

**NEIGRIHMS  
NORTH EASTERN INDIRA GANDHI REGIONAL  
INSTITUTE OF HEALTH & MEDICAL SCIENCES,  
SHILLONG, MEGHALAYA**

**TENDER  
FOR  
CONSTRUCTION  
OF  
NURSES HOSTEL, INCINERATOR BUILDING  
ETC. FOR NEIGRIHMS AT SHILLONG**

**VOLUME - IV**

**TECHNICAL SPECIFICATIONS**

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## TECHNICAL SPECIFICATIONS

### CIVIL WORKS

#### 1.0 GENERAL :-

- 1.01 The specifications and mode of measurements for Civil and Plumbing works shall be in accordance with C.P.W.D. specifications 1996 Volumes I to VI.

Unless otherwise specified in the nomenclature of individual item or in the specifications, the entire work shall be carried out as per the C.P.W.D. specifications with upto date correction slips upto the date of opening of tender.

- 1.02 For the item not covered under CPWD Specifications mentioned above, the work shall be executed as per latest relevant standards/codes published by B.I.S. (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of opening of tenders.
- 1.03 In case of B.I.S. (formerly I.S.I) codes/specifications are not available, the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.
- 1.04 However, in the event of any discrepancy in the description of any item as given in the schedule of quantities or specifications appended with the tender and the specifications relating to the relevant item as per CPWD specifications mentioned above, or in drawings the former shall prevail.
- 1.05 In general the building floor to floor height is 3.5m unless specified otherwise in the drawing. The rates for different items of work shall be for up to 4.0 m floor to floor height at all levels, lifts, leads and depths of the building except where otherwise specified explicitly in the item of work or in special conditions appended with the tender. All works above the top most terrace (main ) shall be paid under the level existing below( ie machine room, mummy etc)
- 1.06 The work shall be carried out in accordance with the architectural, structural, plumbing and electrical drawings etc. The drawings shall have to be properly correlated before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.

- 1.07 All materials to be used on works shall bear I.S. certification mark unless specifically permitted otherwise in writing. In case I.S. marked materials are not available(not produced) , the materials used shall conform to I.S. code or CPWD specifications as applicable in this contract.

In such cases the Engineer shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as "First Quality" by the manufacturers shall be used unless otherwise specified. All materials shall be tested as per provisions of the Mandatory Tests in CPWD specifications and the relevant IS specifications. The Engineer may relax the condition regarding testing if the quantity of materials required for the work is small. Proper proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the satisfaction of Engineer. Grade of cement used shall be 43 /53 unless otherwise specified explicitly. The contractor shall get the Design Mix for RCC done by the labs approved by HSCC only. Reinforcement Steel used shall be of FE-415 unless otherwise specified.

- 1.08 In respect of the work of the sub-agencies deployed for doing work of electrification, air-conditioning, external services, other building work, horticulture work, etc. for this project and any other agencies simultaneously executing other works, the contractor shall afford necessary coordination and facilities for the same. The contractor shall leave such necessary holes, openings, etc. for laying / burrying in the work pipes, cables, conduits, clamps, boxes and hooks for fan clamps, etc. as may be required for the electric, sanitary air-conditioning, fire fighting, PA system, telephone system, C.C.T.V. system, etc. and nothing extra over the agreement rates shall be paid for the same.
- 1.09 Unless otherwise specified in the bill of quantities, the rates for all items of work shall be considered as inclusive of pumping out or bailing out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, subsoil water table being high or due to any other cause whatsoever.
- 1.10 Any cement slurry added over base surface (or) for continuation of concreting for bond is added its cost is deemed to have in built in the item unless otherwise/explicitly stated and nothing extra shall be payable or extra cement considered with consumption on this account.
- 1.11 The rate for all items in which the use of cement is involved is inclusive of charges for curing.
- 1.12 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer before the work is considered as complete.
- 1.13 Rates for plastering work (excluding washed grit finish on external wall surfaces) shall include for making grooves, bands etc. wherever required and nothing extra shall be paid for the same.

- 1.14 The rates quoted for all brick/concrete work shall be deemed to include making openings and making good these with the same specifications as shown in drawings and/or as directed. No extra payment shall be made to the contractor on this account.
- 1.15 Rates for all concrete/plaster work shall include for making drip course moulding, grooves etc. wherever required and nothing extra shall be paid for the same.
- 1.16 Rates for flooring work shall include for laying the flooring in strips / simple designs wherever required and nothing extra shall be paid for the same.
- 1.17 The drawing(s) attached with the tender documents are for the purpose of tender only, giving the tenderer a general idea of the nature and the extent of works to be executed. The rates quoted by the tenderer shall be deemed to be for the execution of works taking into account the "Design Aspect" of the items and in accordance with the "Construction Drawings" to be supplied to the Contractor during execution of the works.
- 1.18 The quoted rate shall be for finished items and shall be complete in all respects including the cost of all materials, labour, tools & plants, machinery etc., all taxes, duties, levies, octroi, royalty charges, statutory levies etc. applicable from time to time and any other item required but not mentioned here involved in the operations described above. The client/HSCC/Employer shall not be supplying any material, labour, plant etc. unless explicitly mentioned so.

## **2.00 ALUMINIUM DOORS AND WINDOWS :**

### **2.1 EXTENT AND INTENT:-**

The work shall be carried out through an approved specialist contractor, who shall furnish all materials, labour, accessories, equipment, tools and plant and incidentals required for providing and installing anodized/powder coated aluminium doors, windows, claddings, louvers and other items as called for on the drawings. The drawings and specifications cover the major requirement only. The supplying of additional fastenings, accessory features and other items not mentioned specifically herein, but which are necessary to make a complete installation shall be a part of this contract.

### **2.2 GENERAL:-**

Aluminium doors, windows etc. shall be of sizes, section details as shown on the drawings. The details shown on the drawings indicate generally the sizes of the component parts and general standards. These may be varied slightly to suit the standards adopted by the manufacturer. Before proceeding with any manufacturing, the contractor shall prepare and submit complete manufacturing and installation drawings for approval of the Engineer and no work shall be performed until the approval of these drawings is obtained.

### **2.3 SHOP DRAWINGS:-**

The contractor shall submit the shop drawings of doors, windows, louvers, cladding and other aluminum work, based on architectural drawings, to the Engineer for his approval. The drawings shall show full size sections of doors, windows etc. thickness of metal (i.e. wall thickness), details of construction, sub frame / rough ground profile, anchoring details, hardware as well as connection of windows, doors and other metal work to adjacent work. Samples of all joints and methods of fastening and joining shall be submitted to the Engineer for approval well in advance of commencing the work.

### **2.4 SAMPLES:-**

Samples of doors, windows, louvers etc. shall be fabricated, assembled and submitted to the Engineer for his approval. They shall be of sizes, types etc. as decided by Engineer. All samples shall be provided at the cost of the contractor.

### **2.5 SECTIONS:-**

Minimum doors and windows shall be fabricated from extruded section of profiles of detailed on drawings. The sections shall be extruded by the manufacturers approved by the Engineer. The aluminium extruded sections shall conform IS designation 63400-WP (HV9WP Old designation) with chemical composition and technical properties as per IS: 733 and IS:1285. The permissible

dimensional tolerance of the extruded sections shall be such as not to impair the proper and smooth function / operation and appearance of doors and windows.

## 2.6 FABRICATION:-

Doors, Windows, etc. shall be fabricated to sizes as shown, as shown, at factory and shall be of section, size combinations and details as shown in the Architectural Drawings. All doors, windows etc. shall have mechanical joints. The joints shall be designed to withstand a wind load of 150 kgs. Per sqm. The design shall also ensure that the maximum. All members shall be accurately machined and fitted to form hairline joints prior to assembly. The joint and accessories such as cleats, brackets, etc. shall be of such material as not to cause any bimetallic action, the design of the joints and accessories shall be such that the accessories are fully concealed. The fabrication of doors, windows, etc. shall be done in suitable sections to facilitate easy transportation, handling and installation. Adequate provision shall be made in the door and window members for anchoring to support and fixing of hardware and other fixtures as approved by the Engineer.

2.6.1 For fixed portion, the aluminium angle cleat used shall be 38mm x 38mm x 4.8mm size and minimum 50mm long. The quantity of minimum 0.9m length shall be used for 39.13 kg. of extruded sections fabricated.

2.6.2 For shutters of doors, windows and ventilators, aluminium angle cleat used shall be of the size mentioned above having minimum length of 35mm. Minimum 0.42 m length of angle cleat shall be used for 20.21 kg. of extruded sections fabricated.

No extra payment shall be made for using such quantity of cleat as mentioned in para 7.6.1 & 7.6.2 above.

## 2.7 ANODISING:-

All aluminium sections shall be anodised as per IS:7088 and to required colour if specified in the item as per IS:1868 grading as specified in item schedule after cutting the member to requisite sizes before the final assembly. Anodising to conform to specified grade with minimum average thickness of 15 microns when measured as per IS:612. The anodic coating shall be properly sealed by steams or in boiling water are cold sealing process as per IS:1868/IS:6057. Polythene tape protection shall be applied on the anodised section before they are brought to site. All care shall be taken to ensure surface protection during transportation, storage at site and installation. The tape protection shall be removed on installation. The sample will be tested in the approved laboratory and cost of samples, cost of testing, shall be borne by the contractor.

## 2.7B POWDER COATING:-

Pure polyester powder coating of 50 micron thickness shall be applied of approved shade of Goodlass Nerolac or equivalent make of powder.

2.8 PROTECTION OF FINISH:-

All aluminium members shall be wrapped with approved self adhesive non-staining PVC tapes.

2.9 HANDLING AND STACKING:-

2.9.1 Fabricated materials shall be stacked in an approved manner to protect the material against any damage during transportation. The loading and unloading shall be carried out with utmost care, on receipt of materials at site, they shall be carefully examined to detect any damaged pieces. Arrangements shall be made for expeditious replacement of damaged pieces / parts. Materials found to be acceptable on inspections shall be repacked in crates and stored safely.

2.9.2 In the case of composite windows and doors, the different units are to be assembled first. The assembled composite units should be checked for line, level and plumb before final fixing is done. Units may be serial numbered and identified as how to be assembled in their final location of situation so warrants.

2.9.3 Where aluminium comes into contact with masonry brickwork, concrete, planter or dissimilar metals, it shall be coated with approved insulation lacquer, paint or plastic tape to ensure that electro-chemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

2.9.4 The contractor shall be responsible for assembling composite, bedding and filling the groove with polysulphide sealant inside and outside, at the transoms and mullions, placing the doors, windows etc. in their respective openings. After the doors / windows have been fixed in their correct assigned position, the open hollow sections abutting masonry concrete shall be fitted with approved polysulphide sealant densely packed and neatly finished.

2.9.5 The contractor shall be responsible for doors, windows, etc. being set straight plumb, level and for their satisfactory operation after fixing is complete.

2.10 INSTALLATION:-

2.10.1 Just prior to installation the doors, windows, etc. shall be uncrated and stacked on edge on level bearers and supported evenly. The frame shall

be fixed into position true to line and level using adequate number of expansion machine bolts, anchor fasteners of approved size and manufacturer and in an approved manner. The holes in concrete / masonry members for housing anchor bolts shall be drilled with an electric drill.

- 2.10.2 The doors, windows assembled as shown on drawings shall be placed in correct final position in this opening and marks made on concrete members at jambs, sills and heads against the holes provided in frames for anchoring. The frame shall then be removed from the opening and laid aside. Neat hole with parallel sides of appropriate size shall then be drilled in the concrete members with an electric drill at the marking to house the expansion bolts. The expansion bolts shall then be inserted in the holes, struck with a light hammer till the nuts is forced into the anchor shell. The frame shall then be placed in final position in the opening and anchored to the support through cadmium plated machine screws of required size threaded to expansion bolts. The frame shall be set in the opening by using wooden wedges at supports and be plumbed in position. The wedges shall invariably be placed at meeting points of glazing bars and frames.

2.11 NEOPRENE GASKETS:-

The contractor shall provide and install Neoprene gaskets of approved size and profile at all locations as shown and as called for to render the doors, windows etc. absolutely air tight and weather tight. The contractors shall produce samples of the gaskets for approval and procure after approval only.

2.12 FITTINGS:-

Hinges, stays, handles, tower bolts, locks and other fittings shall be of approved quality and manufacturers shall be approved by the Engineer.

2.13 MANUFACTURER'S ATTENDANCE:-

The manufacturer immediately prior to the commencement of glazing shall adjust and set all windows and doors and accept responsibility for the satisfactory working of the opening frames.

2.14 MASTIC CEMENT:-

The gaps between frames and supports and also any gaps in the door and windows section shall be raked out as directed and filled with mastic cement of approved colour and make to ensure complete water tightness. The mastic cement shall be of such colour and composition that it would not stain the masonry / concrete work, shall receive paint without bleeding, will not sag and shall not set hard or dry out under any conditions of weather. The samples of mastic cement to be used for this purpose shall be got approved by the Engineer before its actual use.

2.15 DETAILS OF TESTS:-

2.15.1 The various tests on aluminium sections shall be conducted in accordance with the relevant IS codes.

2.15.2 The minimum number of tests for anodic coating and corrosion resistance shall be as given below:-

S.NO.	DETAILS	NO. OF TESTS
(i)	Doors, Windows & Ventilators	5% of Nos.

manufactured.

2.15.3 The samples of major member of each unit of doors / windows shall be selected at random by Engineer as such that all the aluminium section shall be got tested.

2.15.4 Work shall be carried out as per CPWD Specifications - 1996 Vol.I to Vol. VI with correction slips 1 to 8 unless specified.

2.16 PROTECTION & CLEANING:-

The sub-contractor shall adequately protect all components and accessories from damage during shipments, storage at job site, erection and after completion of the work. At such time as may be directed, the sub-contractor shall remove all protective tapes or coating, thoroughly clean all anodized/powder coated aluminium and glass surfaces with suitable cleaning agent, make final adjustments to all ventilators, etc. and hardware leaving all in first class working order.

2.17 SCOPE OF WORK:-

The sub-contractor shall design, supply, fabricate, deliver and install and guarantee all construction necessary to provide a complete aluminium composite panel cladding, complete with all necessary anchors, hardware and fittings to provide a total installation, fully in conformity with the requirements and intent of the drawing and specification herein.

The scope of work shall be read in conjunction with those in the specification of structural glazing.

2.18 ACCEPTANCE CRITERIA:-

The aluminium sections shall conform to the provisions of the relevant item of BOQ. For payment purposes only actual weight of sections shall be taken into account. If, however, the sectional weight of any aluminium section is higher than the permissible variation then the weight payable shall be restricted to the weight of the section including permissible variation.

Measurement : Payment by weight shall be made for aluminium sections including beading only and all fixing angles, fittings / fixtures such as handles and hinges etc. shall not be included in the weight to be paid.

- 2.19 GUARANTEE BOND : All aluminium work shall carry two years guarantee after completion of the work against water leakage, unsound material and workmanship and defective anodising as per approved proforma.

Two years guarantee in prescribed proforma must be given by the specialised firm, which shall be counter signed by the contractor, in token of his overall responsibility in addition 10% (Ten Percent) of the cost of these items would be retained as guarantee to which the performance of the work done. The cost guarantee against this item of work shall be in addition to the security deposit mentioned elsewhere in the contract form. If any defect is noticed during the guarantee period, it should be rectified by the contractor within seven days, and if not attended to, the same will be got done from another agency at the risk and cost of the contractor. However, this security deposit can be released in full, if bank guarantee of equivalent amount for two years is produced and deposited with the department.

- 2.20 Work shall be carried out as per CPWD Specifications - 1996 Vol.I to Vol. VI with correction slips 1 to 6 unless specified.

- 2.21 LIGHTENING PROTECTION:-

The structural glazing contractor shall incorporate lightning protection device. The structural glazing contractor shall install all necessary conductors, wiring connection etc. for the structural glazing. The electrical contractor will be responsible for contracting the earthing system for the lowest and top point of the structural glazing to ground level.

Proposal on the lightning protection system shall be endorsed by a qualified lightning protection engineer. The whole of the system shall be tested to ensure its compliance with the requirements as laid down in the British Standard Code of Practice CP 326:1965 at the cost of the Contractor.

- 2.22 RATES:-

- 2.22.1 The rate of the item shall include the cost of materials, T&P, Double Scaffolding and labour , water charges etc. required in all the above operations.

**3.00 CERAMIC TILE DADO**

**3.01 DESCRIPTION :**

This section covers the requirements for furnishing of all materials, labour tools and equipment for completion of ceramic tile dado including preparation of surface under layer.

**3.02 Applicable codes and standards:**

The codes and standards generally applicable to the work of this section are listed hereinafter:

IS : 8112 Ordinary Portland cement ( 43/53 grade)  
IS : 383 Coarse and fine aggregates from natural sources.  
IS : 777 Glazed Earthenware tiles.  
IS : 1489 Portland Pozzolona Cement.  
IS : 8042 White Portland Cement.

**3.03 SAMPLES:**

The contractor shall furnish samples of ceramic tiles to the Engineer well before the commencement of dado work for his approval.

**3.04 CERAMIC TILES :**

The ceramic tile slabs shall be of the approved make colour, texture and sizes conforming to IS:777. the thickness of the tiles shall be as specified in the item. A tolerance of + or - 1mm in facial dimensions and + pr - 0.5mm shall be allowed in thickness of tiles. The tiles shall be of uniform colour and shade without crazing. they shall be true to size and shape and free from cracks, twists uneven and chipped edges and corners and other defects. The underside of the tiles shall be ribbed or some other formation so that the tiles adhere properly to the base. The tiles shall have the following properties:

**3.05 SPECIFIC GRAVITY:**

The mean specific gravity shall be 2.40 gm/cu.cm with a minimum of 2.3 gm/cu.cm

**3.06 ABSORPTION OF WATER:**

The mean water absorption shall be as per relevant IS standards.

**3.07 WEAR RESISTANCE:**

The average wear by abrasion shall not exceed 3.5mm and wear on any individual specimen shall not exceed 4.0 mm.

**3.08 CEMENT:**

Ordinary cement shall be either ordinary Portland cement (53/43 grade) confirming to IS: 8112 or Portland Pozzolona Cement confirming to IS: 1489. White cement shall be white Portland cement conforming to IS: 8042. Cement shall be fresh when delivered to the site.

**3.09 FINE AGGREGATE :**

Fine aggregate shall be clear pit sand or other approved sand confirming to IS:383. It shall be free from injurious amounts of soft and flaky particles and free from vegetable, organic, clayey matter, loom, mice, salts and other deleterious substances.

3.10 WATER :

Water used for both mixing and curing shall be fresh, clean, free from oil, salt, acid, alkali or other chemicals and deleterious matter confirming to IS : 456 :1978

3.11 PREPARATION OF SURFACES :

The joints shall be raked out to a depth of atleast 15-mm in masonry wall, preferably when the masonry is being done. In case of concrete walls the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with and keep wet before skirting is commenced.

3.12 LAYING :

Unless specified otherwise in the item, 12-mm thick cement mortar shall be applied and allowed to harden. The plaster/base shall be roughened with wire brushes or by scratching diagonal at closed intervals. The tiles should be soaked in water washed clean, and a coat of cement slurry applied liberally at the back of tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines. The tiles shall be set in required pattern and jointed. The joints shall be as fine as possible. Top of dado shall be truly horizontal and joints truly vertical except where otherwise indicated. Dado shall not be fixed. These shall be cut/sawn to the required size and their edge rubbed smooth.

3.13 CURING AND FINISHING :

The joints shall be cleared off the cement grout with wire brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush jointed with white cement mixed with pigment required to match the shade of the tiles. The dado shall be kept wet and finished clean. The finished work shall not sound hollow when trapped with wooden mallet.

3.14 MEASUREMENTS :

Length and breadth shall be measured correct to a centimeter. Height shall be measured correct to a centimeter in the case of dado and 5 mm in case of riser and skirting. The area shall be calculated in SqM, correct to two places of decimal. Length and height shall be measured along the finished face of skirting or dado including curves where specials such as coves, internal and external angles and beads are used. Where cornices are used the area of dado shall be measured excluding the cornices.

Nothing extra will be paid for cutting (sawn) the tiles to sizes.

3.15 RATE :

The rate includes the cost of all materials & labour involved in all the operations described above. the specials like covers, internal & external angles, beads & cornices, where required, shall be measured & paid for separately.

**4.0 APP MODIFIED BITUMEN WATER PROOFING**

The vital physical and chemical parameters of the membrane shall be as under: -  
Joint strength in longitudinal and transverse direction at 23 Degree Celsius as 650/450 N/5cm. Tear strength in longitudinal and transverse direction as 300/250N. Softening point of membrane not less than 150 Degree Celsius. Cold flexibility shall be up to -2 Degree Celsius when tested in accordance with ASTM, D-5147. The laying of membrane shall be got done through the authorized application of the manufacturer of membrane.

Waterproofing treatment of roofs shall be executed through approved specialist agency only, using polymer modified membrane. Vertical / upturn at parapet, skirting includes cost of GI chicken wire netting including necessary extensions and overlaps. Openings for lights, grilles, other fixtures and inspection doors shall be framed to receive the respective fixtures in ceilings – horizontal or vertical faces – as required. The contractor shall submit layout & detail shop drawings for approval.

## 5.00 PLUMBING & SANITARY INSTALLATIONS

### 5.01 Wall Caps

Wall caps shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pass through them. These wall caps shall be chromium plated brass snugly fittings and shall be large enough to cover the puncture properly and shall conform to IS: 4291.

### 5.02 Pipes, Hangers, Brackets, etc.

Sturdy hangers, brackets and caddles of approved design shall be installed to support all pipe lengths, which are not embedded over their entire runs. The hangers and brackets shall be of adjustable heights and painted with red oxide primer, and two coats of enamel paint of approved make and shade. Clamps, coils and saddles shall be provided to hold pipes with suitable gaskets of approved quality. The brackets and hangers shall be designed to carry the weights of pipes safely. Wherever required pipes may run along ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:

	Vertical	Horizontal
G.I. Pipes	300 cms	240 cms
H.C.I. Pipes	180 cms	120 cms

### 5.03 Pipe sleeve

Adequate number of sleeves (pipe inserts) of Cast Iron or Mild Steel shall be provided where pipes cross through concrete, masonry and similar work. The pipe inserts shall be provided with removable timber plugs to keep foreign matter out till installation of the services pipe cross the sleeve. The diameter of sleeve should be one size higher than the proposed dia or as instructed by the Engineer.

### 5.04 Floor trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, contractor shall have a special type G.I. / M.S. inlet hopper without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and hopper inlet socket shall be lead caulked/welded/threaded. Hopper shall connected to a C.I. P or S trap with at least 50mm water seal. Floor trap inlet hoppers and traps shall be set in cement concrete 1:2:4 blocks without any extra cost.

### 5.05 C.P. gratings

Floor trap and urinal trap shall be provided with 110mm square or round C.P. grating, with rim of approved design and shape. Minimum thickness shall be 3 mm.

### 5.06 Hot Water Supply

The chase will be closed in cement mortar 1:2 ( 1 cement : 2 coarse sand). Pipes shall be clamped to the wall inside the chase.

**5.07 Making Connections**

Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manholes for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

**5.08 Water Heater/ Geysers**

Geysers shall be electrically heated storage type water heaters conforming to IS:2082-1978. The outer shell shall be of stainless steel body. The inner container shall be made from 99% pure copper and tested to 7.0 kg/cm<sup>2</sup> pressure. The geyser shall be fitted with thermostat adjustable from 35 °C to 85 °C and an indication lamp, which goes off where the temperature has reached the set level. Water heater shall be automatic pressure type water heater (with pressure release valve) with heavy gauge copper container duly tinned, thermostats, indicator lamp and glass wool insulator. the water heaters shall be fitted with pressure release valve, non-return valve and inlet and outlet stop valves as required. The insulation shall be of glasswool.

**5.09 FULLWAY BALL VALVE**

The valves shall be of full-bore type and of quality approved by the Engineer. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

## **6.00 FIRE FIGHTING WORKS:**

### **6.1 HAND APPLIANCES**

#### **1.0 Scope of work**

1.1 Work under the section shall consist of furnishing all labor, material, appliances and equipments necessary and required to install fire extinguishing hand appliances.

1.2 Without restricting to the generality of the foregoing the work shall consist of the following:

Installation of fully charged and tested fire extinguishing hand appliances CO<sub>2</sub>, Foam, Dry chemical powder type as required by these specifications and drawings.

#### **2.0 General Requirements**

2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended upto date:-

- |             |                                                                        |
|-------------|------------------------------------------------------------------------|
| a) IS 2873  | Specifications for fire extinguisher of Carbon-di-oxide                |
| b) I.S. 940 | Water gas type                                                         |
| c) IS 934   | Specifications for portable chemical fire extinguisher soda acid type. |

2.2 Fire extinguishers shall be installed as per Indian Standard "Code of practice for selection, installation and maintenance of portable first aid appliances "I.S. 2190-1962".

2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fastners.

2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

2.5 All appliances shall be fixed in a true workman like manner truly vertical and at correct locations.

## **7.0 HORTICULTURE WORKS:**

### **7.1 GRASSING**

#### **7.1.1 PREPARATION**

During period prior to planting the ground shall be maintained free from weeds.

Grading and final nevenne of the lawn shall be completed at least three weeks prior to the actual sowing. Clods of excavated earth shall then be broken upto the size not more than 75mm in any direction. The area shall then be flooded with water and after 10 days and within 15 days of flooding, weeds that re-germinate shall be uprooted carefully. The rubbish arising from this operation shall be removed and disposed of in a manner directed by Engineer. Regular watering shall be continued until sowing by dividing the lawn area into portion or approx 5 mts. Square by constructing small bunds to retain water. These 'bunds' shall be nevenn just prior to sowing of grass plants. At the time of actual planting of grass, it shall be ensured that he soil has completely settled.

Slight nevenness, ups and downs and shallow depressions resulting from the settlement of the flooded ground, in drying and from the subsequent weeding operations, shall be removed by fine dressing the surface to the final levels by adding suitable quantities of good earth brought from outside, if necessary as directed by the Engineer. In fine dressing, the soil at the surface and for 40mm depth below shall be broken down to particles of size not exceeding 6mm in any direction.

#### **7.1.2 SOIL :**

The soil itself shall be ensured to satisfaction of Engineer to be a good, fibrous loam, rich in humus.

#### **7.1.3 SOWING THE GRASS ROOTS :**

Grass roots (Cynodon dactylon or a local approved by the Engineer) shall be obtained from a grass patch, seen and approved before hand.

The grass roots stock received at site shall be manually cleaned of all weeds and water sprayed over the same after keeping the stock in a place protected from sun and dry winds.

Grass stock received at site may be stored for a maximum of three days. In case grassing for some areas is scheduled for a later date fresh stock of grass roots shall be ordered and obtained.

#### **7.1.4 EXECUTION :**

Small roots shall be debbled about 15 cms (or at other spacings as per BOQ item )apart into the prepared grounds. Dead grass and weeds shall not be planted.

Grass areas will only be accepted as reaching practical completion when germination has proved satisfactory and all weeds have been removed.

All planting is to be done in moderately dry to moist (not wet ) soil and at times when wind does not exceed a velocity of 8 kilometer per hours.

#### **7.1.5 MAINTENANCE OF LAWN**

As soon as the grass is approximately an inch high it shall be rolled with a light wooder, roller in fine, dry weather and when it has grown to 2 to 3 inches above the ground, weeds must be removed and regular cutting with the scythe and rolling must be begun. A top dressing of announce of guano to the square yard on well decomposed well broken sludge manure will help on the young grass. The scythe must continue to be used for several months until the grass is sufficiently secure in the ground to bear the mowing machine. It should be possible to use the inch above the normal level of the first two or three cuttings. That is to day the grass should be cut so that it is from 1 to 2 inches in length, instead of the  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch necessary for mature grass.

In absence of rain the lawn shall be watered every ten days heavily, soaking the soil through to a depth of at least 25 cms.

Damage failure or dying back of grass due to neglect of watering especially for seeding out of normal season shall be the responsibility of the contractor.

Any shrinkage below the specified levels during the contract or defects liability period shall be rectified at the contractor's expense.

The contractor is to exercise care in the use of rotary cultivator and mowing machines to reduce to a minimum the hazards of flying stones and brickbats. All rotary mowing machines are to be fitted with safety guards.

#### **7.1.6 ROLING :**

A light roller shall be used periodically, taking care that the lawn is not too wet and sodden. Rolling should not be resorted to, to correct the levels in case certain depressions are formed due to watering

#### **7.1.7 EDGING :**

The contractor shall establish a neat edge where planting areas meet grass areas with spade or edging tool immediately after all planting, including lawn planting, is completed. Particular care shall be exercised in edging to establish good flowing curves as shown on the plans or as directed by the Engineer. Edging must be cut regularly and shall be maintained by the contractor.

#### **7.1.8 FERTILIZING :**

The lawn shall be fed once a month with liquid manure prepared by dissolving 45 grams of ammonia sulphate in 5 litres of water.

#### **7.1.9 WATERING :**

Water shall be applied daily during dry weather. Watering whenever done should be thorough and should wet the soil at least upto a depth of 20 cms to eliminate air pockets and settle the soil.

#### **7.1.10 WEEDING :**

Prior to regular mowing the contractor shall carefully remove rank and unsightly weeds.

### **7.2 MAINTENANCE**

7.2.1 The landscape contractor shall maintain all planted area within the landscape 1 contract boundaries until the period of one year after the complete plantation. Maintenance shall include replacement of dead plants. Watering, weeding, cultivating, control of insects, fungicide and other disease by means of spraying with an approved insecticide or fungicide, pruning and other horticulture operations necessary for the proper growth of the plants and for keeping the landscape sub-contract area neat in appearance.

#### **7.2.2 PRUNING & REPAIRS**

Upon completion of planting work on the landscape sub-contract all trees should be pruned and all injuries repaired where necessary. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots and the results of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or special shape of the trees. In general, one third to one fourth branching structure of the plants to be removed to compensate the loss of roots during transplantation by thinning or shortening branches but no leaders shall be cut. All pruning shall be done with sharp tools in accordance with instructions of the consultant. Pruning cuts shall be painted with recommended paints.

#### **7.2.3 TREE GUARDS :**

Where tree guards are necessary, care should be taken to ensure that they do not impede movement or restrict growth.

#### **7.2.4 NURSERY STOCK :**

Planting should be carried out as soon possible after reaching site. Where planting must, of necessity, be delayed, care should be taken to protect the plants from pilfering or damage from people or animals. Plants with bare roots should be heeled in as soon as received or otherwise protected from dying out, and others set closely together and protected from the wind. If planting should be unpacked, the bundles opened up and each group of plants heeled in separately and clearly labeled. If for any reason the surface of the roots becomes dry the roots should be thoroughly soaked before planting.

#### **7.2.5 PROTECTIVE FENCING :**

According to local environment shrubs may have to be protected adequately from vandalism until established.

#### **7.2.6 COMPLETION :**

On completion the ground should be formed over and left tidy.

#### **7.2.7 RATE:**

The rates quoted for the horticulture items listed in BOQ shall provide for the cost involved in all the operations described above.

## **8.00 LIST OF APPROVED MAKES : CIVIL WORKS**

Sl.No.	MATERIALS	MANUFACTURERS
1.	Doors & Windows fixtures/ Fittings:	Everite, Hardima, Earl Bihari, Global, Classic
2.	Door Closer / Floor spring :	Doorking, Everite, Hardwyn, Amar D army, Hardima
3.	Aluminium Sections. :	Indal , Bhoruka, Hindalco, Jindal
4.	Clear Glass/ Clear Float Glass / Toughened Glass :	Modi, Gujrat Guardian, Tata, Saint Gobain(SG)
5.	Laminates :	Formica, Decolam, Century, Marino, National, Green Ply
6.	Synthetic Enamel Paints :	Berger (Luxol gold), Asian(Apcolite), ICI Dulux (Gloss), Nerolac (Full gloss hard drying)
7.	Oil Bound Distemper :	Asian (Tractor), Berger (Bison), Nerolac (Super Acrylic).
8.	Cement Paint :	Snowcem Plus, Berger (Durocem Extra), Nerolac (Nerozem with titanium),.
9.	Plastic Emulsion Paint :	ICI, Asian, Nerolac
10.	Other Paints/Primers :	ICI Dulux, Asian, Berger, Nerolac
11.	Cement :	OPC 43 grade conforming to BIS-8112 and approval of source by Engineer
12.	Reinforcement Steel :	TMT steel conforming to BIS-1786 and approval of source by Engineer
13.	Glass Mosaic Tiles :	Italica, Bizzaza. Pallidio
14.	Back-up Rod. :	Supreme Industries or equivalent
15.	M.S. Pipe :	Jindal Hisar, Prakash-Surya, BST, Kalinga
16.	Polysulphide sealant. :	Pidilite, Fosroc, Choskey, Chematal Rai
17.	Polycarbonate Sheets :	GE Plastics or approved equivalent
18.	Wooden/Metal Fire Check Doors :	Navair, Shakti-met, Godrej, Pacific Fire Control, Promat
19.	Gypsum Board System :	India Gypsum, Laffarge, Boral

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Sl.No.	MATERIALS	MANUFACTURERS
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20.	Sunken Portion Treatment	:	Choksey, Roffe, Krytone,Sika
21.	Admixtures for concrete.	:	Cico, Vam Organics, Roffe, Pidilite
22.	Epoxy Paint.	:	Nerolac, Shalimar or approved equivalent.
23.	Ceramic Tiles	:	Johnson, Somany, Kajaria, Spartek, Nitco, Orient
24.	Pre-Laminated Particle Board	:	Novopan, Greenlam, Kitlam, Bhutan Board.
25.	Flush Door Shutters.	:	Century, Kitply, Novapan, Green Ply
26.	Silicon Treatment	:	GE-Silicon, Pidilite, Choksey, Wacker, Forsoc
27.	Glazed Tiles	:	Bell, Somany, Johnson, Kajaria, Cera.
28.	PVC Water Stops	:	Supreme, Fixopan or approved equivalent
29.	White Cement.	:	Birla White, J.K.
30.	Powder Coating Material Pure Polyester.	:	Jotun , Berger, Goodlass Nerolac
31.	Masking Tapes	:	Suncontrol , Wonder Polymer.
32.	Stainless Steel Screws For Fabrication and fixing of Windows.:	:	Kundan , Puja , Atul.
33.	Proposed Treatment on MS Brackets.	:	:Galvanised Brackets As per IS:4759-1996 610 gms./sqm. (microns) 80-90
34.	Dash Fasteners./Anchor bolts	:	Hilti, Fischer, Bosch.
35.	Stainless Steel Bolts, Washers and Nuts.	:	Kundan, Puja, Atul.
36.	Stainless Steel Pressure Plate Screws.	:	Kundan, Puja, Atul.
37.	Stainless Steel Friction Stay.	:	Securistyle, Earl Bihari.

Sl.No.	MATERIALS	MANUFACTURERS
38.	E.P.D.M. Gaskets.	Anand Reddiplex, Enviro Seals
39.	Weather Silicon.	Dow Corning, Wacker, GE
40.	Structural Silicon at butt joints	- Do -
41.	PVC continous fillet for periphery packing of Glazings /Structural glazings.:	Roop, Anand, Forex Plastic.
42.	Floor Springs.	Doorking, Opel.
43.	Aluminium Cleat arrangement for Glazings.	Deco or approved equivalent
44.	Water proofing / Injection Grouting	Overseas Water Proofing Corporation or approved equivalent
45.	6mm thick Reflective Glass	Glaverbel, Glavermas, Saint Gobain.
46.	Door Locks.	ACME, Godrej, Harrison, Hardima, Mobil
47.	Door Seal – Woolpile Weather Strip	Anand -Reddiplex.
48.	Aluminium Grill	Decogrille and approved Equivalent
49.	Vitrified Porcelene Tiles:	Restile (Granamite- Atena), Naveen, Bell-Ceramics, Kajaria, Somani
50.	Carpets	Hollitex, Standard, Mohawk
51.	Aluminium Cladding sheets	Alstrong , Alpolic, Alucobond, Alucomat
52.	Aluminium Die-cast handles & two point locking kit	Giesse, Securistyle, Alu-alpha
53.	Stainless steel D-handles	D-line, Giesse, Dorma,Hardima
54.	Auditorium Chairs	Penworker, Suri Cine chairs, Godrej
55.	Woollen Fabric for Auditorium	ESSMA, Raymonds
56.	Stainless Steel Pipes/Flats	304 Grade

Sl.No.	MATERIALS	MANUFACTURERS
57.	Structural Steel	: Conforming to BIS 2062 and approval of source by Engineer
58.	Ready Mix Concrete	: ACC,BIRLA or approved equivalent
59.	Antistatic Epoxy Floor	: Fosrock, Beck, Famaflor, STP
60.	SBS bitumen based Self adhesive membrane Material	: Grace-Bituthene CP1.5, Texsa-Texself 1.5
61.	Acoustic Mineral Fibre	: USG-Radar, Armstrong, 21 <sup>st</sup> Century, Acostyle
62.	APP modified Bitumen water proofing membrane	: Lloyds, STP, Bitumat
63.	Hand made ceramic tiles	: Raja Tiles, Saraswathi
64.	Curtain wall	: Specialised Agency to be Approved by Engineer
65.	Fire Panic bar	: Briton, Monarch, Von-Duprin, Dorma, Mobel
66.	Ply board	: Greenply, Kitply, Century, Archid
67.	PVC Doors	: Rajshri or approved equivalent
68.	PVC Flooring	: LG, Responsive or approved equivalent
69.	SS Railing	: Mobel, D Line, Hardima
70.	Solar Water Heating System	: Arsh Solar Water Heating System or approved equivalent

**Note :**        **Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer**

**9.00 LIST OF APPROVED MAKES : PLUMBING WORKS**

S.No.	Materials	Relevant IS Code	Manufacturers
1.	Vitreous China Sanitary ware	2556	Hindustan Sanitary ware, Cera, Parryware, Neycer
2.	White Glazed Fire Clay Sink	771	Sanfire, Cera, Neycer, Hindware.
3.	Stainless Steel Sink		AMC, Orient, Suhag, Jayna, Commander
4.	Plastic seat cover of W.C	2548	Commander, Bestolite, Diplomat, Jaquar, Sona
5.	Geyser		Spherehot, Racold, Batliboi, Venus, Voltas, Usha Lexus
6.	C.P. Fittings Mixer/Pillar taps Washers, C.P. brass accessories	1795 4291/4827	Parko, Kingston, Aquaplust, Ceramix Nova
7.	Centrifugally /Sand cast iron pipes & fittings	3989/1729	R.I.F., NECO, B.C., B.I.C., ISP
8.	G.I. Pipes	1239 Part I	Jindal-Hissar, Tata, Prakash-Surya B.S.T., SAIL, Bansal
9.	G.I. Fittings	1239 Part I	Unik, K.S., Zoloto
10.	Gunmetal Valves	778	Zoloto, Leader, Sant, Kilburn
11.	Brass stop & Bib Cock	781	Zoloto, Sant, L&K, Jaquar
12.	Ball valve with floats	1703	Zoloto, Leader, Sant, Jayco
13.	Stoneware pipes & Gully Traps	651	IS Marked pipes
14.	R.C.C. pipes	458	IS Marked pipes
15.	C.I. Manhole Covers	1726	RIF, NECO, B.C. , B.I.C.
16.	Water Tank		Sintex, Polycon, Uniplas
17.	Mirror		Golden, Atul, Modi guard Gujrat Guardian
18.	Hand drier		Kopal, Automat, Euronics
19.	PVC flusing cistern		Commander, Parryware, Duralite
20.	Insulation of Hot water pipes		Vidoflex insulation, Superlon insulation or equivalent

S.No.	Materials	Relevant ISI Code	Manufacturers
21.	PVC Rain Water Pipes.		Supreme, Prince, Finolex. Oriplast
22.	C.I. pipes Class LA and fittings.		Keso-spun, supra, Electrosteel.
23.	Sluice valve / NRV		Kirloskar, IVC, Kilburn, Zoloto Castle, CIM
24.	Water supply pumps	:	KIRLOSKAR, CROMPTON, KSB, MAX FLOW
25.	Submersible pumps	:	KIRLOSKAR, GRUNDFOS, KSB, Mather & Platt
26.	UPVC/HDPE pipes & fittings	;	Finolex , Prince, Supreme
27.	Chlorinator	:	ALFA, USA, Ion exchange, Sigma DH Combine Inc.
28.	HDPE Solution tank	:	WATCON, ION EXCHANGE, Water Supply Specialist P (Ltd)
29.	C.P Flush Valves	:	Jaquar, DOCOL(Germany) marketed by GEM, Ideal Orient
30.	C.P Angle Valves(Ball valve type)	:	ITAP: Italy, Bugatti, Italy
31.	Infrared Sensor operated Faucets	:	Jaquar, AOS-Robo , Euronics,U-tec
32.	Gratings, Strainers, Cleanouts etc	:	Neer Brand (Sage Metals) or Equivalent
33.	Level controller	:	Femac or equivalent
34.	Drainage Pumps	:	Grundfos, KSB , Salmson Kirloskar
35.	Package Sewage Treatment Plant	:	Sriram, Watcon, Geo Miler & Co Ion-Exchange, JSC Unitherm
36.	Decorative bath room fittings	:	Jaquar (Florentine range), Marc (equivalent) Aquabaths (equivalent)
37.	R.O System	:	Ion Exchange, Watcon, Fontus Akar-Impex, JSC Unitherm
38.	PE-AL-PE	:	Kitec, Jindal

39 HDPE pipes and fittings : Oriplast, Polyfab

**Note :** **Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer**

**10.00 LIST OF APPROVED MAKES : FIRE FIGHTING WORKS**

S.No.	Material	Relevant ISI Code	Brand/ Manufacturers
1.	G.I./M.S. Heavy class pipe	1239/3589	Jindal-Hissar, Tata, Prakash -Surya, B.S.T., SAIL
2.	Gate Air Valve		Leader, Zoloto, Sant, SBI, Seeko
3.	Butterfly valves	13095	Audco, Keystone, Intervolve, C & R, Zoloto, Castle
4.	Portable Fire Extinguisher	2171	Minimax, Safex, Nitin, Firex, Ceasefire, Newage
5.	First aid Fire hose reels	884	Minimax, Safex, Firex, Newage
6.	Fire hose pipes	636	Newage, Safex, Jayshree, Jyoti
7.	Fire Hydrant valves	5290	Minimax, Newage, Getech, Safex, Ceasefire, Vijay, Agnice
8.	Sprinkler Heads		
a)	Pendent type		Spray safe, HD, Reliable, Grinnel
b)	Side wall type		Spray safe, Reliable
c)	Sprinkler Side wall extended through		Spray safe, HD, Reliable, Fire Protec. Co.
9.	Sluice and non return/ check valve foot valve strainer		Kirloskar, I.V.C., Kilburn, Zoloto, Leader
10.	Rubber hose 12/20mm dia		Dunlop, Good year, Jyoti
11.	Reinforced rubber lined/canvas		Newage, Jayshree, CRC
12.	Standby battery lead acid		Exide, Standard, Amco
13.	PVC Insulated Copper Conductor.		Finolex, Plaza, National
14.	Recessed/concealed type		Spraysafe., Reliable
15.	Horizontal centrifugal pumps		Kirloskar, Mather & Platt, Greaves Cotton, Max-Flow
16.	Diesel engine		Kirloskar Cummins, Ashok Leyland
17.	Electric motors		Kirloskar, GEC, Siemens, NGEF, ABB Crompton
18.	Electrical switch gear & starters		As per Electrical Works
19.	Cables		As per Electrical Works
20.	Flow meter		Scientific Equipment (P) Ltd. Hyderabad or equivalent

S.No.	Material	Relevant ISI Code	Brand/ Manufacturers
21.	Suction strainer		Leader or equivalent
22.	Vibration eliminator connectors		Resistoflex, or equivalent
23.	Single phase preventor		L & T, GEC, SIEMENS
24.	Electrical Pumps		Kirloskar, KSB, Siemens
25.	Submersible Pumps		Kirloskar, KSB, Siemens
26.	Fire Pumps		Kirloskar, Beacon, Mather & Platt

**Note :**        **Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer**

## TECHNICAL SPECIFICATIONS

### 1.00 GENERAL SCOPE OF WORK

The scope of work shall cover internal and external electrical works for proposed **Nurses Hostel at Shillong** as below / as per BOQ. The scope covers supply, installation, testing and commissioning of electrical works of the project including the following main items/systems:

- a) Internal electrification through concealed MS conduit and provide light points, fan points, socket outlets etc. including supplying, installation, testing and commissioning of light fixtures, fans etc.
- b) Providing M.V. Panels (Floor Panels) & MCB Distribution Boards including sub main wiring/cabling.
- c) Conduiting and wiring for telephone points including Main Telephone Distribution Boards (Tag Blocks), telephone outlets etc. complete with telephone cabling from tag blocks to telephone outlets.
- d) RCC/GI pipes for cable entry & road crossings.
- e) Cabling Work including making layouts, cable schedule, cable laying, Trench work, Road crossings, terminations, etc.
- f) External lighting and cabling.
- g) Earthing of electrical installation complete in all respect including earthing of OT Floors.
- h) Submission of GA drawings of electrical equipments and getting approvals from HSCC before manufacturing/fabrication.
- i) Testing and commissioning of all electrical installations
- j) Obtaining approvals from Chief Electrical Inspectors, Local Electricity Supply Authority, Telecom Department and any other statutory authorities for the complete scope.

- k) Any other works required for completion of electrical works.

## **2.00 REGULATIONS AND STANDARDS**

**2.01** The installation shall conform in all respects to Indian Standard Code of Practice for Electrical Wiring Installations IS:732-1989. It shall also be in conformity with Indian Electricity Rules and the Regulations, National Electric Code, National Building Code, CPWD specifications and requirements of the Local Electric Supply Authority. In general, all materials, equipment and workmanship shall conform to the Indian Standards, specifications and code. Some of the applicable codes/standards are as under:

- |    |                                                                                                |                    |
|----|------------------------------------------------------------------------------------------------|--------------------|
| a) | Guide for marking of insulated conductors                                                      | IS 5578            |
| b) | Guide for uniform system of marking and Identification of conductor and apparatus terminals    | IS 11353           |
| c) | Low voltage switchgear and controlgear assemblies I                                            | S 8623 Part-1 to 3 |
| d) | Degrees of protection provided by enclosures for low voltage switchgear and controlgear.       | IS 2147            |
| e) | Enclosed distribution fuseboards and cutouts for voltages not exceeding 1000V AC and 1200 V DC | IS 2675            |
| f) | Code of practice for selection, Installation and maintenance of switchgear and controlgear.    | IS10118 Part1-4    |
| g) | Low-voltage fuses for voltages not exceeding 1000V AC or 1500V DC                              | IS13703 Part-1&2   |
| h) | PVC insulated (heavy duty) electric cables                                                     | IS 1554            |
| i) | PVC insulated cables for working voltages upto and including 1100V.                            | IS 694             |
| j) | Conduit for electrical installations                                                           | IS 9537            |
| k) | Accessories for rigid steel conduits for electrical wiring                                     | IS 3837            |
| l) | Boxes for the enclosure of electrical accessories                                              | IS 5133            |
| m) | General and safety requirements for luminaries                                                 | IS 1913            |
| n) | Code of practice for earthing                                                                  | IS 3043            |
| o) | Electrical accessories – circuit breakers for                                                  | IS 8828            |

Over current protection for household and Similar installations

- |    |                                                                                                                                                         |                     |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| p) | Low voltage switchgear and controlgear                                                                                                                  | IS 13947 Part 1-5   |
| q) | Residual current operated circuit breakers                                                                                                              | IS 12640            |
| r) | Current Transformers                                                                                                                                    | IS 2705             |
| s) | Voltage Transformers                                                                                                                                    | IS 3156             |
| t) | Direct acting indicating analogue electrical measuring instruments and their accessories                                                                | IS 1248 Part-1 to 9 |
| u) | Control Switches (switching device for control and auxiliary circuits including contactor relays) for voltages upto and including 1000V ac and 1200V dc | IS 6875 Part-1 to 3 |

### **3.00 INTERNAL ELECTRIFICATION OF BUILDING**

#### **3.01 SCOPE**

As specified in subhead 1.00

#### **3.02 GENERAL**

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice for Electrical Wiring Installation IS: 732-1989 and IS: 2274-1963. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations, so far as these become applicable to the installation. Electrical work in general shall be carried out as per following CPWD Specifications with upto date amendment.

- Specifications for Electrical Works Part-I (Internal) by CPWD – 1994 or latest revision
- Specifications for Electrical Works Part-II (External) by CPWD – 1994 or latest revision
- Specifications for Electrical Works Part-III (Lift & escalators) by CPWD 2003 or latest revision
- Specifications for Electrical Works Part-IV (Substation) by CPWD – 1994 or latest revision

Wherever these specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification then the specification here under shall take precedence over the said regulations and standards.

### **3.03 DISTRIBUTION BOARDS.**

Distribution Board shall be standard type. Distribution boards shall contain miniature circuit breakers of rating specified in BOQ/DB Schedule.

Miniature circuit breakers shall be quick make and quick break type with trip free mechanism. MCB shall have thermal and magnetic short circuit protection. All miniature circuit breakers shall be of 9 KA rated rupturing capacity unless otherwise specified.

Neutral busbars shall be provided with the same number of terminals, as there are single ways on the board, in addition to the terminals for incoming mains. An earth bar of similar size as the neutral bar shall also be provided. All live parts shall be screened from the front. Ample clearance shall be provided between all live metal and the earth case and adequate space for all incoming and outgoing cables. A circuit identification card in clear plastic cover shall be provided for each distribution board.

MCB's shall be provided on the phase of each circuit. The individual banks of MCB's shall be detachable. There shall be ample space behind the banks of MCB's to accommodate all the wiring. All the distribution boards shall be completely factory wired, ready for connections. All the terminals shall have adequate current rating and size to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Earth Leakage Circuit Breaker shall be current operated type and of 30mA sensitivity unless otherwise specified. It shall also provide over-current and short circuit protection i.e. it shall be MCB-cum-RCCB (Residual Current Circuit Breaker). In case ELCB doesn't have inbuilt short circuit protection, same rating MCB have to be provided for short circuit protection along with ELCB. Cost of this MCB is deemed to be included in the cost of ELCB. ELCB shall be housed within the Distribution Board.

Before procurement of Distribution Boards, MCB's, ELCB's (incomer and outgoings) etc., the contractor has to take approval of the DB Schedule/Drawings of each DB from the HSCC's electrical engineer. The whole unit i.e. Distribution Board, MCB's, ELCB's etc. shall come from the manufactures premises/workshop. After inspection and clearance from the HSCC's electrical engineer the same may be dispatched to site for installation. However if a single component (such as ELCB or MCB or DB) is required for any reason such as replacement, increase in no. of circuits in the DB, change in the load of existing circuit, change in the total load on a particular DB etc., the same may be ordered separately but after the approval of HSCC engineer.

### **3.04 METALLIC CONDUIT WIRING SYSTEM.**

#### **3.04.1 TYPE AND SIZE OF CONDUIT.**

All conduit pipes shall be of approved gauge (not less than 16 SWG for conduits of sizes up to 32 mm diameter and not less than 14 SWG for conduit of size above 32mm diameter) solid drawn or reamed by welding finished with black stove

enameled surface. All conduit accessories shall be of threaded type and under no circumstances pin grip type accessories shall be used. The maximum number of PVC insulated 650/1100 volts grade copper conductor cable that can be drawn in conduit of various sizes shall be as per IS Code. No steel conduit less than 20mm in diameter shall be used.

#### **3.04.2 CONDUIT JOINTS.**

Conduit pipes shall be joined by means of threaded couplers, and threaded accessories only. In long distance straight run of conduits, inspection type couplers at reasonable intervals shall be provided or running threads with couplers and jamnuts shall be provided. In the later case the bare threaded portion shall be treated with anti-corrosive preservative. Threads on conduit pipes in all cases shall be between 13 mm to 19 mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories.

Cut ends of conduit pipe shall have neither sharp edges nor any burrs left to avoid damage to the insulation of conductor while pulling them through such pipes.

#### **3.04.3 PROTECTION AGAINST CONDENSATION.**

The layout of conduit should be such that any condensation or sweating inside the conduit is drained out. Suitable precaution should also be taken to prevent entry of insects inside the conduit.

#### **3.04.4 PROTECTION OF CONDUIT AGAINST RUST.**

The outer surface of conduit including all bends, unions, tees, junction boxes etc. forming part of conduit system shall be adequately protected against rust when such system is exposed to weather by being painted with two coats of oxide paint applied before they are fixed. In all cases, no bare threaded portion of conduit pipe shall be allowed. Unless such bare thread portion of conduit is treated with anticorrosive preservative or covered with approved plastic compound.

#### **3.04.5 PAINTING OF CONDUIT AND ACCESSORIES.**

After installation, all accessible surface (if any) of conduit pipes, fittings etc. shall be painted with two coats of approved enameled paint or aluminium paint as required to match the finish of surrounding wall, trusses etc.

#### **3.04.6 RECESS/CONCEALED CONDUIT.**

The chase in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of building under construction, conduit shall be buried in the wall before plastering and shall be finished neatly after erection of conduit. In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work. Entire work of chasing the wall, fixing the conduit in chases, and burring the conduit in mortar before plastering shall form part of point wiring work.

The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60cm apart or by any other approved means of fixing. Fixing of standard bends and elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with the long radius, which shall permit easy drawing in of conductors. All threaded joints of conduit pipe shall be treated with some approved preservative compound to secure protection against rust. Suitable inspection boxes to the barest minimum requirements shall be provided to permit periodical inspection and to facilitate replacement of wires, if necessary. These shall be mounted flush with the wall. Suitable ventilating holes shall be provided in the inspection box covers. Wherever the length of conduit run is more than 10 meters, then circular junction box shall be provided.

#### **3.04.7 METAL OUTLET BOXES & COVERS.**

The switch box shall be made of modular metal boxes with suitable size modular cover plates. Modular metal box shall be made of mild steel on all sides except on the front.

#### **3.04.8 ERECTION AND EARTHING OF CONDUITS.**

The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirement by means of special approved type of earthing clamp effectively fastened to conduit pipe in a workmen like manner for a perfect continuity between the earth and conduit.

#### **3.04.9 SWITCHES.**

All 5 and 15 Amp switches shall be modular type of 240 volts A.C. grade. All switches shall be fixed on modular metal boxes. All 5 Amp socket shall be 5 pin type and 15 Amp socket shall be 6 pin type (unless otherwise specified) suitable for 15/5 Amp. All modular switches, sockets, telephone outlets, etc. shall be in off white finish unless otherwise approved. The switches controlling the lights or fans shall be connected to the phase wire of the circuit. Switch boards shall be located at 1200 mm above finished floor level unless otherwise indicated on drawings or directed by HSCC's electrical engineer.

In case of computer power points, power points, telephone points etc. to be fixed on laminated partition board (furniture), same shall be fixed on laminated board (portion of laminated board meant for fixing power points) with base plate/cover plate as applicable, duly fixed with screws.

#### **3.04.10 COVER PLATE.**

All modular switches, sockets, telephone outlets, Nurses call push, etc. shall be fixed modular metal boxes with modular base plates and modular cover plates on top.

### 3.04.11 WALL SOCKET PLATE.

Each outlet shall have a switch located beside the socket preferably on the same cover plate/modular base. The earth terminal of the socket shall be connected to the earth wire.

### 3.05 WIRING.

All PVC insulated copper conductor wires shall conform to relevant IS Codes. All wires/cables shall be stranded type irrespective of its size. Cable conductor size and material shall be specified in BOQ.

All internal wiring shall be carried out with PVC insulated wires of 650/1100 volts grade. The circuit wiring for points shall be carried out in looping in system and no joint shall be allowed in the length of the conductors. Circuit wiring shall be laid in separate conduit originating from distribution board to switch board for light/fan. A light/fan switchboard may have more than one circuit but shall have to be of same phase. Looping circuit wiring shall be drawn in same conduit as for point wiring. Each circuit shall have a separate neutral wire. Neutral looping shall be carried out from point to point or in light/fan switchboards. A separate earth wire shall be provided along with circuit wiring for each circuit. For point wiring red/yellow/blue colour wire shall be used for phase and black colour wire for neutral. Circuit wiring shall be carried out with red, yellow or blue colour PVC insulated wire for RYB phase wire respectively and black colour PVC insulated wire for the neutral wires. Bare copper wire shall be used as earth continuity conductor and shall be drawn along with other wires. No wire shall be drawn into any conduit until all work of any nature, that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire.

Before the wires are drawn into the conduit, the conduits shall be thoroughly cleaned of moisture, dust and dirt. Drawing and jointing of copper conductor wires and cables shall be as per CPWD specifications.

Maximum number of PVC insulated 650/1100 V grade aluminium/copper conductor cable conforming to IS : 694 - 1990

Nominal Cross-Sectional area of conductor in Sq.mm.	25mm		32mm		38mm		51mm		64mm	
	S	B	S	B	S	B	S	B	S	B
1	4	5	6	7	8	9	10	11	12	13
1.5	10	8	18	12	-	-	-	-	-	-
2.5	8	6	12	10	-	-	-	-	-	-
4	6	5	10	8	-	-	-	-	-	-
6	5	4	8	7	-	-	-	-	-	-
10	4	3	6	5	8	6	-	-	-	-
16	2	2	3	3	6	5	10	7	12	8
25	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	3	2	6	5	8	6

50	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	4	3	5	4

**NOTE :**

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
3. Conduit sizes are the nominal external diameters.

**3.05.1 JOINTS.**

All joints shall be made at main switches, distribution board socket and switch boxes only. No joint shall be made in conduits and junction boxes. Conductors shall be continuous from outlet to outlet.

**3.05.2 LOAD BALANCING**

Balancing of circuits in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

**3.05.3 COLOUR CODE FOR CIRCUIT WIRING.**

Colour code for circuit and sub main wiring installation shall be strictly followed. The colors to be followed are Red, Yellow, and Blue for R, Y & B phases respectively. Black for neutral and green for earth incase of insulated earth wire.

**3.05.4 CLASSIFICATION OF POINTS.**

**3.05.4.1 General**

Classification and measurement of Point wiring shall be as per CPWD specification for Electrical Works (Part-I-Internal) 1994.

**3.05.4.2 Point Wiring (Modular)**

**Definition of point wiring**

A point (other than socket outlet point) shall include all work necessary in complete wiring to the light points/fan/exhaust fan/call bell point from the controlling switch/MCB. The scope of wiring for a point shall, however, include the wiring work necessary in tapping from another point in the same distribution circuit i.e. from first switch board (wiring from distribution board to first switch box is covered in the circuit wiring and is not in the scope of point wiring) to subsequent switch board(s) in the same distribution circuit. The point wiring includes all materials specified below including chasing the wall (in case of recessed wiring in wall), fixing the conduit and

making the wall good as it originally was. It also includes supply, drawing, testing and commissioning of wires.

### **Scope of point wiring**

Following shall be deemed to be included in point wiring.

- (a) Supply & fixing conduit & conduit accessories for the same and wiring cables (including supplying and drawing wires) between the switch box and the point outlet. [See also (i) below]
- (b) All fixing accessories such as clips, nails, screws, phil plug, rawl plug etc. as required.
- (c) Modular Metal boxes for control switches, regulators, sockets etc. recessed or surface type, modular base plates and modular cover plates over the same.
- (d) Fan Box in slab with hook & cover, Outlet boxes, junction boxes, pull-through boxes etc..
- (e) In case of recessed wiring in wall the scope includes chasing of wall, fixing the conduit and making the wall good as it originally was.
- (f) Control modular switch (5/6A) as specified.
- (g) Ceiling rose or connector (in case of points for ceiling/exhaust fan point, prewired light fittings and call bells).
- (h) Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.
- (i) Interconnecting wiring between points on the same circuit, in the same switch box or from another. Interconnecting wiring from first switchboard to subsequent switch board(s).
- (j) Protective (loop earthing) conductor (as specified in the BOQ) from one metallic switch box to another in the distribution circuits, and from switchboard to each point (light/fan/exhaust fan/call bell etc) and DB to switch board with circuit wiring.
- (k) Bushed conduit where wiring cables pass through wall etc.
- (l) Ceiling rose (in the case of pendants except stiff pendants).
- b) Lamp holder (in the case of goose neck type wall bracket, batten holder and fittings which are not prewired).
- c) Back Plate (in the case of stiff pendants).

Note: - In the case of call bell points the words “from the controlling switch or MCB” shall be read as “from the ceiling rose/ switch box meant for connection to bell push”.

### **Measurement of Point Wiring (other than socket outlet points)**

- i) There shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting,
- ii) No separate measurement shall be made for interconnections between points in the same distribution circuit and for the circuit protective (loop earthing) conductors between metallic switch boxes or Fixtures.

### **3.05.4.3 Circuit and Submain Wiring**

#### **Circuit Wiring**

Circuit wiring shall mean the wiring from the distribution board upto the tapping point for the nearest first point of that distribution circuit i.e. upto the nearest first switch box alongwith earth wire.

#### **Submain Wiring**

Submain wiring shall mean the wiring from one main/distribution switchboard to another along with earth wire.

#### **Measurement of circuit wiring and submain wiring**

- (i) Circuit and submain wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all lengths from end to end of conduit, exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included in the measurement.
- (ii) The length of circuit wiring with two wires shall be measured from the distribution board to the first nearest switch box in the circuit irrespective of whether neutral conductor is taken to switch box or not.
- (iii) When wires of different circuits are grouped in a single conduit, the same shall be measured on linear basis depending on the actual number and size of wires run.
- (iv) When circuit wires and wires of point wiring are run in the same conduit, circuit wiring shall be measured on linear basis depending on the actual number and sizes of wires run in the existing conduit.
- (v) Protective (loop earthing) conductors, which are run along the circuit wiring and submain wiring, shall be measured on linear basis and paid separately. This is not applicable if protective conductor is clubbed with the BOQ item of circuit and submain wiring.

### **3.05.4.4 Power Plug Wiring**

#### **5A Plug Wiring**

Wiring for all 5 A Socket Outlets shall be done with 2X1.5 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, from the switchboard or 15A power point as the case may be.

Measurement of 5A point wiring shall be done on number basis (or as mentioned in schedule) from switchboard/15A power point to 5A point. Conduit of point wiring/power point wiring can also be used for 5A point wiring, butt both phase and neutral wires shall come directly from switchboard/power point. Looping of neutral shall not be done.

### **15A Power Plug Wiring**

Wiring for all 15 A Socket Outlets/Geyser point shall be done with 2X4 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, directly from the MCB-Distribution Board or from one power point to another in case of computer power points. Looping shall not be done in general 15A power points (other than computer power points).

Measurement of power point wiring shall be done on number basis under following two subheads (as mentioned in schedule):

- i) Directly from MCB-Distribution Board to the Socket Outlets
- ii) From one Power point to other ( To be used only if it is specified in the drawings).

### **Wiring for 20A Metal Clad Socket Outlets**

Wiring for all 20A Metal Clad Socket Outlets shall be done with 2X6 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, directly from the MCB-Distribution Board. Measurement of wiring for 20A Metal Clad Socket outlet shall be done on number basis i.e. complete wiring directly from MCB-Distribution Board to the socket outlet.

No extra payment shall be made on account of minor changes in location of power points (15A or 20A or computer power points) due to change in the architectural layout or change due to any other reason. Height of the power socket outlets shall be 300mm from the finished floor level unless otherwise specified.

### **3.05.5 CONDUCTOR SIZE.**

Wiring shall be carried out with following sizes of PVC insulated stranded single core copper conductor wire/cable.

- i. Light point. - 1.5Sq.mm
- ii. Ceiling /Cabin/Exhaust Fan Point - 1.5Sq.mm
- iii. Call Bell Point - 1.5Sq.mm
- iv. Plug Point (5 A Outlet) - 1.5Sq.mm
- v. Circuit Wiring - 1.5Sq.mm
- vi. General Power Point - 4Sq.mm
- vii. 20A Industrial Socket Outlet – 4 Sqmm
- viii. Special Power Point – 6 Sqmm

### **3.06 LIGHTING FIXTURE AND FANS**

#### **3.06.1 GENERAL**

- a. The Contractor shall supply and install lighting fixtures including but not limited to lamps, ballasts, accessories fixing hardware necessary for installations, as shown on the Drawings, as required, and as herein specified.
- b. All fixtures shall be delivered to the building complete with suspension accessories, canopies, hanging devices, sockets, holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc. all wired and assembled as indicated.
- c. Full size shop detail drawings of special fixture or lighting equipment, where called for in the fixtures schedule, shall be submitted to the Engineer in-charge for approval.
- d. Fixtures, housing, frame or canopy, shall provide a suitable cover for fixture outlet box or fixture opening.
- e. Fixtures shall comply with all applicable requirements as herein outlined unless otherwise specified or shown on the Drawings.
- f. Manufacturer's name and catalogue number of light fixtures, fans, switchgears etc. shall be strictly adhered.
- g. Fixtures shall bear manufacturer's name and the factory inspection label.
- h. Fixtures shall be completely wired and constructed to comply with the IEE wiring regulations requirements for lighting fixtures, unless otherwise specified.
- i. Revamping the fixture shall be possible without having to remove the fixture from its place.
- j. Lamps of the proper type, wattage and voltage rating shall be furnished and installed in each fixture.

#### **3.06.2 INSTALLATION**

Fixtures shall be installed at mounting heights as detailed on the Drawings or as instructed on site by the HSCC engineer.

Pendent fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation.

Flush mounted recessed fixtures, shall be installed so as to completely eliminate leakage of light within the fixture and between the fixture and adjacent finish.

Fixtures mounted outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Hickeys or extension pieces shall be installed where required to facilitate proper installation.

Fixtures located on the exterior of the building shall be installed with non-ferrous metal screws finished to match the fixtures.

### **3.06.3 LAMPS-GENERAL**

Lamp shall be supplied and installed in all lighting fixtures listed in the BOQ.

Lamps used for temporary lighting service shall not be used in the final fixture units.

Lamps shall be of wattage and type as shown in the BOQ.

Lamps for permanent installation shall not be placed in the fixtures, until so directed by the Engineer In-charge.

### **3.06.4 BALLASTS-FLUORESCENT**

Ballasts shall be electronic type and having high power factor type.

Ballasts shall have manufacturer's lowest sound level and case temperature rise rating.

Ballasts shall be special cool operated type.

Ballasts for indoor fixtures shall be protected by an integral thermal automatic resetting protective unit, which shall disconnect the ballast in the event of overheating.

Ballasts shall be of the same manufacture as the lamps/fixture.

### **3.06.5 FIXTURE SAMPLES**

Detailed catalogue for all fixtures or if so required by the Engineer In-charge sample fixtures shall be submitted for prior approval of the Engineer In-charge before orders for the fixtures are placed.

### **3.06.6 TESTING**

After all lighting fixtures are installed and are connected their respective switches, test all fixtures to ensure operation on their correct switch in the presence of the engineer.

All non-operating fixtures or ones connected to the wrong or inconveniently located switch shall be correctly connected as directed by the Engineer In-charge.

### **3.07 CEILING FANS**

All ceiling fans shall be provided with suspension arrangement in the concrete/slab/roof members. Contractor to ensure that provision are kept at appropriate stage at locations shown on the drawing. Fan box with MS hook (to be provided under civil works) shall be as per CPWD specification. Ceiling fan shall be double ball bearing type, copper wound motor complete with canopy, down rod, blades etc. and shall conform to relevant IS standards ceiling fan shall be white in colour unless otherwise specified. Ceiling fan shall be provided with electronic regulator. Electronic Regulator shall be suitable for 240 volts A.C supply 50 Hz and shall be of continuous duty type

### **3.08 EXHAUST FANS**

Exhaust fans shall be heavy-duty type with double ball bearing and conforming to IS 2312 (latest revision). Exhaust fan shall be complete with copper wound motor, capacitor, Louver/shutter, frame and mounting bracket. Exhaust fan shall be suitable fan operation on 240 volts single phase A.C supply.

## **4.0 MV PANELS**

### **4.1 GENERAL**

Main/Sub Distribution Panels shall be indoor type, metal clad, floor mounted, free standing, totally enclosed, extensible type, air insulated, cubicle type for use on 415 Volts, 3 phase, 50 cycles system.

### **4.2 CONSTRUCTION**

Main/Sub Panels shall be :

- i. Of metal enclosed, indoor, floor mounted, free standing construction (unless otherwise specified) type.
- ii. Made up of the requisite vertical sections, which when coupled together shall form continuous dead front switchboards.
- iii. Provide dust and damp protection.
- iv. Be readily extensible on both sides by the addition of vertical sections after removal of the end covers in case of Main Panels.

Main/Sub Panels shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses, as the effects of humidity, which are likely to be encountered in normal service.

Each vertical section shall comprise of :

- i. A front-framed structure of rolled/folded sheet steel channel section, of minimum 2 mm thickness, rigidly bolted together. This structure shall house

the components contributing to the major weight of the equipment, such as circuit breaker cassettes, moulded case circuit breaker, main horizontal busbars, vertical risers and other front mounted accessories. The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 2 mm thickness and 100 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

- ii. A rear cable chamber housing the cable end connections, and power/control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling, and adequate safety for working in one vertical section without coming into accidental contact with live parts in an adjacent section.
- iii. A cover plate at the top of the vertical section, provided with a ventilating hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1 mm diameter perforations to prevent entry of vermin.
- iv. Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.

The height of the panels should not be more than 2200 mm for main LT Switchgear Panels and 2000 mm for other MV Panels. Operating handle of breaker in top most compartment shall not be higher than 1800 mm. The total depth of the panel should be adequate to cater to proper cabling space and should not be less than 350mm.

Doors and covers shall be of minimum 2mm thick sheet steel. Sheet steel shrouds and partitions shall be of minimum 1.6 mm thickness. All sheet panels shall be smoothly finished, leveled and free from flaws. The corners should be rounded. The apparatus and circuits in the power control centers (panels) shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.

Apparatus forming part of the Main/Sub Panels shall have the following minimum clearances.

- i. Between phases - 32 mm
- ii. Between phases and neutral - 26 mm
- iii. Between phases and earth - 26 mm
- iv. Between neutral and earth - 26 mm

When, for any reason, the above clearances are not available, suitable insulation shall be provided. Clearances shall be maintained during normal service conditions.

Creepage distances shall comply with those specified in relevant standards.

All insulating material used in the construction of the equipment shall be of non-hygroscopic material, duly treated to withstand the effects of the high humidity, high temperature tropical ambient service conditions.

Functional units such as circuit breakers and moulded case circuit breakers shall be arranged in multi-tier formation, except that not more than two air circuit breakers shall be housed in a single vertical section. Cable entry for various feeders shall be from the rear. Panel shall be suitable for termination of busduct for incoming breakers.

Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

- i. Main busbars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
- ii. Cable termination of one functional unit, when working on those of adjacent unit/units.

All doors/covers providing access to live power equipment/ circuits shall be provided with tool operated fasteners to prevent unauthorized access.

Provision shall also be made for permanently earthing the frames and other metal parts of the switchgear by two independent connections.

#### **4.3 METAL TREATMENT & FINISH**

All steel work used in the construction of the Main/Sub Panels should have undergone a rigorous metal treatment process as follows:-

- i. Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.
- ii. Pickling in dilute sulphuric acid to remove oxide scales & rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.
- iii. A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.
- iv. Passivating in de-oxalite solution to retain and augment the effects of phosphating.
- v. Drying with compressed air in a dust free atmosphere.
- vi. Panel shall be powder coated with epoxy based powder paint after the above process so as to render the material suitable for corrosive environment.
- vii. Paint shade shall be Pebble (light) gray, shade no 31 of IS5 unless otherwise specified.

#### **4.4 BUSBARS**

The busbars shall be air insulated and made of high conductivity, high strength aluminium alloy complying with the requirement of IS-5082.

The busbars shall be suitable braced with non-hygroscopic SMC supports to provide a through fault withstand capacity of 50kA RMS symmetrical for one second and a peak short circuit withstand capacity of 105KA for main LT Switchgear Panels and 25kA RMS symmetrical for one second for other MV Panels. The neutral as well as the earth bar should be capable of withstanding the above level. Ridges shall be provided on the SMC supports to prevent tracking between adjacent busbars. Large clearances and Creepage distances shall be provided on the busbar system to minimize possibilities of fault.

The Main/Sub Panels shall be designed that the cables are not directly terminated on the terminals of breaker etc. but on cable termination links. Capacity of aluminium busbars shall be considered as 0.8 Amp per sqmm. of cross sectional area of the busbar. The main busbars shall have continuous current rating throughout the length of Panels. The cross section of neutral busbars shall be same as that of phase busbar for busbars of capacity upto 200Amp; for higher capacity the neutral busbar shall not be less than half (50%) the cross section of that the phase busbars. The busbar system shall consist of main horizontal busbar and auxiliary vertical busbars run in busbar alley/chamber on either side in which the circuit could be arranged/connected with front access.

Connections from the main busbars to functional circuit shall be arranged and supported to withstand without any damage or deformation the thermal and dynamic stresses due to short circuit currents. Busbars to be colour coded with PVC sleeves.

#### **4.5 SWITCHGEARS**

Refer subhead 5.00 – LT switchgears

#### **4.6 CABLE TERMINATIONS**

Cable entries and terminals shall be provided in the Main/Sub Distribution Panels to suit the number, type and size of aluminium conductor power cables and copper conductor control cable specified.

Provision shall be made for top or bottom entry (or as per site requirement) of cables as required. A cable chamber 150 mm. high shall be provided at the bottom through out the length and depth of the MDB/SDB. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated.

Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.

Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.

#### **4.7 LABELS**

Labels shall be anodized aluminium with white engraving on black background shall be provided for each incoming and outgoing feeder of Main/Sub Distribution Panels.

#### **4.8 TEST AT MANUFACTURES WORK**

All routine tests specified in IS: 8623-1977 shall be carried out and test certificates submitted.

#### **4.9 TESTING AND COMMISSIONING**

Commissioning checks and tests shall be included all wiring checks and checking up of connections. Primary/secondary injection tests for the relays adjustment/setting shall be done before commissioning in addition to routine meggar test. Checks and tests shall include the following.

- a) Operation checks and lubrication of all moving parts.
- b) Interlocking function check.
- c) Insulation test: As per CPWD Specifications.
- d) Trip tests & protection gear test.

#### **PUSH BUTTONS**

Push buttons shall be:

- i) Of the momentary contact, push to actuate type rated to carry 10A at 240V AC and 1A (inductive breaking) at 220V DC.
- ii) fitted with self reset, 2 NO. and 2NC contacts.
- iii) provided with integral escutcheon plates marked with its function.

'Start', 'Open', 'Close' push buttons shall be green in colour.

'Stop' push buttons shall be red in colour.

All other push buttons shall be black in colour.

'Emergency stop' push buttons shall be of the lockable in the pushed position type and shall be shrouded to prevent accidental operation. Key shall not be required for the operation of the push button.

## **5.00 SWITCHGEARS**

### **5.01 MOULDED CASE CIRCUIT BREAKERS.**

#### **5.01.01 GENERAL**

Moulded Case Circuit Breaker shall be incorporated in the Main/Sub Distribution Boards wherever specified. MCCBs shall conform to IS 13947 (Part 2) & IEC 947 (2) in all respects. MCCBs shall be suitable either for single-phase AC 230 volts or three phase 415 volts.

#### **5.01.02 FRAME SIZES**

The MCCBs shall have the following frame sizes subject to meeting the fault level.

- |    |                       |       |             |
|----|-----------------------|-------|-------------|
| a. | Upto 100A rating      | ..... | 100A frame. |
| b. | Above 100A upto 200A  | ..... | 200A frame. |
| c. | Above 200A upto 250A  | ..... | 250A frame. |
| d. | Above 250A upto 400A  | ..... | 400A frame. |
| e. | Above 400A upto 630Aq | ..... | 630A frame. |
| f. | Above 630A to 800A    | ..... | 800A frame. |

#### **5.01.03 CONSTRUCTIONS**

The MCCB's cover and case shall be made of high strength heat treatment and flame retardant thermo-setting insulating material. Operating handle shall be quick make/quick break, trip-free type. The operating handle shall have suitable "ON", "OFF" "and" "tripped" indicators. Three phase MCCBs shall have common operating handle for simultaneous operation and tripping of all the three phases. MCCBS shall be provided with rotary handle.

Suitable extinguishing device shall be provided for each contact. Tripping unit shall be of thermal magnetic or static release type provided in each pole & connected by a common trip bar such that tripping of any pole operates all three poles to open simultaneously. MCCB shall be current limiting type.

Contact trips shall be made of suitable air resistant, silver alloy for long electrical life. Terminals shall be of liberal design with adequate clearance.

#### **5.01.04 BREAKING CAPACITY**

Unless otherwise specified, rated service breaking capacity of the Moulded Case Circuit Breakers shall be :

- |   |                          |   |       |
|---|--------------------------|---|-------|
| - | Upto 63 Amps rating      | : | 25 kA |
| - | Above 63A and upto 400 A | : | 35 kA |
| - | Above 400A               | : | 50 kA |

However breaking capacity of all MCCB's in the Main LT Switchgear Panels (Normal Supply & Emergency Supply) shall be minimum 50kA.

#### **5.01.05 TESTING**

- a. Original test certificate of the MCCB as per Indian Standards (IS) 315-C-8370 shall be furnished.
- b. Pre-commissioning tests on the Main Distribution/Sub Distribution Board incorporating the MCCB shall be done as per standard.

#### **5.02 SWITCH DISCONNECTOR FUSE UNITS**

The Switch Disconnecter Fuse Units shall be double break type suitable for load break duty (AC 23) quick make and break action. Hinged doors shall be duly interlocked with operating mechanism so as to prevent opening of the door when the switch is in 'ON' position and also prevent closing of the switch when the door is not properly secured. All contacts incoming and outgoing terminals of switch shall be adequately sized to receive proper size of cables. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall be in accordance with IS 13703-1&2-1993 and having rupturing capacity of not less than 31 MVA at 415 volts. HRC fuse links shall be provided with visible indicators to so that they have operated. The switch disconnecter fuse units shall be manufactured in accordance with IS 13947-3-1993.

#### **FUSE**

Fuse shall be of the high rupturing capacity (HRC) fuses links and shall be in accordance with IS 13703-1&2-1993 and having rupturing capacity of not less than 31 MVA at 415 volts. The backup fuse rating for each motor/equipment shall be chosen as the fuse does not operate on starting of motors/equipments.

#### **5.03 MEASURING INSTRUMENTS, METERING & PROTECTION**

##### **5.03.01 GENERAL**

Direct reading electrical instruments shall be in conformity with IS 1248. The accuracy of direct reading shall be 1.0 for voltmeter and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The errors due to variations in temperature shall be limited to a minimum. The meter shall be suitable for continuous operation between -10 degree Centigrade to + 50 degree Centigrade. All meters shall be of flush mounting type of 96mm square or circular pattern. The meter shall be enclosed in a dust tight housing. The housing shall be of steel or phenolic mould. The design and manufacture of the meters shall ensure the prevention of fogging of instrument glass. Instruments meters shall be sealed in such a way that access to the measuring element and to the accessories within the case shall not be possible without removal of the seal. The meters shall be provided with white dials and black scale markings.

The pointer shall be black in colour and shall have zero position adjustment device which could be operated from outside. The direction of deflection shall be from left to right.

Suitable selector switches shall be provided for all ammeters and voltmeters intended to be used on three-phase supply.

The specifications herein after laid down shall also cover all the meters, instrument and protective devices required for the electrical work. The ratings type and quantity of meters, instruments and protective devices shall be as per the schedule of quantities.

#### **5.03.02 AMMETERS**

Ammeters shall be moving iron or moving coil type. The moving part assembly shall be with jewel bearing. The jewel bearing shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks, the ammeters shall be manufactured and calibrated as per the latest edition of IS:1248. Ammeters shall be instrument transformer operated, and shall be suitable for 5A secondary of instrument transformer. The scales shall be calibrated to indicate primary current, unless otherwise specified. The ammeters shall be capable of carrying sustained overloads during fault conditions without damage or loss of accuracy.

#### **5.03.03 VOLTMETERS**

Voltmeter shall be of moving iron or moving coil type. The range for 415 volts, 3 phase voltmeters shall be 0 to 500 volts. Suitable selector switch shall be provided for each voltmeter to read voltage between any two lines of the system. The voltmeter shall be provided with protection fuse of suitable capacity.

#### **5.03.04 CURRENT TRANSFORMERS**

Current transformers shall be in conformity with IS: 2705 (Part I, II & III) in all respects. All current transformers used for medium voltage applications shall be rated for 1kV. Current transformers shall have rated primary current, rated burden and class of accuracy as required. However, the rated acceptable minimum class of various applications shall be as given below:

Measuring : Class 0.5 to 1

Protection : Class 5P10.

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 50KA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identification of poles. Separate CT shall be provided for measuring instruments and protection relays. Each C.T. shall be provided with rating plate.

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CT's shall be copper

conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

#### **5.04 MISCELLANEOUS**

Control switches shall be of the heavy-duty rotary type with escutcheon plates clearly marked to show the operating position. They shall be semi-flush mounting with only the front plate and operating handle projecting.

Indicating lamps shall be of the filament type of low watt consumption, provided with series resistor where necessary, and with translucent lamp covers, bulbs & lenses shall be easily replaced from the front.

Push buttons shall be of the momentary contact, push to actuate type fitted with self-reset contacts & provided with integral escutcheon plates marked with its functions.

#### **6.00 TELEPHONE SYSTEM**

##### **6.01 Wiring (Internal & External Telephones)**

- (a) The point wiring shall be carried out with Double pair telephone wire/cable, unarmoured, PVC insulated, 0.61 mm dia annealed tinned copper conductor (IS: 2532-1965) in suitable size conduit (one pair always remaining spare for one point)

Minimum Dia of Conduit for Internal/External Telephone Wiring - 20mm.

If more than one telephone point has to be provided at one point, multicore, unarmoured telephone cable shall be used (pairs required are equal to 2 No. of points) in suitable size of conduit.

- (b) The point shall commence from the main telephone tag box/sub tag box and would terminate at outlet box of point. Connection at both ends included in point wiring.
- (c) Fixing of conduit, conduit accessories draw out boxes and outlet box etc. in concealed/surface conduit works as that of wiring for light fixtures shall be applicable for telephone wiring conduit system also.
- (d) Joint in telephone wiring (between main tag box/sub tag box and outlet box of point) shall not be allowed and the contractor should bear the wastages of wire if resulted due to this special requirement of telephone system.
- (e) External/Internal telephone and intercom wiring can be drawn in the same conduit, provided after drawing wires, 50% of conduit cross sectional area is free. However, independent PVC insulated telephone wire of suitable pairs shall be used for external, internal and intercom.

- (f) To identify each pair of multipair telephone wire/cable, PVC indication numbers shall be put on both end of pair just before termination.

### **6.02 Measurement of Telephone Point Wiring:**

There shall be a linear measurement for telephone point wiring. These shall be measured on meter basis. Wiring for each jack type telephone outlet shall be done directly from the Telephone Tag Block of that floor/area.

### **6.03 Telephone Tag Boxes**

These shall be of MS sheet 2 mm thick with connector suitable for telephone connection (as approved by ITI). It shall have hinged MS sheet cover.

## **7.00 SITE TEST**

### **7.01 GENERAL**

1. Verification for completion of equipment, physical damage/deformities.
2. Alignment of panel, interconnection of busbars & tightness of bolts & connection etc.
3. Interconnection of panel earth busbar with plant earthing grid.
4. Inter panel wiring between transport sections.
5. Cleaniness of insulators and general Cleaniness of panel to remove traces of dust, water etc.

#### **7.01.1 CIRCUIT BREAKER & PANEL**

1. Check for free movement of circuit breaker, lubrication of moving part & other parts as per manufacturers manual.
2. Manual/Electrical operations of the breaker and Functional test as per drawings.
3. Meggar before the Hi Pot test.
4. H.T. Test (At Factory)- Hi Pot test (Power frequency withstand test for one minute at 28kV RMS). At site Hi Pot test is carried out at 80% of 28kV RMS value.
5. Meggar after the Hi Pot test.

6. CT/PT ratio/polarity primary injection test.
7. Secondary injection test on relays to practical characteristics.

## **8.00 ROAD LIGHTING**

### **8.1 GENERAL**

Road lighting shall be done by 4 metre high Post Top Lanterns. The poles shall be provided along the internal roads and pathways. The light shall be on emergency supply as indicated in the respective control wiring layouts.

### **8.2 Luminaire**

The luminaire shall be as specified in schedule. The luminaire shall be suitable to house high pressure mercury vapour lamp or high pressure mercury vapour lamp or a blended light lamp or Sodium Vap. Lamps or as specified in Boq. & shall be of standard make as specified in list of approved makes.

### **8.3 Looping box**

- (i) A looping box shall be provided with every pole having underground cable connection.
- (ii) The looping box shall be fabricated out of 1.6mm (16SWG) thick MS sheet, with hinged front cover having fixing/locking arrangement. The hinge should preferably be at the top to enable self closing of the cover.
- (iii) The looping box shall be of minimum size 250mmx200mmx100mm or any other specified size to suit the individual site requirements.
- (iv) The box shall be complete with brass compression gland(s) of appropriate size(s), earth stud, two MS clamps of 25mmx3mm section for fixing to the pole, the required number of terminal blocks with brass connector strips and fuse carrier with base/MCB, as specified.
- (vi) The box shall be treated with anti-corrosive paint before erection.
- (vii) Earthing of Light poles & Feeder pillars to be provided.

## **9.00 CABLES**

### **9.1 L.T. CABLES**

#### **9.1.1 GENERAL**

L.T. 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 on the drums. The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

#### **9.1.2 MATERIAL**

The L.T. power cable shall be PVC insulated PVC sheathed type aluminium conductor armoured cable and L.T. control cable shall be PVC insulated PVC sheathed type copper conductor unarmoured cable conforming to IS : 1554 : 1988 (Part-I) with upto date amendments.

#### **9.1.3 INSTALLATION OF CABLES**

Cables shall be laid directly in ground, pipes, masonry ducts, on cable tray, surface of wall/ceiling etc. as indicated on drawings and/or as per the direction of HSCC engineer. Cable laying shall be carried out as per CPWD specifications.

#### **9.1.4 INSPECTION**

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

#### **9.1.5 JOINTS IN CABLES**

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilisation and avoiding of cable joints. This apportioning shall be got approved from HSCC engineer before the cables are cut to lengths.

### **9.2 LAYING CABLES IN GROUND**

Cables shall be laid by skilled experienced workmen, using adequate rollers to minimize stretching of the cables. The cable drums shall be placed on jacks before unwinding the cable. With great care it shall be unrolled on over wooden rollers placed in trenches at intervals not exceeding 2 metre. Cables shall be laid at depth of 0.75 metres below ground level for LT Cables and 1 metre below ground level for HT cable. A cushion of sand total of 250mm shall be provided both above and below the cable, joint boxes and other accessories. Cable shall not be laid in the same trench or along side a water main.

The cable shall be laid in excavated trench over 80mm layer of sand cushion. The relative position of the cables, laid in the same trench shall preserved. At all changes in direction in horizontal and vertical planes, the cables shall be bent

smooth with a radius of bent not less than 12 times the diameter of cables. Minimum 3 metre long loop shall be provided at both end of cable.

Distinguishing marks may be made on the cable ends for identifications of phases. Insulation, tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identifications.

Cable route marker shall be provided as per CPWD specifications. Cost of cable route markers is deemed to be included in the cost of cables/cable laying.

### **PROTECTION OF CABLES**

The cables shall be protected by bricks laid on the top layer of the sand for the full length of underground cable. Where more than one cables is laid in the same trench, the bricks shall cover all the cables and shall project a minimum of approximately 80mm on either side of the cables. Cable under road crossings and any other places subject to heavy traffic shall be protected by running them through Hume Pipes of suitable size. Pipes for cable crossing the road shall be laid at a depth of 1000 mm.

### **EXCAVATION & BACK FILL**

All excavation and back fill required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layer not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer.

The Contractor shall restore all surface, road ways, side walks, curbs, wall or the works cut by excavation to their original condition to the satisfaction of the HSCC's engineer.

### **LAYING OF CABLES ON CABLE TRAY/SURFACE OF WALL/ CEILING**

Cable shall be laid on perforated M.S. Cable tray/ladders. Cables shall be properly dressed before cable ties/clamps are fixed. Wherever cable tray is not proposed, cables shall be fixed on surface of wall or ceiling slab by suitable MS clamps/saddles. Care shall be taken to avoid crossing of cable.

### **CABLES ON HANGERS OR RACKS**

The Contractor shall provide and install all iron hangers racks or racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good.

The hangers or racks shall be designed to leave at least 25mm clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more

fixing holes. All cables shall be saddled at not more than 150mm centres. These shall be designed to keep provision of some spare capacity for future development.

### **CABLES TAGS**

Cable tags shall be made out of 2mm thick aluminium sheets, each tag 1-1/2 inch in dia with one hole of 2.5mm dia, 6mm below the periphery. Cable designations are to be punched with letter/number punches and the tags are to be tied inside the panels beyond the glanding as well as below the glands at cable entries. Tray tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 metres.

## **9.3 TESTING OF CABLES**

Prior to installation burying of cables, following tests shall be carried out. Insulation test between phases, phase & neutral, phase & earth for each length of cable.

- a. Before laying.
- b. After laying.
- c. After jointing.

Along with the test as prescribed in IS Code, cross sectional area shall also be checked.

On completion of cable laying work, the following tests shall be conducted in the presence of the Engineer in Charge.

- a. Insulation Resistance Test (Sectional and overall).
- b. Continuity Resistance Test.
- c. Earth Test.

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 tests & shall bear all expenses of conducting such tests.

## **10.00 CABLE TRAY**

### **10.01 Ladder Type Cable Tray**

Ladder type cable tray shall be fabricated out of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a centre to centre spacing of 250 mm. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanised or painted to the desired lengths.

### **10.2 Perforated Type Cable Tray**

The cable tray shall be fabricated out of slotted/perforated M.S. Sheet as channel section single or double bended. The channel section shall be supplied in convenient length and assembled at site to the desired lengths. These shall be galvanised or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mm x 50mm x 6mm as two longitudinal members, with cross-bracings between them by 50mm x 5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

- 10.3** Typically, the dimensions, fabrication details etc. are shown in CPWD General Specification for Electrical Works - Part II -External, 1994.
- 10.4** The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler plates and cable tray shall be scraped and removed before the installation.
- 10.5** The maximum permissible uniformly distributed load for various sizes of cables trays and for different supported span are as per CPWD General Specification of Electrical Work Part II -1994. The sizes shall be specified considering the same.
- 10.6** The width of the cable tray shall be chosen so as to accommodate all the cable in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.
- 10.7** Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. (Details are typically shown in figure 3 of CPWD General Specification of Electrical Work Part II -1994). The radius of bend, junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.
- 10.8** The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mm x 5mm flats at specified spacing as per CPWD General Specification of Electrical Work Part II -1994. Flat type suspenders may be used for channels upto 450mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mm x 50mm x 5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the PMC/Consultant to take the weight of the cable tray with the cables.
- 10.9** The entire tray (except in the case of galvanised type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.

- 10.10** The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.
- 10.11** The cable trays shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross-joints, etc, and paid for accordingly.

## **11.00 EARTHING**

### **11.01 GENERAL**

All the non-current metal parts of electrical installation shall be earthed properly. All metal conduits trunking, switchgear, distribution boards, switch boxes, outlet boxes, and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. Earthing work shall conform to CPWD General Specifications for Earthing work shall conform to Internal) -1994 and Indian Electricity Rules 1956 amended upto date and in the regulations of the local Electricity Supply Authority.

### **11.02 EARTHING CONDUCTOR**

Earth continuity conductor along with submain wiring from Main/Sub Distribution boards to various distribution boards shall be of copper. Earth continuity conductor from distribution board onward upto outlet point shall also be of bare copper. Earth continuity conductor connecting Main & Sub Distribution boards to earth electrode shall be with galvanised MS strip.

### **11.03 SIZING OF EARTHING CONDUCTOR**

Single phase distribution board shall have one earth continuity conductor while three phase distribution board shall be provided with two earth continuity conductors. Earthing of main switch board and sub switch boards shall be earthed with two independent earth electrodes or as indicated elsewhere. Earth conductor laid in ground shall be protected for mechanical injury & corrosion by providing GI pipe.

- 11.04** GI pipe shall be of medium class 40mm dia and 4.5 metre in length. Galvanising of the pipe shall conform to relevant Indian Standards. GI pipe electrode shall be cut tapered at the bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other upto 2 metre of length from bottom. The electrode shall be buried in the ground vertical with its top not less than 20cm below ground level as per detail enclosed. Earth electrode shall not be situated less than 2metres from the building. The location of the earth electrode will be such that the soil has reasonable chance of remaining moist as far as possible. Masonry chamber of size 300 x 300 x 300mm shall be provided with water funnel arrangement a cast iron or MS frame & cover having locking arrangement at the top.

### **11.05 PLATE EARTH ELECTRODE**

Earthing shall be provided with either GI plate electrode or copper plate electrode of following minimum dimensions.

- i. GI Plate Electrode : 600mm x 600mm x 6mm thick
- ii. Copper Plate Electrode : 600mm x 600mm x 3mm thick

The electrode shall be buried in ground with its faces vertical and not less than 3 metres below ground level. 20mm dia medium class GI pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on the top of this pipe for watering and earth electrode. Earth electrode the watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300mm deep. A cash iron or MS frame with cover having locking arrangement shall be provided at top of metres from the building. Care shall be taken that the excavation for earth electrode may not affect the column footing or foundation of the building. In such cases electrode may be further away from the building.

### **11.06 ARTIFICIAL TREATMENT OF SOIL**

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by addition of sodium chloride calcium chloride, sodium carbonates copper sulphate, salt and soft coke or charcoal in suitable proportions.

### **11.07 RESISTANCE TO EARTH**

The resistance of earthing system shall not exceed 1(One) Ohm.

## **12.00 SAFETY EQUIPMENTS**

### **12.01 DANGER NOTICES**

Danger notices shall be affixed permanently in a conspicuous position in Hindi or English and the local language of the district with sign of skull and bones at every overhead lines, transformer, electrical equipments motors, etc.

### **12.02 FIRST AID BOX**

Standard first aid box with all standard contents shall be supplied.

### **12.03 FIRE BUCKETS**

The fire bucket unit shall consist of our galvanised iron baskets, which shall be with round bottom, and of 13 liters capacity. They shall be filled with dry sand.

Arrangement shall be made to hang them on GI pipe stand comprising of at least 2 vertical and one horizontal members of 50 mm GI pipe. The stands shall have hooks and locking chain arrangement. The buckets and stand shall be painted with epoxy red paint.

#### **12.04 FIRE EXTINGUISHER**

Foam type Fire extinguishers of 9 Kg. capacity and Dry Chemical type Fire Extinguishers of 10 Kg capacity shall be of approved make. It shall be filled with carbon tetrachloride. It shall have horns. Extinguishers shall be fixed on walls/columns with necessary clamps made out of 50 mm x 6mm MS flat and coated bolts and nuts grouted in wall/column.

#### **12.05 RUBBER MAT**

12mm corrugated rubber insulating matting shall be provided in front of HT breakers, power & motor control centers, push button station and distribution board in control room. The width of matting shall be one meter. It shall be as ISI mark.

#### **12.06 INSTRUCTION CHART**

Printed instruction chart both in English, Hindi and local language and duly framed with front glass, prescribing treatment to be given to persons having Electric shock, shall be supplied.

#### **12.07 HAND GLOVES**

1 pairs of ISI marked hand gloves shall be provided.

### **13.00 PROCUREMENT, INSPECTION OF EQUIPMENT & APPROVALS**

Approved list of makes and vendors are given in the end of technical specifications. The makes of equipment/materials supplied shall be strictly as mentioned therein. For items not specially mentioned, prior approval shall be taken before procurement of the same. All equipments/material supplied shall be brand new and shall be procured directly from the manufacturers, dealers or authorised agents.

HSCC engineer shall have access to the manufacturer's premises for stage inspection/final inspection of any item during its design, manufacturing, assembly and testing. After carrying out the necessary factory tests and routine tests as per IS Standards, a copy of the routine test certificate shall be forwarded alongwith the call for carrying out the inspection at the manufacturer's works.

Based on the inspection certificate, HSCC engineer reserves the right to carry out the inspection at a mutually agreed date and/or give inspection waiver. A minimum of two weeks will be needed after receipt of complete shop inspection report and other details to depute our inspector for inspection.

It is the responsibility of the contractor to ensure that all electrical works are carried out as per the IE Rules & regulations, National Building Code and IS Codes & Standards. All necessary drawings and details as required by Electricity Board, Electrical Inspector, Pollution Control Board (for DG Set), Fire Department and other Local Statutory agencies, shall be prepared by the contractor. **The contractor is responsible to submit the drawings and other details as required to the Local Authorities (refer above) and obtain necessary approvals including getting connection at 11kV & sanction of load/additional load enhancement of electrical load from SEB before energizing and commissioning.** All official fees required for getting the approval will be reimbursed on account of Client on submission of original documents.

#### 14.00 LIST OF APPROVED MANUFACTURERS

1. M.V. Panel (BOQ Item No 1.06)– CPRI approved make to be approved by HSCC Electrical Engineer.
2. LT Cables
  - Cab Com India
  - Universal
  - ICC
  - NICCO
  - Rallison Cables (Rollex)
  - INCAB
3. PVC insulated Wires
  - National
  - Batra Hanley
  - Plaza
  - Grandley
  - Universal
  - Kalinga Premium.
4. Telephone Tag Blocks
  - Krone Type
5. Modular Range of Switches, sockets etc
  - Anchor Roma
  - North West
  - Toyama
  - MK
  - Standard
  - LK
  - MDS (Mosaic)
  - Crabtree
6. Industrial Sockets & Plugs.
  - Indo Asian
  - Siemens
  - Schneider
  - Crompton
  - Havell's

		-	Standard
		-	MDS
		-	Clipsal
		-	BCH
		-	Keselec
		-	C&S
7.	M.S. Conduit	-	BEC
		-	AKG
		-	M Kay
		-	Harsh
		-	Siddarth
8.	Light fixtures.	-	Philips.
		-	GE
		-	Crompton
9.	Ceiling Fans	-	Crompton Greaves/Alstom/Usha
10.	Exhaust fan	-	Crompton Greaves/Alstom/Usha/Khaitan
11.	MCCB	-	L&T
		-	GE Power Controls
		-	Siemens
		-	ABB
		-	Schneider (Crompton Greaves)
		-	Havell's
		-	MDS
12.	MCB-DB's, MCB, ELCB MCB-Isolator etc.	-	L&T
		-	GE Power Controls
		-	Siemens
		-	MDS
		-	Standard
		-	Schneider
		-	Indo-Kopp
		-	HPL
13.	Telephone Wires	-	Same as that of PVC insulated wires
14.	Measuring Instruments	-	AE/MECO/Rishline (L&T)
15.	Selector Switches	-	AE/L&T
16.	CT's & PT's	-	Kappa/Rishline (L&T)

## 15.00 LIST OF TENDER DRAWINGS :

The lists of tender drawings are mentioned below:

<b><u>S.No.</u></b>	<b><u>Drawing No.</u></b>	<b><u>Floors</u></b>
1.	HSCC/111/D&E/NH/101E	Ground Floor
2.	HSCC/111/D&E/NH/102E	First Floor.
3.	HSCC/111/D&E/NH/103E	Second Floor.
4.	HSCC/111/D&E/NH/104E	Third Floor.