2.0

HINDUSTAN URVARAK & RASAYAN LIMITED

(A JOINT VENTURE OF CIL, NTPC, IOCL, FCIL & HFCL)

BARAUNI UNIT

Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]

SECTION-V

(SOR, TECHNICAL SPECIFICATIONS

SCOPE OF WORK AND OTHER TERMS & CONDITIONS)

Scope of Work:

1.1 SCOPE

1.1.1 The scope covers Design, Engineering, Supply, Installation, Testing and Commissioning, delivery at site in well packed condition of the Highmast and accessories specified herein required at HURL, Barauni Township, Bihar.

1.1.2 The scope of work shall also include digging of earth and refilling for directly buried cables, earth strips, cable protection pipes, earth pits, civil works such as making earth pit inspection chambers with covers, grouting of equipment base plate, channels, supports and foundation bolts, chipping of concrete or in brick work for earth strips, pipes or other minor chipping for foundation preparation, if required, cutting holes in walls light fitting brackets, sealing of cable entries and making good the same after installation of the equipment and levelling, and other minor similar jobs as per directions of Owner / Engineer-in-Charge.

1.1.3 The scope shall include design, engineering, manufacture, testing at works and delivery to site in well packed condition, storage, handling, erection, testing and commissioning of Highmast to be installed at HURL Township, Barauni.

1.1.4 All civil work (like cutting, chipping, grouting, making opening in floor / wall etc. for equipment foundation and cabling work) pertaining to electrical equipment are in the scope of work of the contractor.

1.1.5 Quantities indicated in the Schedule of Rates (SOR) and Inventory are approximate and these may increase or decrease or some items may even be deleted at the time of actual execution. However, the value of total increase or decrease shall be limited to ± 25% of the contract value irrespective of the changes in quantity of individual items.

1.1.6 The contractor shall have valid “A” class license from the Director of Electrical Safety to the Govt. of Bihar. The contractor must have PF & ESI codes covering all persons hired by him for carrying out the job. He shall engage suitably skilled / licensed workmen of various categories for execution of work supervised by supervisors / engineer of appropriate qualification and experience to ensure suitable quality of work.

1.2 REFERENCE STANDARDS

1.2.1 All electrical equipment and installation shall comply with the requirements laid down in the latest issue of relevant Indian Standard Specifications and statutory acts / rules / regulations. In the absence of IS for any particular equipment or in case of imported equipment, relevant IEC Standards shall be applicable. All Specifications, publications mean the latest edition.

1.2.2 The equipment and installation shall also comply with the provisions of latest issue of Indian Electricity Rules.

1.3 EARTHING & LIGHTNING PROTECTION

1.3.1 Complete earthing installation shall be done as per IS:3043 and lightning protection shall be as per IS/IEC 62305 along with its latest amendments.

1.3.2 Earthing & lightning protection shall also conform with the requirements of National building code.

1.4 ERECTION, TESTING & COMMISSIONING

1.4.1 The contractor shall undertake erection of all equipment in accordance with good engineering practices in conformity with statutory regulations and Code of Practice and to the entire satisfaction of the owner.

1.4.2 The contractor shall arrange all the necessary erection tools, tackles, testing and measuring instruments and shall supply erection materials and consumables.

1.4.3 The contractor shall clear the site after commissioning of the equipments / system and obtain the Site Clearance Certificate from owner's Engineer-in-charge.

1.5 DRAWINGS AND DOCUMENTS

1.5.1 The bidder shall supply the drawings and documents as per Annexure-I 'Drawings & Documents Schedule' under Section 2.0.

1.5.2 All drawings and documents shall have the following descriptions written boldly:

- Name of Client.
- Name of Consultant i.e. HURL.
- Enquiry / Order Number with Project/Plant name.
- Equipment Code No. and Description.

1.5.3 The Contractor shall be responsible for preparation and submission of two sets of drawings viz.

(1) "AS BUILT" (2) Material Reconciliation and Deviation Statement

2. Equipment Specification

2.1.1 **High Mast**

SCOPE

a) The scope covers technical requirements of design, engineering, manufacture, testing before dispatch at works and delivery in well packed condition of high mast lighting structure, LED light fittings including lamps, earthing of units, aviation lights for towers, supply of spares for 2 years operation and maintenance etc. for HURL, Barauni. The scope shall also include the erection including civil foundation & piling design, as required , testing, commissioning of the system by High Mast Lighting manufacturer.

APPLICABLE STANDARDS

b) The following shall be the reference standards for the loading of the high mast:

Sr. No.	Code No.	Title

a)	BS Code of Practice CP-3 Chap V Part-II	Gradient of wind speeds related to height above ground
b)	BS 4360	Grades of MS Plates
c)	BS 5135	Welding
d)	BS 729	Galvanizing
e)	Technical report (TR) No. 7	High Mast Lighting specification for design, manufacture assembly, erection, testing and maintenance–2000,published by the Institution of Lighting Engineers, United Kingdom
f)	IS 875 (Part III), 1987	Structural stability to sustain maximum reaction arising from wind
g)	BS EN 10025/10027	Yield strength of steel structure.
h)	BS EN ISO 1461	Environmental protection of the fabrication by hot dip galvanization
i)	BS 5135/AWS	Welding
j)	IS 325	Three Phase Induction motor
k)	IS 3043	Code of Practice for Earthing
l)	IS 2309	Protection of building & Allied structure against Lightning
m)	UL 1029	Standard for high intensity discharge lamp ballast
n)	EN 61347	Lamp Control gear
o)	UL 1059	Standard for Terminal Block
p)	EN 60947	Low Voltage Switchgear & control gear
q)	EN 60598	Luminaries general requirements & test
r)	IE rule	
s)	Any other regulations laid by statutory authorities	

INSTRUCTIONS TO BIDDER

c) As it is not possible to cover all aspects of design, the basic requirements only have been covered in this specification. Bidder shall ensure that design and installation is carried out as per the latest engineering practices, satisfying the requirements of safety, reliability, ease of maintenance and operation, aesthetics and maximum interchange ability.

d) Piling Design for high mast shall be furnished by bidder including its details drawings, documents etc.

e) Compliance with this standard and / or approval of any of the bidder's documents shall not relieve the bidder of his responsibility towards his contractual obligation with regard to the completeness and satisfactory operation of the equipment.

f) **Power Supply (Feeder Pillar)**

The owner shall provide 415V, 3 phase & neutral power supply at the bottom of each mast through suitable XLPE-A-PVC (FRLS) (Al) cable. Suitable FLP/weatherproof arrangement for receiving & distribution of this power including suitable TPN MCCB/MCB incomer, outgoing MCB for switching on/off luminaries, contactors with suitable MCB/MCCB for motor, push button for raising & lowering of lantern carriage through motor operation etc. shall be provided by the bidder.

Above mentioned arrangement shall be weatherproof for the high mast to be installed in non- hazardous area.

g) 2 nos. earth Pit shall be provided by bidder within 10 m of each mast for body earthing. Further 2 nos. earthing connections from high mast to earth pit (one earthing connection to one pit) shall also be provided by the bidder with GI strip of size not less than 50X6 mm^2.

OPERATIONAL REQUIREMENTS

The equipment shall be suitable for operating at rated capacity continuously under the ambient conditions and with voltage and frequency variations indicated above without exceeding the permissible temperature limits as per relevant standards and without any detrimental effect on any part.

GENERAL DESIGN REQUIREMENTS

a. The electrical system and installation shall be designed as per latest practice to provide maximum reliability, flexibility, safety to personnel and equipment and ease of operation and maintenance.

b. All equipment shall have adequate and standardized ratings.

c. Masts shall be of 30m height and unipolar (single pole) structure. Special consideration shall be taken in respect of lamp replacement, operation and maintenance.

d. Manufacture of masts and components, light fittings, lamps, control gears for fittings, control gears for lantern carriage movement (i.e. raise/lower) with self sustaining winch/stainless steel wire/rope, flameproof/weatherproof motors, control push button stations and flexible cables shall be as per relevant Indian / International Standards.

EQUIPMENT DETAILS

High Masts

i) Structure

The High mast shall be of continuously tapered, polygonal cross section, at least 16 sided, presenting a good and pleasing appearance and shall be based on proven In-tension design conforming to the standards referred to above, to give an assured performance, and reliable service. The structure shall be suitable for wind loading as per IS 875 Part III 1987 as well as for prevailing wind condition at HURL, Barauni.

The mast height shall be 30m, with minimum diameter of 150mm at the top and 610mm at the bottom. Minimum plate thickness of bottom section shall be 5mm and other sections 4mm.The structure shall be suitable for wind loading as per IS 875 Part III, 1987 & for 24 nos. 350W LED light fitting complete with lamp. The PCD of the mast flange shall be minimum

740mm.

ii) Construction

The mast shall be capable of safely withstanding the strong winds prevailing at site. The deflection at the top during heavy monsoon periods shall therefore be considered in the design and the mast designed in such way that the above deflection during worst periods is kept to a minimum value.

The High mast shall be fabricated from special steel plates, conforming to BS-EN10025, cut and folded to form a polygonal section and shall be telescopically jointed and fillet welded. The welding shall be in accordance with BS: 5135. The procedural weld geometry and the workmanship shall be exhaustively tested on the completed welds. Mast shall be delivered in multiple sections of length approx.10 metres. Thus a 30 meter mast shall be delivered in three sections.

Each mast section, delivered to site, shall include one no. circumferential welded diaphragm stiffener to reduce the deflection of the mast in heavy winds. At site, the sections shall be joined together by slip-stressed-fit method. No site welding or bolted joint shall be done on the mast. The minimum overlap distance shall be 1.5 times the diameter at penetration.

The mast shall be provided with full penetrated flange 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. The base flange shall be provided with supplementary gussets between the bolt holes to ensure elimination of helical stress concentration. For the environmental protection of the mast, the entire fabricated system shall be hot dip galvanised, internally and externally, having a uniform thickness of 65 microns for the bottom and top sections.

iii) Door Opening

An adequate door opening of size 1000mm x 300mm shall be provided at the base of the mast and the opening shall be such that it permits clear access to equipment like winches, cables, plug and socket, etc. and also facilitate easy removal of the winch. The door opening shall be complete with a close fitting, vandal resistant, weather proof door, provided with a heavy duty double internal lock with special paddle key.

The door opening shall be carefully designed and reinforced with welded steel section, so that mast section at the base shall be unaffected and undue buckling of the cut portion is prevented.

iv) Dynamic Loading for the Mast

The mast structure shall be suitable to sustain an assumed reaction arising from a wind speed as per IS 875 (three second gust), and shall be measured at height of 10m above ground level. The design life of the mast shall be a minimum of 25 years. Wind excited oscillations shall be dampened by the method of construction and adequate allowance shall be made for the related stresses.

v) Earthing Terminals

2 Nos. earthing terminals for earthing of the mast, using 12mm dia. stainless steel bolts shall be provided at convenient location on the base of the mast.

Lantern Carriage

vi) Fabrication

A fabricated Lantern Carriage shall be provided for fixing and holding the LED flood light fittings and control gear boxes. The Lantern Carriage shall be of special design and shall be of steel tube construction, the tubes acting as conduits for wires, with holes fully protected by grommets. The Lantern Carriage shall be so designed and fabricated to hold the required number of flood light fittings and the control gear boxes, and also have a perfect self balance.

The Lantern Carriage shall be fabricated in two halves and joined by bolted flanges with stainless steel bolts and plastic lock type stainless steel nuts to enable easy installation or removal from the erected mast. The inner lining of the carriage shall be provided with protective PVC arrangement, so that no damage is caused to the surface of the mast during raising and lowering operation of the carriage. The entire Lantern Carriage shall be hot dip galvanised after fabrication.

vii) Junction Box

Weather proof junction box with IP55 enclosure, made of cast Aluminium shall be provided on the Carriage assembly as required, from which the inter-connections to the designed number of the flood light LED luminaries and associated control gears fixed on the carriage, shall be made.

Raising and lowering mechanism

For the installation and maintenance of the luminaries and lamps, it will be necessary to lower and raise the Lantern Carriage assembly. To enable this, a suitable winch arrangement shall be provided, with the winch fixed at the base of the mast and the specially designed head frame assembly at the top.

viii) Winch

The winch shall be of completely self sustaining type, without the need for brake shoe, springs or clutches. Each driving spindle of the winch shall be positively locked when not in use, gravity activated PAWLS. Individual drum also should be operated for fine adjustment of lantern carriage. The capacity, operating speed, safe working load of the winch and the recommended lubrication and serial number of the winch shall be clearly marked on each winch.

The gear ratio may be according to manufacturer's standard. However, the minimum working load shall not be less than 750Kg. The winch shall be self lubricating type by means of an oil bath and the oil shall be readily available grades of reputed producers.

The winch drums shall be grooved to ensure perfect seat for stable and tidy rope lay, with no chances of rope slippage. The rope termination in the winch shall be such that distortion or twisting is eliminated and at least 5 to 6 turns of rope remains on the drum even when the lantern is fully lowered and rested on the rest pads.

It should be possible to operate the winch manually by a suitable handle and / or by integral power tool. It shall be possible to remove the double drum after dismantling, through the door opening provided at the base of the mast. Also, a winch gear box for simultaneous and reversible operation of the double drum winch shall be provided as part of the contract. A test certificate shall be furnished by the Bidder from the original equipment manufacturer, for each winch in support of the maximum load operated by the winch.

ix) Head Frame

The head frame, which is to be designed as a capping unit of the mast, shall be of welded steel construction, galvanised both internally and externally after assembly. The top pulley shall be of appropriate diameter, large enough to accommodate the stainless steel wire ropes and the multicore electric cable. The pulley block shall be made of non-corrodible material, and shall be of die cast Aluminium alloy (LM-6). Pulley made of synthetic materials such as plastic or PVC is not acceptable. Self lubricating bearings and stainless steel shaft shall be provided to facilitate smooth and maintenance free operation for a long period. The pulley assembly shall be fully protected by a canopy galvanised internally and externally. Close fitting guides and sleeves shall be provided to ensure that the ropes and cables do not get dislodged from their respective positions in the grooves. The head frame shall be provided with guides and stops with PVC buffer for docking the lantern carriage.

x) Stainless Steel Wire Ropes

The suspension system shall essentially be without any intermediate joint and shall consist of only non-corrodible stainless steel of AISI 316 or better grade. The stainless steel wire ropes shall be of 7/19 construction, the central core being of the same material. The overall diameter
of the rope shall not be less than 6mm. The breaking load of each rope shall not be less than 2350Kg individually, giving a factor of safety of over 5 for the system at full load as per the TR-7 referred to in the beginning of this specification. The end constructions of ropes to the winch drum shall be fitted with telluric.

The thimbles shall be secured on ropes by compression splices. Two continuous lengths of stainless steel wire ropes shall be used in the system and no intermediate joints are acceptable in view of the required safety. No intermediate joint either bolted or else is provided on the wire ropes between winch and lantern carriage.

Electrical System, cable and Cable Connections

The electrical connection from bottom to top shall be made with at least 5 core 2.5 sq.mm flexible round sheath power cables using copper conductors of appropriate rating. A suitable flameproof/weatherproof socket arrangement shall be provided at the bottom of the mast. The trailing cable shall also have an FLP/weatherproof plug connected at the bottom end. Also, suitable provision shall be made at the base compartment of the mast to facilitate the operation of electrically operated integral FLP/weatherproof power tool for raising and lowering of the lantern carriage assembly. The trailing cables at the top shall be terminated in the weather proof junction box.

Power Tool for the Winch

A suitable, high powered, electrically driven, flameproof/weatherproof, integral power tool to be provided in the base compartment coupled with winch and suitable for manual & motorised operation shall be supplied for the raising and lowering of the lantern carriage for maintenance purposes. The speed of the power tool may, preferably, be slow of 1.5 to 1.8 metre/minute, so that vibrations associated with high speed operation are avoided. The power tool shall be single speed, provided with a flameproof/weatherproof motor of required rating. The power tool shall be supplied with suitable reversible starter in flameproof/weatherproof enclosure. The capacity and speed of the electric motor used in the power tool shall be suitable for the lifting of the design load installed on the lantern carriage.

Also, a handle for the manual operation of the winch in case of problems with electrically operated tool, shall be provided and shall incorporate a torque limiter.

Luminaries: 350W LED Flood Lighting Fixture complete with lamp

a. The LED Flood Lighting Fixture complete with lamp suitable for High Mast.

b. The fixture shall have efficiency long life LED with high efficacy and minimum of 100 lm/w with high brightness LED for glare free homogenous illumination.

c. Fixture housing shall be made of Epoxy powder coated die-cast aluminium housing (LM-24).

d. Fixture cover shall be made of high quality toughened glass fixed to housing with screws.

e. The fixture shall have in-built electronic driver with THD ≤ 10%.

f. Twin dome LED type (2x40W) Aviation Obstruction Lights of reliable design and reputed manufacturer shall be provided on top of each mast. It shall have cast aluminium housing finished in aviation yellow colour, suitable rated step-up transformer, thick glass dome mounted on cast aluminium ring and spring loaded high tension porcelain socket fitted with neon cold cathode helix light source. The light source shall be designed to give Omni- directional red colour light distribution to have maximum light output in the zone between 10^{o}C to 90^{o}C above horizontal plane.

Lightning Finial

One number heavy duty, hot dip galvanised, lightning finial shall be provided for each mast. The lightning finial shall be minimum 1.2m in length and shall be provided at the centre of the head frame. It shall be bolted solidly to the head frame to get a direct conducting path to the earth through the mast body. The lightning finial shall not be provided on the lantern carriage under any circumstances in view of safety of the system.

TESTS AND INSPECTION

Routine testing shall be carried out on the supplied items at manufacturer's works as per relevant standards. For imported items of masts, relevant test certificates need to be produced for the purpose. However, testing shall not absolve the supplier from his responsibility for making good any defect which may be noticed subsequently. Site testing to demonstrate working and performance of the system shall also be carried out.

DRAWINGS AND DOCUMENT

all drawings and documents shall have the following descriptions written boldly:

- Name of Client i.e. HURL
- Enquiry / Order Number with Project name.
- Equipment Code No. and Description.

At the time of handing over of the installation, the bidder shall supply as built drawings taking into consideration the actual execution carried out at site.

Drawings and documents shall be submitted as per Annexure-A (Sh.10 of this specification) in number of copies as indicated therein.

SPARES

Commissioning spares as required shall be supplied with the main equipment without any price implication to owner. Item wise list of recommended commissioning spares shall be furnished for information.

All spare parts shall be identical to the parts used in the High Masts.

LT POWER & CONTROL CABLE

a) Cables shall conform to Engineering Standard ES-8160 and enclosed Specification Sheets.

b) All LT power cables shall be with stranded aluminium / copper conductor with XLPE insulation, PVC inner sheathed, armoured, PVC outer sheathed FRLS type and construction as per IS: 7098 (Part 1) and as specified in the specification Sheet (attached in this specification).

c) All control cables shall be stranded copper conductor with XLPE insulation, PVC inner sheathed, armoured, PVC outer sheathed FRLS type and construction as per IS: 7098 (Part 1) and as specified in the specification Sheet (attached in this specification).

d) All control cables cores shall be identified with numerical core numbers printed on core instead of colours.

e) All cables shall be armoured and shall have extruded inner and outer sheath. Cables shall be in continuous length without any joints.

f) Technical Particulars shall be filled by bidder and submitted for approval after order in line with PO requirement before commencement of manufacturing. Separate sheet shall be furnished for different grade cables.

g) The cut ends of cable shall be sealed by means of non-hygroscopic sealing material.

h) Following information shall be embossed on outer sheath throughout the length of cable at regular interval:

i) Cable size & no of cores

ii) Voltage grade

iii) Type of insulation

iv) Year & name of Manufacture

v) Running meter

Cable Jointing and Termination

General

The scope of work shall include but not limited to the followings:

a. Soldering / crimping of sockets / ferrules and connections at all joints/ terminations as per specifications. Sockets shall be provided at all terminations except where pressure clamp type terminals are provided.

b. Glanding of cable and fixing of cable boxes.

Specifications

c. HT XLPE cables shall be terminated by use of heat shrink type termination kits.

d. All LT XLPE power and control cables shall be terminated through compression type gland.

e. In case of LT XLPE cables, armours shall be suitably earthed in compression type glands. For HT XLPE cables, this shall be done either in glands or by any other suitable means like bonding the armour with suitable wire and connecting same to the earth terminals inside cable box.

f. In explosion proof equipment, sealing accessories, where provided in cable box, shall be used for sealing the cable entry to the box and termination.

g. All lighting and control cables shall be provided with crimped Al / Cu Sockets before termination in junction boxes.

Crimping

h. For all power cables, crimping type Al lugs for Al cables and tinned Cu lugs for Cu cables shall be provided. These lugs shall be crimped on the cable conductors by means of special hand/ hydraulic crimping tools. Before crimping the socket inhibiting grease shall be smeared over the conductor. Conductor shall be shaped properly before sliding the socket over it. Crimping shall be done in an approved manner.

i. All the control cables, which shall be of copper conductor, shall be terminated without any

additional lugs in screwed type terminals provided in various equipments.

Jointing

j. The jointing shall be done in an approved manner. Care shall be taken not to damage the insulation when opening the cable for jointing.

k. Before commencing soldering of the socket, conductor shall be thoroughly cleaned and insulation protected. The ferrules shall be thoroughly cleaned. Ferrule and each strand of the cable shall be thoroughly sweated with solder to tin them and fill the conductor gaps to remove all air pockets. Soldering materials of approved quality as per ISS practice shall be used. Taping of the conductors shall be done in an approved manner after crimping / soldering.

l. Filling up compound and sealing the cable box shall never be done in one operation. After the first pouring of compound, it should be topped up again with compound and then sealed.

STRAIGHT THROUGH JOINTS

m. Jointing of XLPE & XLPE cables shall be done with extreme care and manufacturer's instructions shall be strictly followed. Soldering of sockets shall also be done with extreme care as indicated above.

Earth continuity wire shall be plumbed and / or clamped. Compound shall be filled according to the instructions of manufacturers of terminating kit / cable. Joints made inside trench or on rack shall be properly supported. Wherever joints are made inside ground, brick masonry work shall be done around the joint box and filled with sand, and there after covered with earth at no extra cost.

n. A tent shall be used in all circumstances where jointing work is being done outdoor, for protection against rain and to prevent dust from being blown in to exposed joints and jointing materials. Extreme care shall be taken to maintain proper phase sequence while terminating at equipment ends. Records of connection details shall be maintained. Conductors shall be shaped properly while terminating and no sharp bends shall be given. Where numbers of cables are to be connected in parallel, proper tests shall be done before connection, so that no cross connection shall be made. No phase crossings shall be allowed for making the connections.

o. Cables shall be supported adequately at the entry to cable box / equipment so that load of cable does not come on cable glands.

p. All cables shall be meggered before and after jointing and insulation values recorded.

q. While terminating at equipment end, each core shall be properly tagged with numbering ferrules as per nomenclature given in the drawings. Wires should be dressed and clamped neatly, bolting shall be done properly.

Cable Installation

Directly Buried Cables

r. Laying of under ground directly buried cables shall include excavation of earth along the cable route, laying of Hume / GI pipes for road crossing, back filling, ramming, removing of extra earth including supply of bricks, sand etc. as per drawing and instruction of

Owner / Engineer-in-Charge.

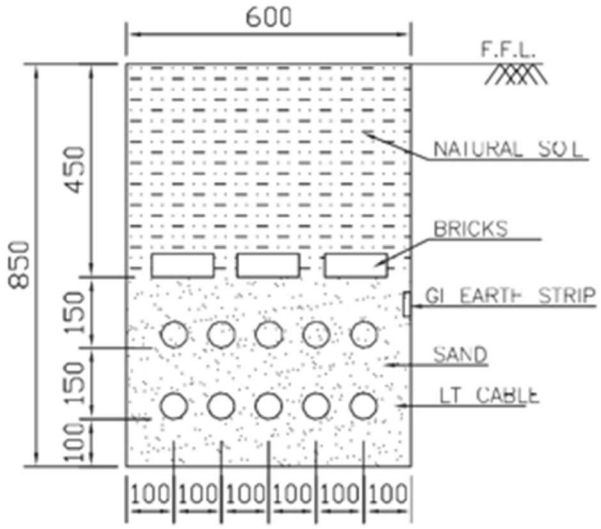
s. Where cables are directly laid into ground, trenches should be dug up to such a depth as to ensure that the depth of the top of the entire cable below the ground level is min. 750 mm for medium and low voltage cables, and min.1050 mm for high voltage cables. Before laying of cables at these trenches, bottom of the trench should be properly levelled up and all odd and sharp materials removed. Trench bottom then should be bedded with a 75 mm thick layer of sand. Approval of Owner / Engineer-in-Charge shall be taken for preparation of this bed before laying of cables. Cables shall be laid in the trenches in straight runs. Care shall be taken so that any kinds or bends are not formed. After laying of the cables, bricks shall be placed length wise on both the sides of the cables along the entire length to form trough.

t. Fill up space between bricks with sand up to height of the bricks. Then place bricks closely width wise on top of the sand layer throughout the length. Fill up loose earth in trench, ram properly to compact, remove extra earth from site. Broken bricks shall not be use for brick working. Only Class-I bricks shall be used.

u. If new cables are laid to cross existing cables, the new cable shall be laid under existing cables at depth of not less than 200 mm from the existing cable. It shall be ensured that the approach of new cable to the crossing is uniform and gradually sloped.

v. Fix cable markers at 100 Mtrs. apart and at joints on the entire cable route length of the cables. The cable markers shall be made of pre-cast concrete blocks of 300 mm x 350 mm x 350 mm size with markings of “HT CABLE”, “LT CABLE”, “Depth of Cable”, “Arrow Marks” etc. inscribed. These shall be supplied by the contractor at no extra cost and fixed as per directions of the Owner / Engineer-in-Charge. The top of the above concrete slabs shall have a smooth finish with cement only.

w. Laying of cables under road crossings etc. shall be done in pipes, and pipe ends shall be sealed with bitumen compound and sand as required after cables are laid. Backfilled soil shall be rammed thoroughly to prevent road surface cracking due to settlement of loose soil.



TYPICAL SECTION OF CABLE TRENCH
(TYPICAL SECTION WITH L.T. CABLES)

Cable Jointing and Termination

General

The scope of work shall include but not limited to the followings:

Soldering / crimping of sockets / ferrules and connections at all joints/ terminations as per specifications. Sockets shall be provided at all terminations except where pressure clamp type terminals are provided.

Glanding of cable and fixing of cable boxes.

Specifications

All LT XLPE power and control cables shall be terminated through compression type gland.

In case of LT XLPE cables, armours shall be suitably earthed in compression type glands. For HT XLPE cables, this shall be done either in glands or by any other suitable means like bonding the armour with suitable wire and connecting same to the earth terminals inside cable box.

In explosion proof equipment, sealing accessories, where provided in cable box, shall be used for sealing the cable entry to the box and termination.

All lighting and control cables shall be provided with crimped Al / Cu Sockets before termination in junction boxes.

Crimping

For all power cables, crimping type Al lugs for Al cables and tinned Cu lugs for Cu cables shall be provided. These lugs shall be crimped on the cable conductors by means of special

hand/ hydraulic crimping tools. Before crimping the socket inhibiting grease shall be smeared over the conductor. Conductor shall be shaped properly before sliding the socket over it. Crimping shall be done in an approved manner.

All the control cables, which shall be of copper conductor, shall be terminated without any additional lugs in screwed type terminals provided in various equipments.

Jointing

The jointing shall be done in an approved manner. Care shall be taken not to damage the insulation when opening the cable for jointing.

Before commencing soldering of the socket, conductor shall be thoroughly cleaned and insulation protected. The ferrules shall be thoroughly cleaned. Ferrule and each strand of the cable shall be thoroughly sweated with solder to tin them and fill the conductor gaps to remove all air pockets. Soldering materials of approved quality as per ISS practice shall be used. Taping of the conductors shall be done in an approved manner after crimping / soldering.

Filling up compound and sealing the cable box shall never be done in one operation. After the first pouring of compound, it should be topped up again with compound and then sealed.

STRAIGHT THROUGH JOINTS

Jointing of XLPE & XLPE cables shall be done with extreme care and manufacturer's instructions shall be strictly followed. Soldering of sockets shall also be done with extreme care as indicated above.

Earth continuity wire shall be plumbed and / or clamped. Compound shall be filled according to the instructions of manufacturers of terminating kit / cable. Joints made inside trench or on rack shall be properly supported. Wherever joints are made inside ground, brick masonry work shall be done around the joint box and filled with sand, and there after covered with earth at no extra cost.

Cables shall be supported adequately at the entry to cable box / equipment so that load of cable does not come on cable glands.

All cables shall be meggered before and after jointing and insulation values recorded.

While terminating at equipment end, each core shall be properly tagged with numbering ferrules as per nomenclature given in the drawings. Wires should be dressed and clamped neatly, bolting shall be done properly.

ANNEXURE-II

MAKE OF EQUIPMENTS / COMPONENTS

Sl. No.	ITEM	MAKE
1.	LT Power, Control & Earthing Cables (XLPE-A-FRLS PVC/ PVC-A-FRLS PVC)	Ravin Cables Ltd.
		KEC International Ltd. (Formerly RPG Cables Limited)
		KEI Industries Ltd.
		NICCO Corporation Ltd.
		Torrent Cables Ltd.
		Universal Cables Ltd.
2	Industrial Cable Gland	Baliga Lighting Equipments Limited
		Comet Brass Products
		Comet Industries
		Dowell's Electricals
		Electromac Industries
		FCG Flameproof Control Gears Pvt. Ltd.
		Gland-Mech. Industries
		Power Engg. Co.
		Quality & Precision Indl. Equipment
		S J Metal Industries (Jainson)
3	Cable Lugs	Dowell's Electricals
		Forward Engg. Industries
		KSE Electrical Pvt. Ltd.
		MG Electrica
		Power Engg. Co.
		S J Metal Industries (Jainson)
		Usha Martin Industries Ltd. (Ismal Divn.)
4	Heat Shrinkable End Termination Kit	Raychem RPG Ltd.
5	MCB/ELCB/RCCB	Adhunik Switchgears (P) Ltd.
		Havell's India Limited
		HPL Electric & Power Pvt. Ltd.
		Indiana Current Control Ltd.
		Indo Asian Fusegear Ltd.
		Legrand India Ltd.
		S & S Power Switchgear Ltd.
		Standard Electricals Ltd.

SCOPE OF WORK

Sl. No.	ITEM	MAKE
		Spaceage Switchgears Limited
6	Fuse	Larsen & Toubro Ltd. (El. Products Divn.)
		Siemens Ltd.
		Alstom Power
		Havells India Ltd.
7.	Contactor	Larsen & Toubro Ltd. (El. Products Divn.)
		Siemens Ltd.
8	Timers	ABB India Limited
		Alstom Power
		Alstom Limited (Areva T&D)
		Bhartia Cutler Hammer
		Siemens Ltd.
9	Push Buttons	Alstom Power
		Larsen & Toubro Ltd. (El. Products Divn.)
		Siemens Ltd.
		Tecnik
		Tulsi
10.	Terminal Blocks	Connectwell
		Elmex
		Larsen & Toubro Ltd. (El. Products Divn.)
		Siemens Ltd.
11	Signal Lamps	Alstom Power
		Binoy
		Larsen & Toubro Ltd. (El. Products Divn.)
		Siemens Ltd.
		Tulsi
12	Copper Wires-600/1100 Volts (Flexible Cable)	Anchor Electricals Pvt. Ltd.
		Finolex Cables Ltd.
		Havells India Ltd.
		Kalinga Cables & Conduit Co.
		Plaza Cable Industries Ltd.
		Polycab Wires & Cables
		TC Communication Pvt. Ltd.
13	Cable Lugs	Dowell's Electricals
		Forward Engg. Industries
		KSE Electrical Pvt. Ltd.
		MG Electrica
		Power Engg. Co.
		S J Metal Industries (Jainson)
		Usha Martin Industries Ltd. (Ismal Divn.)

Sl. No.	ITEM	MAKE
14	Earthing & Lighting Protection Material	Anand Electric Trading Co.
		Bharti Exports
		Controls & Switchgear Co. Ltd.
		Jamna Metal Company
		Jayant Metal Mfg Co.
		Mahavir Industrial Corporation
		Metalite Industries
		Metropolitan Industries
		Premier Power Products (Calcutta) Pvt. Ltd.
		Rukmini Electricals & Components Pvt. Ltd.
		Sadhana Engineering Corporation
		Sai Galvanisers & Fabricators Pvt. Ltd.
		Stealite Engg. Co.
15	GI Pipes	Bharti Exports
		Indian Tube Co. (Tata Div. Of Tubes & Pipes)
		Jindal Pipes Ltd.
		Meghjyot Enterprises
		Rukmini Electricals & Components Pvt. Ltd.
		Steelcraft
16	High Mast Lighting System & Highmast Lighting Fixtures.	Bajaj Electrical Limited
		Crompton Greaves Ltd.
		Philips India Ltd.