiring for Light / Bell with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistring copper wires, in following type of pipe to be erected concealed in/ on surface on wall/ceiling complete with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected,

with necessary Lamp holder/ceiling rose / H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories. Cat. III.

Make: - As per approved vendor list.

Item No-55 Point wiring for FAN with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of .ISI marked 1.1 KV Grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling complete with 6A Modular type switch and hum free EME four or more step type electronic fan regulator with separately mounted and accessories with earth continuity of following type erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected. with necessary ceiling rose / H.D.Connector as directed.(a) with medium class Rigid PVC pipe and accessoriesCat. III

Make: - As per approved vendor list.

Item No-56 Point wiring for Individual Plug with & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of to be erected concealed in / on surface of wall / ceiling complete with Modular type switch & 5 pin Plug erected on PVC / Metallic box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories. [I] For 6A Plug with 2-1.5 sq.mm Cu. Wire. (a) with medium class Rigid PVC pipe and accessoriesCat. III

Make: - As per approved vendor list.

Item No-57 Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed (b) 25 mm.

Make: - As per approved vendor list.

Item No-58 Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed (d) 40 mm

Make: - As per approved vendor list.

Item No-59 Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected concealed in /flushed on wall/ceiling, with 1.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green color for earth continuity of following size (a) with medium class Rigid PVC pipe and accessories (b) 2 wire 2.5 sq. mm

Make: - As per approved vendor list.

Item No-60 Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected in / on wall / ceiling with 2.5 sq. mm copper

conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size(a) with medium class Rigid PVC pipe and accessories (a) 2 wire 4 sq. mm

Make: - As per approved vendor list.

Item No-61 Approved make ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on single phase 240 V. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. for following Max. rating erected as directed (i) 25 Amps.DP Cat.III

Make: - As per approved vendor list.

Item No-62 Providing & erecting 415 V MCB Four Pole for Motor & Inductive Load (C Curve) having 10KA breaking capacity & confirms to IS: 8828 in existing box having following capacity - (c) 63 Amp

Make: - As per approved vendor list.

Item No-63 Providing and erecting Approved make Ceiling fan with double ball bearing ISI mark with condenser A.C. 230V.50 c/s.1200 mm. sweep complete, canopy and 30 cms. down rod erected on existing hook or clamp with 24/0.2 , 3 core flexible wire with earthing.

Make: - As per approved vendor list.

Make: - As per approved vendor list.

Item No-64 Supplying and erecting Fan Hook of 10 mm.M. S. Roundbar grouted in RCC slab with Making the site as original.

Make: - As per approved vendor list.

Item No-65 Supplying & erecting fan hook box of 10mm MS Round bar bounded to the RCC bars up to 50 mm length each side and pierced through 16 gauge MS box/heavy duty PVC box complete erected in ceiling with necessary fittings

Make: - As per approved vendor list.

Item No-66 Providing fan clamp of for Ceiling fan complete erected with necessary bolts and nuts.

Make: - As per approved vendor list.

Item No-67 Providing 2.5mm.thick laminated /pvc sheet to cover the fan hook or Fan box.

Make: - As per approved vendor list.

Item No-68 Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA/ aluminium die cast powder coated and high U.V. & corrosion resistance with diffuser with company mark/name 160V to 270V, Power Factor more than 0.95, THD < 15%, CCT 3000 K to 6500K, Luminaire efficacy> 85 lumens/watt LED driver efficiency > 85 % (fitting required LM-79 & LM-80

Certificates)(NOTE: Below description have shown ranges of Wattage capacity of LED fittings.The Engineer incharge may select any wattage capacity between the ranges shown.)(A) Tube Light with integral driver18-20 Watts, Surge - 2KV,IP-20, conventional 4 feet

Make: - As per approved vendor list.

Item No-69 Providing and erecting metallic vitrified danger notice board as per language suggested by engineer incharge for HIGH VOLTAGE installation to be erected as per IS.-2551.

Make: - As per approved vendor list.

Item No-70 Providing pair of rubber hand gloves suitable for working on 11 KV/22 KV supply.

Make: - As per approved vendor list.

Item No-71 Supplying 12 mm thick rubber matting as per IS:15652/IEC 61111

Make: - As per approved vendor list.

Item No-72 Supplying stand first AID box with antiseptic cream, medicine for use on wounds due burn, crepe bandage, gauge bandage, medicated ready to use bandage (Band-aid) adhesive tape for medicinal user, Scissors, anti-septic solution (Savlon or similar) etc. (All above contents shall be of standard makes).

Make: - As per approved vendor list.

Item No-73 Supplying & erecting ABC powder type 'Ceasefire' type Fire extinguisher as per IS 13849 or 1 Kg capacity with necessary clamp for erection on wall.

Make: - As per approved vendor list.

ELECTRICAL WIRING AND INSTALLATION OF INSTRUMENTS:

Electrical wiring from energy meter to motor through ICTP switch & control panel is to be done as per A.E. Co. rules by the Contractor at his cost all electrical instruments such as control panel, switches, starters, meters etc. will be installed properly and earthing is provided as per rules. This shall include cost of cables/wires and all other materials required for the purpose Test report of licenses contractor shall be provided to A. E. Co. for electrical installation & for capacitor.

Installing testing and commissioning should be as per instructions of Engineer at site, any mal-functioning of the equipment system due to faulty installations shall have to be rectified at contractor risk and cost.

- 1) All the specials like pipes, bend, valves, flanges, erection clamps etc. shall Have to be fabricated as per relevant IS specifications where ISI is not available.
- 2) Test report of licensed contractor to be provided to GEB / TPAEC for Electrical installation. The latest test report for capacitors should also be furnished.
- 3) Installation, testing and commissioning should be as per instruction of Engineer at site. Any mal-functioning of the equipment system due to faulty installation shall have to be rectified at contractor's risk and cost.

**ADDRESS & SIGNATURE OF
THE CONTRACTOR**

**EXECUTIVE ENGINEER
GIDC, Mehsana.**

GUJARAT INDUSTRIAL DEVELOPMENT CORPORATION

Annexure-I (A)

Details of Submersible Pumps: Specified minimum overall guaranteed efficiency

Sr. No.	Duty point discharge L. P. M.	Head Mtrs.	Overall Efficiency without minus tolerance	Minimum motor H. P. rating
For 150 mm diameter bore				
01	90	60	39	3
02	90	90	39	5
03	90	120	40	7.5
04	90	150	41	7.5
05	135	60	42	4
06	135	90	44	5
07	135	120	4	7.5
08	135	150	46	10
09	180	72	48	5
10	180	108	50	7.5
11	180	144	50	12.5
12	240	72	48	7.5
13	240	108	50	12.5
14	240	144	50	15
15	400	60	52	10
16	400	90	52	15
17	400	120	54	20
18	400	150	55	22.5
19	320	92	53	7.5
20	320	92	53	12.5
21	320	130	54	15.0
For 200 mm diameter bore				
22	510	52	55	10.0
23	510	87	56	17.5
24	510	123	56	25.0
25	510	141	56	27.5
26	510	159	57	30.0
27	800	72	57	20.0
28	800	108	58	30.0
29	800	144	60	40.0

Sr. No.	Duty point discharge L. P. M.	Head Mtrs.	Overall Efficiency without minus tolerance	Minimum motor H. P. rating
30	800	162	60	45.0
31	1200	53	60	27.5
32	1200	105	62	45.0
33	1200	126	62	55.0
34	1200	147	62	60.0
For 200 mm diameter bore				
35	1600	117	62	65.0
36	1700	52	62	30.0
37	1700	86	62	50.0
For 300 mm diameter bore				
38	1700	138	64	75.0
39	2000	50	62	35.0
40	2000	74	62	50.0
41	2750	140	67	125.0
42	2900	45	62	45.0
43	2900	68	62	65.0
44	4000	72	67	90.0

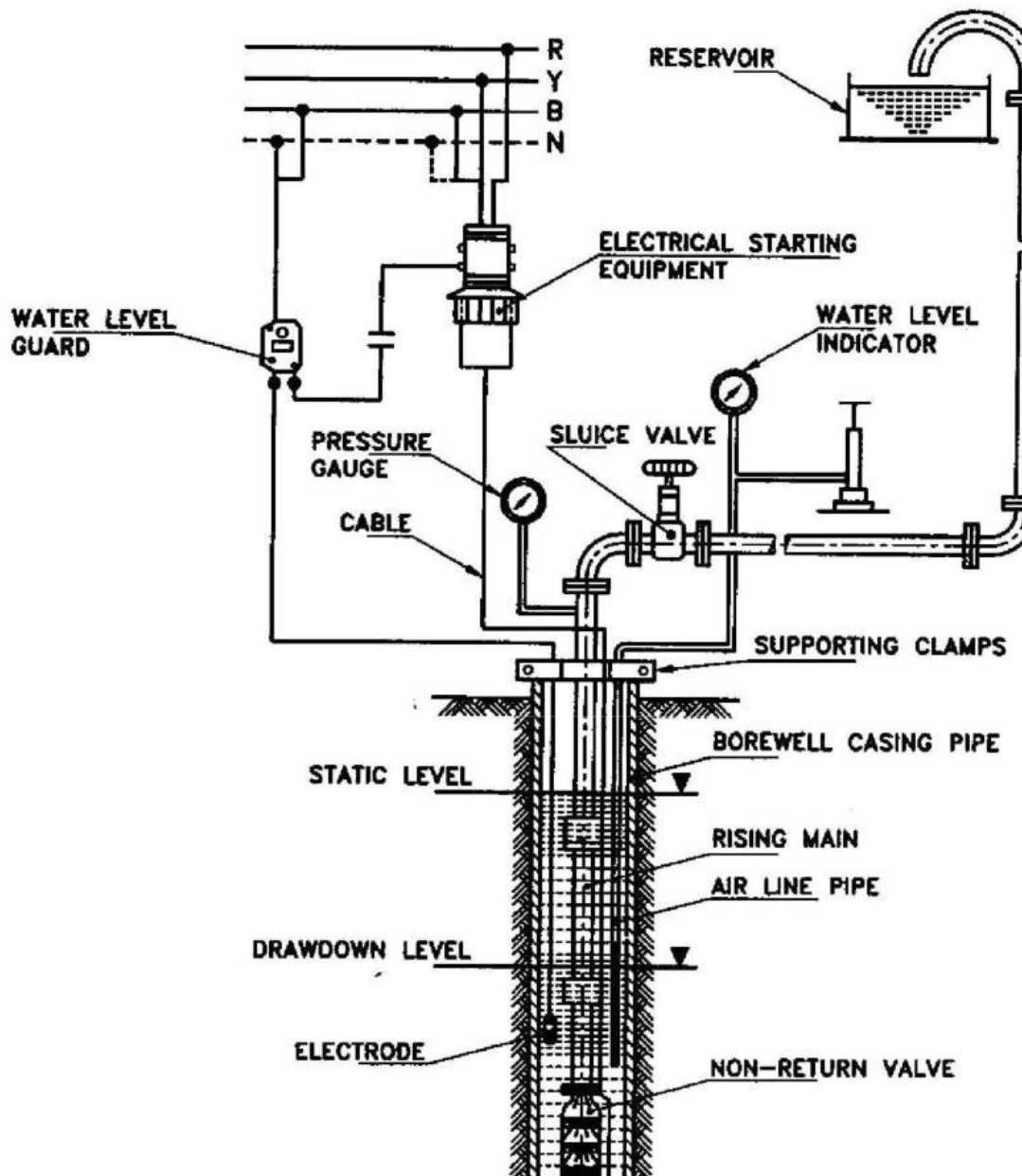
**ADDRESS & SIGNATURE OF
THE CONTRACTOR**

**EXECUTIVE ENGINEER
GIDC, Mehsana.**

MAKE LIST		
SR. NO	ITEM	STANDARD MAKE
1	Submersible pump set	JASCO/KSB/GRUNDFOSS/UNEEL/LUBI/AMRUT/DUKE
2	PVC sheathed flexible copper cable	FINOLEX/TORRENT/POLYCAB/KEI/RR KABEL /ADCAB
3	MCB/ELCB/MCCB/RCCB	ABB/L&T/SIMENSE/HAVELLS/LEGRAND/SCHNEIDER/HAGER/C&S
4	Sluice Valve	HAWA ENGINEERS LTD/ R & D MULTIPES PVT. LTD. (PLANT-2) / VAG Valves (India) Pvt. Ltd./ Ketan Engineering Works / M/S. L&T Valves Limited., / IVC / IVI / DURGA / AARKO / ICSI MARKED PN 1.6
5	Non Return Valve	M/S. HAWA ENGINEERS LTD/ M/S. R & D MULTIPES PVT. LTD. (PLANT-2)/ VAG Valves (India) Pvt. Ltd./Ketan Engineering Works / M/S. L&T Valves Limited.,
6	Electromagnetic Flowmeter	Krohne marshal/E&H/ FLOWTECH/ AAROHI/ MANAS / ADMAS
7	horizontal mono block pump	JASCO/KSB/GRUNDFOSS/UNEEL / LUBI / AMRUT/DUKE
8	XLPE armored cable	POLYCAB/TORRENT/RR KABEL/ALLCAB/AVOCAB/KEI / JOHNSON/GOODCAB
9	HOT-DIP GALVANIZED POLE	BAJAJ/TRANSRAIL/VALMONT/ RR ISPAT /UTKARSH/AMBICA
10	STREET LIGHT BRACKET	BAJAJ/TRANSRAIL/VALMONT/ RR ISPAT /UTKARSH/AMBICA
11	LED STREET LIGHT FITTING	BAJAJ/WIPRO / CROMPTON/ HAVELLS/ SURYA/ NESSA/ LITSUN/ GRE
12	FR PVC INSULATED WIRE	FINOLEX/TORRENT/POLYCAB/KEI/RR KABEL /ADCAB
13	DOUBLE WALL CORRUGATED (DWC) POLYTHINE PIPE	DURAGUARD / GEMINI/VARAH
14	EARTHING	RAPID/ASHLOK/OBO/INDELEC/SULAH SAFE SOLTION
15	LUG	DOWELL's/ISMILE/3D/JAINSON/ R&B APPROVED VENDOR IN CATEGORY-III
16	GLAND	COMET/HMI/SIEMENSE/ R&B APPROVED VENDOR IN CATEGORY-III

17	Ceiling Fan	USHA/HAVELLS/CROMPTON/BAJAJ/ORIENT
18	LED Indoor Fitting	BAJAJ/WIPRO / CROMPTON/ HAVELLS/ SURYA/ NESSA/ LITSUN/ GRE

Note: - Make to be approved as per above list OR as approved by Engineer In charge.



ADDRESS & SIGNATURE OF
THE CONTRACTOR

EXECUTIVE ENGINEER
GIDC, Mehsana