TENDER DOCUMENT
TENDER No.: DLI/ENGG/PI-592/HOSTEL

FOR

CONSTRUCTION OF BOYS HOSTEL
AT
SVNIT, SURAT-GUJARAT

FOR

SARDAR VALLABHBHAI NATIONAL INSTITUTE
OF
TECHNOLOGY, SURAT, (SVNIT)

VOLUME – IIB

TECHNICAL SPECIFICATION

EXECUTING AGENCY

ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
Core-3, Scope Complex, 7, Institutional Area,
Lodhi Road, New Delhi-110003
TEL NO: 011-24361666, 24366226 FAX NO. 011- 24363426
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TECHNICAL SPECIFICATIONS
(CIVIL WORKS)

All works shall be carried out in accordance with latest CPWD Specifications with up to date correction slips wherever applicable unless and otherwise specified.

PARTICULAR SPECIFICATIONS

1.0 EXPANSION JOINT

1.1 Polysulphide Expansion Joint Filler Board

    i) Polysulphide Expansion Joint Filler Board shall be of approved make.
    ii) The board shall be waterproof, resilient, non-impregnates, non-staining, non bleeding and chemically inert.
    iii) The application shall be done as per manufacturer’s written instructions.
    iv) The Board shall be laid flat and stored under shed away from sources of excessive heat and flame.
    v) Rates shall be inclusive of all operations including labour material, T&P, scaffolding etc. complete. Nothing extra shall be payable on any account.

2.0 FLOORING

All work in general shall be carried out as per latest CPWD Specifications with up to date correction slips.

2.1 Whenever flooring is to be done in patterns tiles / stone, the contractor shall get samples of each pattern laid and approved by the Engineer-in-charge before final laying of such flooring for which nothing extra shall be paid.

2.2 Different stones / tiles used in pattern flooring shall be measured separately as defined in the nomenclature of the item and nothing extra for laying pattern flooring shall be paid over and above the quoted rate. No additional wastage if any shall be accounted for any extra payment.

2.3 The proper gradient shall be given to flooring for toilets, verandah, kitchen, courtyard, etc. as per the directions of Engineer-in-charge.

2.4 Vitrified Tiles

2.4.1 Make

Vitrified floor tiles shall be of approved quality and make with water absorption less than 1%. These shall be flat, true to shape and free from cracks, crazing spots, chipped edges and corners. These shall be of specified size, type and colour and laid to pattern as shown in the drawings or as approved by the Engineer -in- Charge.

2.4.2 Sub-Base

The base shall be prepared as per latest CPWD Specifications with up to date correction slip. Over the prepared base, if required, 1:4 cement mortar shall be laid to make up the total thickness of floor finish as specified. The surface shall be laid to falls and slopes as required and scratched for key.

2.4.3 Laying of Floor Tiles

The tiles shall be laid as recommended by the manufacturer and as per latest CPWD specifications with correction slip for ceramic tiles.
2.4.4 Pointing
The joints shall be thoroughly cleaned and grouted with polymer based non-shrink grout of desired colour of approved make.

2.4.5 Cutting of Tiles
Care shall be taken to see that full tiles are used as far as possible. Where not possible, the edge tiles shall be neatly cut with a tile cutter to required size and the edges rubbed smooth to ensure straight and true joints. The cut of the tiles shall not be installed in exposed locations.

2.4.6 Curing
Curing work shall be done as per latest CPWD specification with up to date correction slip.

2.4.7 Rates shall be inclusive of all operations including labour, material, T&P, scaffolding etc. complete. Nothing extra shall be payable on any account.

3.0 ALUMINIUM DOOR, WINDOW AND VENTILATORS

3.1 Extent and Intent
The work shall be carried out through an approved specialist contractor, who shall furnish all materials, labour, accessories, equipment, tool and plant and incidentals required for providing and installing anodised 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.

3.2 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 components 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-in-charge and no work shall be performed until the approval of these drawings is obtained.

3.3 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-in-charge 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-in-charge for approval well in advance of commencing the work.

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

3.5 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-in-charge. 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.
3.6 Fabrication
Doors, Windows, etc. shall be fabricated to sizes as shown, at factory and shall be of section, sizes combinations and details as shown in the Architectural Drawings. All doors, windows etc. shall have mechanical joints. 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 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-in-Charge.

3.7 Anodising /Powder coating
All aluminium materials used shall be specially anodized for protection against corrosion in marine environment in approved shade. The anodic coating shall conform to IS 1868-1968 and shall be of AC25 grade with minimum thickness of 20 Microns when measured as per IS:660/2-1970 and density shall be atleast 32 MG/sqm. The anodic coating shall be double sealed or alternatively sealed with steam and shall be of a minimum thickness of 50 micron. The anodic coating shall be tested in an approved laboratory by Eddy current method as per IS: 6012 for thickness. Sulphuric acid shall be used as the electrolyte for the anodic process. Prior to anodizing all aluminium shall be rendered uniform in appearance free from disfiguring scratches, stains or other blemishes and etched in a caustic soda solution. Requisite tests shall also be carried out at the site as required by the Engineer and the contractor shall arrange all assistance and equipments required for the purpose.

Wherever specified, polyester grade machine applied powder coating of minimum thickness 20 micron shall be provided and such coating shall be of approved shade. Samples of powder coated panels shall be submitted by the Contractor well in advance to commencement of work from the approved agency. Pretreatment to frames shall be carried out to suit the requirements of final finishing as stated above.

3.8 Protection of Finish
All aluminum members shall be wrapped with approved self-adhesive non-staining PVC tapes.

3.9 Handling and Stacking
3.9.1 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.

3.9.2 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.

3.9.3 Where aluminum comes into contact with masonry brickwork, concrete, plaster 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.

3.9.4 The contractor shall be responsible for assembling composite, bedding and filling the groove with backup roads polysulphide sealant inside and outside, 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.
3.9.5 The contractor shall be responsible for doors, windows, etc. being set straight plumb, level and for their satisfactory operation after fixing is complete.

3.10 Installation

3.10.1 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.

3.10.2 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.

3.11 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.

3.12 Fittings
Hinges, stays, handles, tower bolts, locks and other fittings shall be of anodised aluminum and of approved design, shade and make. Before procuring the material the sample shall be got approved by the Engineer-in-charge/Architect.

3.13 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.

3.14 Sealant
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 sealant of approved make to ensure complete water tightness. The sealant shall be of such composition that it would not stain the masonry / concrete work, will not sag and shall not set hard or dry out under any conditions of weather. The samples of sealant to be used for this purpose shall be got approved by the Engineer-In-Charge before its actual use.

3.15 Glazing
Glazing shall generally be accomplished from the inside of building.
The glazing system shall be designed to this end use a continuous E.P.D.M. compression gaskets on both sides (Present Gasket on one side of glazing pocket and roll in gasket on another side). A continuous wet seal shall be employed to ensure a complete water tightness. Maintain a minimum glazing bite, edge clearance and surface clearance depending on the glass as recommended by the glass manufacturer.

3.16 Protection & Cleaning
The 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 anodised aluminium and glass surfaces with suitable cleaning agent, make final adjustments to all ventilators, etc. and hardware leaving all in first class working order.

3.17 Details of Tests

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

3.17.2 The minimum number of tests for anodic/powder coating and corrosion resistance for Doors, Windows & Ventilators shall be 5% of Nos. manufactured.

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

3.17.4 The cost of samples, carriage or the samples and testing charges, if any, shall be borne by the contractor.

3.18.1 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.

3.19.1 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.

3.19.2 Guarantee Bond
Guarantee bond in prescribed proforma of EPI shall be submitted by the Contractor that shall be signed by both the specialised agency and the contractor to meet their liability/ liabilities under the guarantee bond. However, the sole responsibility shall rest with the building contractor.

3.19.3 The rate of the item shall include the cost of materials including sealant, T&P, Scaffolding and labour, required in all the above operations.

4.0 POLYCARBONATE SHEET ROOFING

4.1 The polycarbonate sheet roofing shall be of Lexan of GE Plastics and shall conform to manufacture’s specifications. The contractor shall procure the sheets from the manufacturer as per the approved list. The material procured shall be free of any defects and damage to the edges, surface etc. The defective material shall be replaced by the contractor of his own cost. The contractor shall ensure that the material is procured and delivered at installation site without any damage.

4.2 Adequate care shall be taken for protection of the material before installation as well as afterwards till handing over the building for occupation. The contractor shall ensure careful handling and storage and prevent any rough handling, to prevent any edge or surface damage. Any panel with edge damaged or damage to the finish etc. shall not be allowed to be used in the work and shall be replaced by the contractor at his own cost. The contractor shall procure the material including providing for wastages, damages etc. in one lot so as not have any color and shade variation. Atleast one sample of the polycarbonate sheets brought by the contractor to the site of work shall be tested. The test shall be got done at reputed independent laboratory as approved by the Engineer-in-Charge. However, the contractor shall obtain and submit to the
4.3 The polycarbonate sheet shall be multi-wall (twin wall) section with thickness of the sheet not less than 16mm and the thickness of the walls on the two external faces not less than 0.8mm each. The sheet shall be extruded from polycarbonate material and shall have homogeneous composition of the material. The sheet shall have co-extruded UV protective layer. The sheet shall be fixed with the face treated for UV resistance, upward/exposed to sunlight. The weight of the sheets shall not be less than 1.7 Kg per sq.m. Light transmission shall be minimum 35% 3%. The sheets shall be obtained with closed edges. The sheet shall be bent (if required) to the require profile as per the architectural drawings but with radius not less than 175 times the thickness of the sheet. The sheet shall be fixed in a manner that the cells are parallel to the span of the shed.

4.4 The polycarbonate sheets shall be of color and shade as specified by the Architect and approved by the Engineer-in-Charge.

4.5 The physical and the chemical characteristics of the polycarbonate sheets shall be as per the manufacturer's specifications and shall conform to the ASTM standards. The sheets shall conform to BS 476 part 7 for the fire rating. The contractor shall submit written guarantee to the Engineer-in-Charge for the polycarbonate sheets procured and provided by him against any defects like peeling, breakage, fading of color/ discoloration, cracking, leakage through the roofing loss of strength etc. for a period of ten years after the date of completion of the work. The contractor shall obtain similar back-to-back guarantee from the manufacturer. The strength requirements are as specified below:

Distribution load : 800 N per sq.m.

4.6 The polycarbonate sheets shall be used in one piece along the span of the temporary sheds. The width of the sheet across the span of the shed shall not be more than 700 mm. The polycarbonate sheets shall be bent to required profile (linear or curvilinear) as per the architectural drawings and fixed in position, to the structural steel framework, using self-driving self-tapping screws with EPDM washers etc. The sheets shall be secured to the structural steel framework so as to with stand all the design dead, live, wind, other accidental loads etc. and shall be fixed in a workmanlike manner. It shall not have any sag. Therefore the fabrication work shall be got done through experienced & reputed fabricator, to be got approved from the Engineer-in-Charge. The contractor shall submit to the Engineer-in-Charge the shop drawings giving fixing details for the polycarbonate sheets in roofing and also quality assurance and methodology statement for the item. The polycarbonate sheets shall be jointed along the length of the shed using aluminum top & bottom pressure plates having required profiles for fixing the EPDM gaskets, screws, washers etc. The aluminum pressure plates shall be color anodized or powder coated to the require shade. The joints in the sheet shall be provided only on the RHS steel sections of the framework and shall not be permitted elsewhere. The joint width of about 3-4 mm may be provided between the sheets at the junction for thermal expansion. The EPDM gaskets of the required profiles shall than be fixed in the grooves in the aluminum pressure plates on either side of the joint in the polycarbonate sheet. The bottom aluminum plate shall be fixed to the structural steel framework using self-driving self-tapping screws; washers etc. (one screw fixed to each sheet) and the screws fixed @300 mm center to center along the span of the shed. The EPDM gaskets of the required profile shall be fixed in the grooves in the aluminum pressure plate on either side of the joint in the polycarbonate sheet. The top aluminum pressure plate shall than be fixed securely to the bottom aluminum plate using countersunk self-driving self-tapping screws, EPDM washers etc. All the screws shall be concealed using structural silicone sealant DC 995 of Dow Corning or equivalent approved brand. Also, wherever required (especially at the joint in the EPDM gasket etc.) the junction of the polycarbonate sheet and the sides of the pressure plates on both sides shall be sealed using structural silicone sealant DC 995 of Dow Corning or equivalent brand as approved. The item includes cost of all the operations and all
inputs of the material [including Polycarbonate sheet, EPDM gaskets, anodized aluminum capping, anodized aluminum edge capping to the sheet with U-shaped EPDM gasket, all structure silicone sealant, self-driving self-tapping screws with EPDM washers, nuts, bolts, washers etc. and the like, labor, T & P, all the incidental charges, wastages etc. involved in the work. However for the purpose of payment only the actual area of the polycarbonate sheet provided and fixed in position shall be paid for separately under relevant item. The contractor shall maintain the roofing scratch and damage free till the handling over the building for occupation, at his own cost.]

4.7 Tolerance
   a) Weight : 5%
   b) Length : 30 mm
   c) Width : 0.5%
   d) Thickness : 1mm

4.8 The polycarbonate sheets shall be obtained with protective films on both sides. Care shall be taken while fixing to fix the sheets with UV protected side exposed to outside. The sheet shall be stored in a manner not to expose to direct sunlight. The sheet shall be cut to the required size or drilled using the toothed blade/machine. After fixing the protective film shall be removed and the sheets cleaned using non-alkaline based detergent and abrasive equipments or solvents be avoided. The silicones, gaskets, tapes etc. shall be compatible with the polycarbonate sheet.

4.9 For joining the sheets, atleast one complete channel width of each sheet shall be secured per sheet within the joining profile. Since thermal coefficient of expansion of the sheets is different from the RHS steel frames, suitable provision shall be made for accommodating differential expansions. Also any rigid jointing agent that may prevent thermal movements shall not be used. The required section aluminum profiles (upper central profile, lower central profile and top profile) for fixing the polycarbonate sheet to the structural framework as well as for joining the sheet shall be as per the manufacturer’s specifications. The top capping profile shall be snap fit to the upper central profile, The EPDM gaskets and the screws shall be provided as per the manufacturer's specifications.

4.10 The Gaskets shall be extruded microwave/ steam cured EPDM/ silicone of approved quality compatible with substrates, finishes and other components they are in contact with. All gaskets exposed directly on the exterior face shall be silicon gaskets, which are UV resistant. They shall not degenerate/discoolor or/each on exposure to weather/rain/pollutants etc.

**INSPECTION**

The completed space frame structure shall under go a full and complete final inspection by manufacturers site representative and shall be certified in writing by the manufacturer that the finished product has been erected in accordance with its approved drawing and contract documents.

5.0 **ALUMINIUM COMPOSITE PANEL METAL CLADDING**
5.1 **Scope of Work**

The contractor shall design, supply, fabricate, deliver and install and guarantee all construction necessary to provide a complete aluminum 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 as per item description.

The scope of work shall be read in conjunction with those in the specification of semi unitized structural glazing / curtain walling.

5.2 **Design Concept**

a) The proposed cladding shall be based on a watertight system.

b) A 20mm wide joint shall be provided between cladding elements to cater for individual panel installation and shall be sealed off with extruded EPDM gasket or silicon sealant.

5.3 **Aluminum Composite Panel Cladding**

Providing, designing, cutting, bending and fixing 4mm thick aluminum composite cladding of approved make on external façade of size as shown with Water tight system either curved or straight in plan. Skin material 0.5mm thick aluminum sheet (3005 H6) core material natural polyethylene, aluminum cladding panel to be of approved colour/shade fixed with extruded aluminum basic frame, angle cleats, weather sealants, rivets, GI brackets all as approved, using suitable chemical-anchor bolts on structural steel work including necessary accessories complete in all respects. Where level difference is shown dummy structural steel backup frame shall be provided. Protective Film: The finished surface shall be protected with 80 microns self adhesive Peel Off film with two layers of white and black tested to withstand at least 6 months exposure to local weather condition, without loosing the original peel off characteristic or causing stains or other damages.

The quoted rate to include for any provision of openable access panels for services wherever required. Weather silicon sealant, non-streaking /staining weather sealant shall also be used wherever required.

**Technical Data**

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<tr>
<td>B. Dimensions</td>
<td>Panel thickness: 4mm&lt;br&gt;Panel size: Width 1000/1250/1500mm&lt;br&gt;Length between 1500 and 5000mm&lt;br&gt;Tolerance&lt;br&gt;Width + 2.0mm&lt;br&gt;Length + 4.0mm&lt;br&gt;Thickness + 0.02mm</td>
</tr>
<tr>
<td>C. Principal Properties</td>
<td>Panel weight: 5.5 kg/sq.m&lt;br&gt;Thermal expansion: 1mm/M/60 deg.C.</td>
</tr>
<tr>
<td>D. Acoustic Properties</td>
<td>Average airborne sound transmission loss 26 db.</td>
</tr>
<tr>
<td>E. Mechanical Properties</td>
<td>Tensile Strength RM&gt; 160 MPa.&lt;br&gt;0.2% Proof stress RP&gt; 130 MPa.&lt;br&gt;Modulus of Elasticity E 70,000 MPa.</td>
</tr>
</tbody>
</table>
5.4 Design Wind Loading

850 N/m² positive and negative to Podium.
1150 N/m² positive and negative to Tower.
1500 N/m² positive and negative to Crown to Tower.

No cladding element shall sustain permanent deformation of failure under loading equivalent 1.5 times the design wind pressure specified.

5.5 Deflection

Deflection of any aluminum frame shall not exceeding 1/175 of the clear span.

5.6 Expansion and Contraction

The cladding shall be so fabricated and erected as to provide for all expansion and contraction of the components. Any temperature change due to climatic conditions shall not cause harmful buckling, opening of joints, undue stress on fastening and anchors, noise of any kind or other defects.

5.7 Flatness

The cladding surface taken individually shall not have any irregularities such as oil canning, waves, buckles and other imperfections when viewed at any position but not less than at an angle of 15 degrees to the true plane of the panel with natural lighting of incident of not less than the same angle.

5.8 Water Tightness

The panel cladding shall be so constructed to be watertight with provision for rear ventilation.

5.9 Acoustic Treatment

The cladding panel system shall be designed so as to dampen noise caused by splashing water.

5.10 Fixings

a) Fasteners including concealed screws, nuts, bolts and other items required for connecting aluminum to aluminum shall be of non-magnetic stainless steel.

b) Rivets used for fastening panel to aluminum sub-frame shall be of alloy aluminum large flange head type with stainless steel mandrel.

c) All fixing anchors, brackets and similar attachments used in the erection shall be of aluminum or non-magnetic stainless steel.

5.11 Weather seal

a) All exposed joints between panels, which require to be watertight, shall be sealed with extruded EPDM gasket of hardness approx. 75 SHORE.
b) All secondary weather seal shall be of self-adhesive tape as approved by Architects.

6.0 STRUCTURAL/CURTAIN WALL SYSTEM

6.1 SCOPE OF WORK

A. The contractor shall design, engineer, test, fabricate, deliver, install, and guarantee all construction necessary to provide a complete curtain wall/structural glazing system to the proposed building, all in conformity with the Drawings as shown. Specification and all relevant construction regulations including providing any measures that may be required to that end, notwithstanding any omissions or inadequacies of the Drawings and/or

Without limiting the generalities of the foregoing, the semi unitized structural glazing Systems shall include, without being limited to, the followings:

Metal frames, glass glazing, spandrels, and ventilators, finish hardware, copings metal closure, windows etc.

All anchors, attachments, reinforcement and steel reinforcing for the systems required for the complete installations.

All thermal insulation associated with the system.

All fire protection associated with the system.

All copings, end closure and metal cladding to complete the system.

All sealing and flushing including sealing at junctions with other trades to achieve complete watertightness in the system.

Isolation of dissimilar metals and moving parts.

Anticorrosive treatment on all metals used in the system.

Polyester powder coating aluminum sections.

B. The contractor shall also be responsible for providing the followings:

1. Engineering Proposals, Shop Drawings, Engineering data and Structural Calculations in connection with the design of the Curtain Wall/structural glazing System.

2. Scheduling and Monitoring of the Work.

3. Mock-ups, samples and test units.


5. Co-ordination with work of other trades.

6. Insulation with glass wool 48 Kg./cu.m. at spandrels area.

7. Protection.

8. All final exterior and interior cleaning and finishing of the Curtain Wall /structural glazing System
9. As-built record drawings and photographs.
11. All hoisting, staging and temporary services.
12. Conceptualizing and design of a suitable maintenance system for curtain/structural glazing.

C. The water tightness and structural stability of the whole Curtain Wall /structural glazing System are the prime responsibility of the Contractor. Any defect or leakage found within the Guarantee Period shall be sealed and made good all at the expense of the Contractor.

D. The curtain wall/structural glazing system shall be designed to provide for expansion and contraction of components which will be caused by an ambient temperature range without causing buckling, stress on glass, failure of joint sealants, undue stress on structural elements or other detrimental effects. Specific details should be designed to accommodate thermal and building movements.

6.2 BUILDING REGULATIONS

Curtain Wall/structural glazing shall comply with all Government Codes and Regulations including IS codes, if any.

All curtain walling/structural glazing, individual aluminum and glass components and all completed work shall be designed and erected to comply with the following:

a) Design load and deflection.

i) Curtain Wall/structural glazing construction in its entirety shall be fabricated and erected to withstand without damage or permanent deformation inward (positive) and outwards (negative) pressure, all acting normal to the construction plane with a maximum deflection of not exceeding 1/175 of the clear span between structural support or 20mm maximum whichever is less.

ii) Structural performance of all parts of curtain wall/structural glazing system shall conform to relevant IS codes, wind load as per IS-875 and seismic loads as per IS-1893. Deflection shall cause no permanent set in excess of 1/1000 of span or evidence of structure failure.

6.3 MEASUREMENTS

Measurements of the Curtain Wall /structural glazing shall be in the metric system in sq.m correct to two places of decimal. The area considered for measurement shall be net area as fixed on the exterior face of the curtain wall/structural glazing including openable windows as part of curtain wall/structural glazing. The contractor shall be responsible for verifying all the dimensions and actual conditions on site.

6.4 RATE

The rates shall include the cost of all the operations described above including the cost of all materials, labour, design, fabrication, erection, finishing, scaffolding and testing of water tightness etc.

6.5 TENDER DRAWINGS AND SPECIFICATIONS

The tender drawings indicate profile and configuration required together with relationship to structural frame and interior building elements.
The Specification and tender drawings is of the performance type and includes only the minimum requirements of the /structural glazing Wall System without limiting the Contractor to the method of achieving desired performance.

6.6 POST TENDER REQUIREMENTS

a) Design Proposals

The contractor shall propose the final design in such a way that all basic functional and architectural requirements are fulfilled and get the same approved by Engineer-in-charge/Consultant. However, basic design requirements as described in the specification and other Architectural requirements such as the size of window, net glass area, ventilator, configuration of windows and spandrels shall be retained.

The design proposals shall be in the form of drawings, drawn to suitable scale as far as practical and specification shown in or describing all items of work including:

i) Request details as indicated on the tender drawings.

ii) Metal quality, finishes and thickness.

iii) Glass quality, coating and thickness and proposed manufacturer’s brand names.

iv) Sections of the mullion and transom together with structural calculations.

v) Arrangement and jointing of components.

vi) Field connections especially mullion to mullion and transom to mullion.

vii) Fixing and anchorage system of typical wall unit together with structural calculations.

viii) Drainage system and provision in respect of water leakage in the curtain wall/structural glazing system.

ix) Provisions for thermal movements.

x) Sealant and sealing method.

xi) Glazing method.

xii) Wind load and seismic load and any other specific load considered in the design.

xiii) Lightning protection link-up system of the curtain wall/structural glazing for connection and incorporation into the lightning conductor system of the building. Design concept must be stated in the proposal.

The maximum permissible structural tolerances of the building that the system has been designed to accommodate in case these tolerance exceed those specified in the Specification.

Any parts of the curtain wall/structural glazing, when completed, shall be within the following tolerances:

Deviation from plumb, level or dimensioned angle must not exceed 3mm per 3.5m of length of any member, or 6mm in any total run in any line.

Deviation from theoretical position on plan or elevation, including deviation from plumb, level or dimensioned angle, must not exceed 9mm total at any location.
Change in deviation must not exceed 3mm for any 3.5mm for any 3.5m run in any direction.

b) Samples

The contractor shall also submit samples of mullion and transom sections in lengths of 300mm with the same finish and workmanship along with the proposals and 300mmx300mm samples of glass (samples to include exposed screws and other exposed securing devices, if any).

c) Preliminary Programme

The tenderer shall also submit a preliminary programme of the contract works showing the various stages of design sampling, testing, fabrication, delivery and installation of the works.

d) Upon Engineer-in-charge approval, of the shop drawing at least 4 copies shall be submitted by the Contractor.

e) The Contractor/Sub-contractor shall submit a maintenance manual for the curtain wall/structural glazing system inclusive of all metal parts, glass and finish etc.

f) During detailed design and execution any details may increase as per actual requirement at site, these variations shall be executed without any extra cost implications to the client/Engineer-in-charge.

6.7 EXECUTION

a) Performance Testing

General Requirements

Mock-up units shall be constructed by the contractor and tested to determine the structural stability as well as air and water infiltration or leakage at glazing beads and all other joints designed into the façade.

After approval of structural calculations and shop drawings for the curtain wall/structural glazing, one (1) Test Unit for performance testing of the curtain wall/structural glazing shall be constructed by the contractor at a laboratory approved by the Engineer-in-charge

Erect mock-up under manufacturer's/installer's direct supervision and employ workmen as they would be employed during the actual erection at the job site.

Test procedures test schedules and test locations shall be submitted to Engineer-in-charge for approval before testing.

Prior to fabrication of Test Units, the contractor shall submit shop drawings and calculations of the Test Unit for the Architect’s approval.

Production for final job site erection shall not start until approval has been obtained as a result of the mock-up test.

The Engineer-in-charge shall be the sole judge of the mock-up test conditions.

b) Test of Wind Pressure

The equivalent load of wind pressure or wind suction shall be given to the Test Unit as increasing or decreasing the inside pressure in the ‘Pressure Chamber’ at which the Test Unit is fixed.
The static wind pressure shall be applied up to 1.5 Kpa at maximum wind pressure.

The variation of dynamic pressure shall be of any approximate sine-curve-line.

Deflection on each observational points of the Test Unit shall be observed and recorded under the Static pressure as described above.

Any damage and harmful permanent deformation on any parts except sealing materials shall not be found at maximum wind pressure.

The deflection on the main structural parts in this condition shall not exceed:

1/175 of the span between supports or 20mm, whichever is the lesser for vertical elements.

1/250 of the span between supports for horizontal elements.

The extent of recovery of deformation 15 minutes after the removal of the test load is to be least 95%.

c) Test of Lateral Deflection per Floor Height

Lateral deflection per floor height shall be occurred on the test unit, when the structural frame, which fixes the test unit, is deflected horizontally.

The deflection of every + 2.5mm shall be increased upto + 13mm on the Test Unit (Static Deflection Test).

The dynamic deflection shall be applied upto + 13mm.

The variation of dynamic deflection shall be of an approximate sine-curve-line, one period of 3 seconds.

The dimension of the deflection on each observational points of the Test Unit shall be measured under the condition as described above, the damage shall be observed.

Any damage and harmful permanent deformation shall not be found in any parts of the curtain wall/structural glazing except sealant at maximum deflection.

d) Test of Water-tightness

Water shall be sprinkled to the Test Unit under the wind pressure.

Pressure shall not be applied to the Test Unit.

The volume of the sprinkling water in one minute shall be 5 litres/m2 min. (0.1 gal/sq/ft.).

All water leakage and drainage system at the joint and openable sash of the curtain wall/structural glazing system shall be observed from the outside of the chamber.

Hold the test 2 times, in sequence as described below, conforming to the above mentioned conditions.
Install the test unit.
Hold 1st water-tightness test.
Hold test of wind pressure as described above.
Host 2nd water-tightness test.
Lateral deflection test.
Water leakage at all parts of the Test Unit shall not be observed inside during the 1st watertightness test.

e) Test Report

The Contractor is required to submit five (5) copies of test reports to the Engineer-in-charge.

f) Cost of Performance Test

The Contractor shall allow in his tender for the cost of the performance testing and of fabrication, erection, corrections to and demolition of the Test Units including any special provision required in the testing laboratory for the tests mentioned above.

The Contractor shall allow for amendments and adjustments to the mock-up as required by the Employer/Engineer-in-charge.

If the Test Unit fails to pass the initial testing, the Contractor shall make the necessary corrections to the Test Unit and shall have to get the Test Unit retested by the Testing Laboratory till it passes the tests.

Cost of corrections to the Test Unit and cost of re-testing shall be borne by the Contractor at no additional cost to the Employer.

g) Shop Drawings and Calculations for the Performance Testing

Prior to fabrication of Test Unit, the Contractor shall submit shop drawings and calculations of the Test Unit for Engineer-in-charge’s approval.

h) Record Drawings

The testing laboratory shall keep copy of approved Test Unit shop drawings and calculations at testing laboratory during testing of Test Unit.

The testing laboratory shall accurately and neatly record on the above mentioned shop drawings all changes, revisions, modification etc. made to Test Unit, which shall become the record drawings.

At completion of testing and after approval of test reports the testing laboratory shall submit the marked-up record drawings to the Engineer-in-charge.

i) Contractor’s Representatives

Full time attendance by Approved Representatives of the Contractor & subcontractor associated with the erection of curtain wall/structural glazing shall be provided for the erection of the Test Unit and for all testing of the Test Unit.

7.0 PERFORMANCE GUARANTEE

The tenderer shall provide a performance guarantee of requisite value to be indicated in the General Conditions of Contract for a period of five years, to provide for expenses, to cover the
risk and cost of rectification of defect, noticed during the five years guarantee period. Guarantee period to start from the date of completion of the project.

Supply, Design, fabrication and installation of semi-unitised Structural glazing system in the form of fixed panels, using specially designed aluminium extruded sections, mullions and transoms having 25 micron Anodised of approved colour and shade and make with mullions fixed on the RCC beams/columns through adequately designed brackets including providing masking tape on the profiles for safety against external scratches on site complete with approved silicon sealant EPDM gasket etc. to make the structural glazing air tight and water tight as per standards and as per Architect's drawings and specifications. The design to be as per BIS code for required wind pressure IS: 875 part III and use of aluminium section alloy as per IS:8147.

System design to strictly consider for thermal movements, air infiltration, water penetration, seismic movement and structural movement. Contractor to furnish shop drawings along with sequence of work and for approval of Engineer-in-charge. The minimum section shall be 131x66x2mm and per sqmt weight shall be 10kg approx, the item shall be measured and paid for actual surface area of structural glazing.

Extra for providing & fixing 24mm made up thickness insulated glass over above corresponding item. Hermetically sealed with 6mm heat strengthened toughened solar control off line coated high performance temper able glass of approved colour having reflective soft coating and 6mm clear toughened float glass inside with 12mm dry air cavity between two glass panes separated by a hollow aluminium spacer bar with twin lines of micro holes as approved filled with molecular desiccant of approved make and using primary hot meld duly and secondary polysulphide or silicon sealant of approved make all complete over above item. (U value less than 2.85w/sqm k, shading coefficient less than 0.55, solar factor less than 0.50, light transition minimum 40%)  

Extra for providing and fixing Aluminium Composite Sheet Cladding using 4 mm thick sheet of approved make consisting of a core of 3mm natural polyethylene core sandwiched between two skins (0.5mm each) of aluminium alloy with outer surface in all colour coating of PVDF paint in fully automatic coil coating process. The PVDF coated finished surface to be factory protected with self-adhesive peel off foil tested to withstand at least 6 months exposure to local weathering conditions. The composite sheet cut and bent to shaped profiles as required to, including perimeter extrusions base frame, extruded stiffeners, expansion fasteners & silicone sealant (Dow Corning 789) required for installation as per approved elevation drawing. Work includes necessary accessories complete in all respects.

Extra over corresponding item for providing and fixing of openable window/door in structural glazing, including all associated hardware minimum weight of shutter shall not be less than 6kg per SQM

8.0 Specification For Concrete Penetrating Corrosion Inhibiting Admixture (CPCIA)
**Description:**

Concrete penetrating corrosion inhibiting admixture upon addition into the concrete matrix inhibits the corrosion process. It need not be in direct contact with the steel. It migrates over a considerable distance by virtue of its bipolar inhibition mechanism property (B.I.M) to provide protection to the steel. Non-migrating corrosion inhibitors are specifically excluded from this specification.

<table>
<thead>
<tr>
<th><strong>Base</strong></th>
<th>Bipolar Organic inhibitor. Concrete penetrating type.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colour</strong></td>
<td>Brownish</td>
</tr>
<tr>
<td><strong>Specific Gravity</strong></td>
<td>Minimum 1.04</td>
</tr>
<tr>
<td><strong>Viscosity at 27 ± 2°C</strong></td>
<td>10-20 sec by Ford Cup No. 4</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>Minimum 9.0</td>
</tr>
<tr>
<td><strong>Dosage</strong></td>
<td>3 kgs per cubic meter</td>
</tr>
<tr>
<td><strong>Effect on concrete properties</strong></td>
<td>No adverse effect on concrete properties in fresh and hardened state.</td>
</tr>
<tr>
<td><strong>Tropical Compatibility</strong></td>
<td>Compatible for higher thermal cycles. No deleterious effects even at high temperature. Effective even at higher temperatures.</td>
</tr>
<tr>
<td><strong>Cement &amp; Admixture Compatibility</strong></td>
<td>Compatible with all grades of Indian Cements - OPC / PPC / PSC &amp; SRC.</td>
</tr>
</tbody>
</table>

Product: EPCO-KP-200 of Krishna Conchem Products Pvt. Ltd. or equivalent
TECHNICAL SPECIFICATIONS
SANITARY AND PLUMBING WORKS

PREAMBLE TO BILL OF QUANTITIES

1.0 GENERAL

1.1 This preamble covers Water Supply, Sewerage, Drainage, Sanitary Fixtures and C.P. fittings, Pumps and Miscellaneous works etc.

1.2 This preamble shall be read in conjunction with the specifications, conditions of contract, drawings and all other documents accompanying the tender papers.

1.3 For all items of work the rates shall be comprehensive and all inclusive. The rates shall include for all matters and things necessary for satisfactory completion and maintenance of the work in proper working order and to the satisfaction of the Engineer, including testing, making samples, etc., and all that have been indicated in the specifications or other Tender Documents either directly or indirectly, and cover for all obligations of the Contractor under the Contract. No claim for additional payment shall be allowed for any error or misunderstanding by the Contractor of the work involved.

1.4 Unless otherwise mentioned in the description of the item, this Bill of Quantities shall be applicable for work in any height, position or condition.

1.5 Unless otherwise stated, method of measurement as described in the latest editions of I.S.1200 with its parts corresponding to different sections of work shall be followed. In case of any dispute in this matter, the decision of Engineer shall be final, binding and conclusive.

1.6 The following notations have been used throughout the Bill of Quantities:

- m: Metre
- mm: Millimetre
- m2: Square Metre
- mm2: Square Millimetre
- m3: Cubic Metre
- No.: Number/Numbers
- dia.: Diameter
- Kg.: Kilogram/s
- T: Metric Tonne
- L.S.: Lumpsum
- Pt.: Point/Points
- Set: Set/Sets
- c/c: Centre to Centre
- @: At the rate of
- V: Volt/Volts
- A: Ampere/s
- SWG: Standard Wire Gauge
1.7 The Contractor shall be deemed to have full knowledge of all his obligations under the Contract and shall be deemed to have made full allowance for complying with all such obligations in his offer.

2.0 TRADE PREAMBLE

2.1 Water Supply Lines

Pipe laying, excavation, bedding, dewatering of the trench where necessary, jointing (include for all joints, gaskets, nuts, bolts, jointing compound) backfilling in trench and disposal of surplus earth pipes shall be measured by length for an average depth as a single item but separately in accordance with type and diameter of pipe. Testing and necessary rectification, and sterilizing the pipe line including supplying of necessary water, chemicals and disinfectant and disposal of the water after use, should be included in this rate.

All pipe work shall be measured by length in accordance with diameters and type of pipes, unless otherwise stated.

Chambers

Valve chambers, surface boxes and similar items shall be measured by number constructed according to type.

Appurtenances

Valves, metres, taps and similar items shall be measured by number supplied. The installation shall be included in the rate for laying, etc. of the pipes measured by length.

Fittings

Pipe fittings, such as tees, bends, elbows, reducers and similar items shall be measured with pipes. Installation shall be included in the linear metre rate for laying, etc. of the pipe line.

2.2 Masonry, RCC Chambers for Valves, Hydrants, etc.

Chambers shall be measured in number according to type. The rates shall include:

a) Necessary excavation in any kind of soil backfilling and disposal of surplus earth as specified.

b) Protecting the excavation with all necessary shoring, strutting and keeping the excavation clear of water;

c) Providing and laying foundation concrete as shown on drawing and as specified;

d) Providing and constructing brick masonry walls in cement mortar/RCC walls including reinforcement as shown on drawing and as specified. The openings required to be left open for pipes and subsequent reinforcement grouting shall also be included in the rates;

e) Providing and casting RCC top slab including reinforcement as shown on drawing and as specified;

f) Providing fitting and fixing C.I. surface box and C.I. access cover including frame as shown on drawing and as specified and/or directed at site by the Engineer.

g) Providing internal cement plaster 1:3 with water proofing compound, 12mm thick inside faces of the chamber walls;

h) Providing external cement plaster 1:4 with water proofing compound 150mm from the
bottom of the top slab for the external faces of the chamber walls. All external faces of chamber in touch with soil to be painted with two coats of bitumen coatings;

i) Providing concrete benching, seats, etc. for pipes and valves as shown in the drawing and as directed by the Engineer.

The rates quoted shall be net and should any variation occur either in drawings or in specifications, the rates of individual items of work quoted in Civil Work shall apply.

2.3 Valves, Metre, etc.

For supply of valves, metres, taps and similar items shall be measured by number. This rate shall also include cost of installation and fitting.

2.4 Water Supply pipe laying

Pipe laying as per specifications shall be measured in Running Metre as actually laid measured along the centre line of the pipe line for an average depth. The bends, junctions, specials, fittings shall be included in Running Metre length of the pipe. The rates for pipe laying shall include:

a) Excavation of trenches in any kind of soil backfilling and disposal of surplus earth as specified.

b) Providing required beddings as shown in drawing and as specified;

c) Providing the pipes and fittings, joints, specials, etc. to the site;

d) Lowering the pipes, fittings, etc. into trench, jointing and fixing true to lime and level including providing protective coating and sleeving as per specifications;

e) Providing all equipment, labour and materials, necessary to carry out the above works complete in all respects as specified and/or instructed;

f) Installation of valves, metres, other fittings and similar items, etc. as shown and specified;

 g) Construction of thrust blocks as specified, or as directed by the Engineer.

h) Testing, cleaning and sterilisation of pipe lines including supply of required water for such work;

i) Commissioning of completed pipe lines;

j) Backfilling to finished grade level with approved materials as shown and directed by the Engineer.

k) Removal of surplus excavated materials to an approved dumping yard;

2.5 External Drainage

a) Specified pipes shall be measured per Running Metre for the clear length between the chambers and appurtenances for an average depth. The rate shall be inclusive of the cost of pipes, all fittings, jointing and testing of pipes and fittings etc. as specified;

b) Manholes and chambers shall be measured in number and shall include all works as stated in 2.2

c) Specified gully traps shall be measured by number and the rate shall include the cost of masonry chamber with cover, 150 x 150mm C.I. grating including fixing in position with cement mortar.
2.6 Soil and Waste Vent and Rain Water Pipes

   a) Soil, waste, vent and rain water pipes shall be measured in running metres along the centre line of the pipes as actually laid. The cost of all fittings, e.g. bends, junctions, offsets, terminal guards, clamps and jointing shall be measured separately. The rate of pipes shall be inclusive of excavation, backfilling and disposal of surplus earth (where required), cutting chases, holes in walls and floors and making good, testing, etc. all complete as per specifications.

   b) Specified floor traps shall be measured by numbers and shall include the cost of CP grating of the required size and setting the floor traps in cement concrete with suitable extension pieces where required.

2.7 External/Internal Water Supply

   a) Specified pipes for cold and hot water supply shall be measured in running metre along the centre line of the pipe lines and the rate shall include the cost of all necessary fittings, clamps, cutting chases and holes in walls, floors and making good the surfaces, necessary excavation, backfilling and disposal of surplus earth, where required. The rate shall be inclusive of the cost of necessary fittings, testing and commissioning of the pipe lines, as specified.

   b) Valves and taps shall be measured by numbers.

   c) Insulation to hot water pipes shall be measured separately.

2.8 Sanitary Fixtures

   All sanitary fixtures of specified trade mark or equivalent shall be paid by number and rate shall include all C.P. fittings, traps, flushing cisterns, specials, connecting pipes all fixing components, brackets, screws, etc. as stated in Schedule of Rates.

2.9 Mechanical Equipments

   All mechanical equipments e.g. pumps, valves, panels etc. shall be measured in No. The rate shall include all items as indicated in the Bill of Quantities. The rate shall also include the cost, of testing and commissioning of the equipments.

3.0 TECHNICAL SPECIFICATIONS FOR PLUMBING AND SANITARY WORKS

3.1 GENERAL

3.1.1 Scope of work

   The scope of work comprises supply, installation, testing and commissioning of water supply, sewerage and drainage, sanitary fixtures and fittings and water pumping system. The scope of work includes supply of all materials as per specifications and drawings, laying, fitting, fixing, installation and commissioning the same.

3.1.2 All the water supply, drainage and sanitary works shall be carried out strictly as per printed central PWD Specifications, 1996 Vol. (Two), 2002 Edition with up to date corrections for sanitary installation, water supply, drainage and miscellaneous works. The works related with pumping system shall be carried out as per relevant Specifications.

3.1.3 All the water supply and sanitary works shall be carried out by the licensed plumbers approved by the Local Authorities and skilled workmen, experienced in the trade.

3.1.4 All works shall be completely concealed either within shafts or chases or in fills and dropped
ceilings unless specifically shown in drawings or required otherwise.

3.1.5 All works shall be adequately protected, to the satisfaction of the Engineer, so that the whole work is free from damage throughout the period of construction up to the time of handing over.

3.1.6 No work shall be covered without approval of the Engineer.

3.1.7 The Contractor shall be responsible for coordinating the work with works of other trades sufficiently ahead of time to avoid unnecessary hold-ups. Hangers, sleeves, recesses, etc. shall be left in time as the work proceeds whether or not these are shown in drawings.

3.1.8 All clamps, screws, brackets, hangers and all miscellaneous steel work needed in the work shall be fully galvanised.

3.1.9 Only specified brand of material will be used subject to the approval of the sample.

3.1.10 The Contractor shall submit as directed by the Engineer samples, manufacturer's drawings, equipment characteristics and capacity data etc. of all equipment, accessories, devices, etc. that he proposes to use in the installation, to the Engineer for approval.

3.1.11 The Contractor shall prepare and submit to the Engineer for approval before the work is commenced, all shop drawings.

These shop drawings in triplicate must be submitted by the contractor.

The work shall commence only after the shop drawings are approved by the Engineer.

3.1.12 On completion of work the contractor shall submit to the Engineer one original and two copies of as-built drawings.

3.1.13 Before the work is handed over, the Contractor shall clean all fixtures removing all plaster, stickers, rust stains and other foreign matter of discolouration of fixtures, leaving every part in acceptable condition and ready for use, to the satisfaction of the Engineer.

3.1.14 All sanitary ware and fittings shall conform to I.S. standards. The Contractor shall submit samples of all fittings and fixtures proposed to be used to the Engineer for his approval. The approved samples shall remain with the Engineer till the completion of the work.

3.1.15 All workmanship shall conform to Indian Standard Codes of Practice. The fixing and finishing shall be neat, true to level and plumb. Manufacturer's instructions shall be followed closely regarding installation and commissioning.

3.2 SANITARY FIXTURES AND FITTINGS

3.2.1 Workmanship

All sanitary-ware shall be fixed in a neat workmanlike manner, true to level and plumb. Manufacturer's instructions shall be followed closely regarding installation and commissioning.

3.2.2 Protection of Fixtures

Fixtures shall be protected throughout the progress of the work from damage. Special care shall be taken to prevent damage and scratching of chromium plated fittings. Tool marks on chromium fixtures, etc. shall not be accepted. All fixtures shall be fixed with chromium plated brass screws with washers whenever necessary.

Protective paper on fixtures shall be removed with hot water only at the final completion of work.
3.2.3 Sanitary ware

All porcelain sanitary ware shall be of first quality, free from warps, cracks and glazing defects. All sanitary ware, fittings and fixtures shall be as shown in drawings and indicated in Bill of Quantities.

3.2.4 Testing

When the installation has been completed to the satisfaction of the Engineer it shall be tested in the following manner:

a) The entire system shall be slowly filled with water, allowing any trapped air to escape.

b) When all outlets are closed the system shall be checked for water tightness.

c) Each outlet shall then be checked for rate of flow and correct operation.

4.0 PLANT AND EQUIPMENT

4.1 Scope of Work

The Scope of work in this subhead shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely do all work relating to the supply, installation, testing & commissioning of water pump as described hereinafter and shown on the drawings.

The work shall include the following :-

Supply, installation, testing & commissioning of

a) Water supply pumping system.

b) All piping, valves and accessories

c) Electrical works related with water supply pumps

d) Painting of equipment and piping

e) Unloading of the equipment and placing in position at site.

f) Foundation of equipments as required

4.2 General Requirements

a) All materials shall be new and of the best quality conforming to specifications and subject to the approval of the Engineer.

b) All equipment shall be of the best available make manufactured by reputed firms.

c) All equipments shall be installed on suitable foundations, true to level and in a neat workmanlike manner.

d) Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.

e) Piping within the pump house shall be so done as to prevent any obstruction in the movement within the pump house.

5.0 PUMPING SYSTEM
5.1 Water Supply Pumps

a) Water supply pumps shall be single stage horizontal centrifugal pumps, centre line discharge volute type delivery casing unit with closed balanced bronze impeller, stainless steel shaft, and grease or oil lubricated heavy duty ball bearings suitable for direct drive to a TEFC electric motor. Each pump shall be capable of operating within a performance pressure characteristics range sufficiently below and above the required working pressure.

b) Pumps and motors shall be mounted on a common M.S. structure base plate.

c) Each pump shall be provided with a totally enclosed fan cooled induction motor of H.P. and R.P.M. specified in schedule of quantities.

d) Each pumping set shall be provided with a Gun Metal "Bourden" type pressure gauge with gunmetal isolation cock and connecting piping.

e) Appropriate vibration eliminating pads shall be provided with each pump.

5.2 Level Controller/Indicator

Contractor shall provide and install low voltage transistorised level controllers/indicator as specified in Schedule of Quantities. Each level controller/indicator shall be provided with required number of PVC sheathed stainless steel probes with necessary wiring and conducting.

5.3 Neoprene flexible pipe connectors

Suction and delivery lines of the pumps shall be provided with double flanged reinforced Neoprene flexible pipe connectors. Connectors shall be suitable for a working pressure of each pump as specified in Schedule of Quantities.

5.4 Piping

Pipes for suction and delivery line shall be galvanised steel tubes to IS:1239 (Medium Class). Fittings shall be malleable cast iron fittings as per IS:1879.

Fullway and check valve above 80mm dia shall be CI double flanged conforming to IS-780.

Fullway and check valves 80mm dia and below shall be gunmetal conforming to IS:778.

Suction strainer or foot valve shall be gunmetal.

5.5 Joints

All G.I. pipes and fittings shall be provided with screw joints unless otherwise instructed.

5.6 Testing

All G.I. pipes shall be tested hydrostatically for a period of two hours to a pressure of 14.0 Kg/Cum. without drop in pressure.

5.7 Composite Pipes

All internal water supply pipes shall be Polyethylene-Aluminium-Polyethylene (PE-AL-PE) composite pressure pipes as per IS 15450 and shall be U.V. stabilized with carbon black, having thermal stability for hot and cold water, capable to withstand temperature range –40 to +80 degree Celsius. The pipe shall be made up of welded Aluminium tube (capable to sustain
internal pressure) with inner and outer layer of Polyethylene bonded by adhesive layers. Fittings used should be plastic-metal composite fittings crimp/compression type (as indicated) internal sealing capable to provide perfect water tight joints, pipes and fittings shall be of approved make.
1. The electrical works shall be executed by the contractor / sub contractor himself if he registered in appropriate class for electrical works with CPWD / State PWD

2. The work shall be carried out as per CPWD Specification 2005 Part- I (Internal), Part - II 1995 (External) both amended up to date. All the installation shall comply with the requirement of Indian electricity Rule 1956 amended up to date. If the specification for any item is not available in the CPWD specifications cited above, relevant IS specifications shall be followed. In case ISI specifications are also not available, the decision of the Engineer-In-charge given in writing based on acceptable sound Engineering Practice and local usage shall be final and binding on the contractor.

3. All the materials to be used on the work shall be of superior quality and shall have to be got approved from the Engineer-In-Charge before use at site.

4. The layout for running of the conduits, positions of switches fitting etc. shall have to be got approved from the Engineer-In-Charge before execution of the same.

5. All the conduits to be laid shall be provided with fish wire of not less than 16 SWG for which nothing extra shall be paid.

6. All the switches to be provided for lighting/ fans/ light plug/ power plug/ call bell etc. shall be of modular type of approved make.

7. The contractor shall make his own arrangement for the safe custody/ storage of his material. Breakage, damage if any done during the storage/ execution, the same shall be replaced / rectified by the contractor at his own cost.

8. The contractor is bound to sign the entry/ entries made by the Engineer-In-Charge or his representative in the site order book time to time.

9. Good workmanship is an essential requirement for compliance with the rules & specifications.

10. The entire installation shall be at the risk and responsibility of the contractor until these are tested and handed over to the department.

11. Earthing, loop earthing shall invariably be as per CPWD specifications.

12. Not withstanding the schedule of quantity. All items of inter-related work considered necessary to make installation complete and separative deemed to be included should be provided by the contractor at no extra cost.

13. Contractor has to supply the layout / circuit drawings of installation after the completion of work.

14. The contractor shall submit a copy of shop drawings of conduiting, etc. for electrical, telephone and data networking prior to start of the work for approval. These shall be got approved by the Engineer-in-Charge / Architect. The cover of all junction boxes shall be of Bakelite sheet.

15. The contractor shall submit a sample board, incorporating the samples of all electrical wires, conduits etc. proposed to be used for approval of Engineer-in-charge before commencement of work. No extra payment shall be given for the same.

16. The electrical works shall be executed in close co-ordination with the progress of Building work and no claim for idle labour will be entertained.
17. Any damage caused to Building as a result of execution of electrical work shall be responsibility of the electrical contractor. The damage if so caused shall be made good by the contractor promptly at his own cost to the entire satisfaction of the Engineer-In-charge.

18. Embedding of earth electrode shall be done in the presence of Engineer-in-charge for his authorized representative.

19. The contractor shall submit the completion plan separately for each floor for one particular building only in triplicate on Blue print showing the route of sub-mains etc.

20. The Engineer-in-charge will be at liberty to get the work inspected through the C.T.E. or any other agency appointed by the Govt. or Municipal Corporation and the result of their finding will be binding on the contractor.

21. Contractor shall not assign or sub-let the work without prior approval of Engineer-in-charge.

22. It will be the responsibility of the Contractor to obtain statutory approval from local inspecting authority for installation of Sub-station and shall also obtain NOC from Chief Electrical Inspector from the state of Gujrat and shall also obtain NOC from local authorities for the installation of fire alarm system as well.

23. For the purpose of design of equipment / system, an ambient temperature of 50°C shall be considered.

24. Tests:
   
   Routine tests shall be carried out as per relevant IS Codes on all equipments. Certificates for type tests carried out in last five years on similar design shall be submitted for review.

25. Data, Manuals and Drawings:
   
   The contractor shall submit the following drawing for approval –

   (i) General arrangement drawing of the equipments complete with dimensions and clearances.

   (ii) All panels schematics & wiring diagrams including circuit wiring.

   (iii) All conduit layout drawings.

   (iv) Any other drawing or data that may be necessary for the job.

   (v) The contractor shall furnish three sets of ‘As Built Drawings’ while handing over the installation.
SPECIFICATIONS FOR INTERNAL ELECTRICAL INSTALLATION

GENERAL AND TECHNICAL

POINT WIRING

A point (other than a socket outlet point) shall include all work necessary in complete wiring to the following outlets from the controlling switch or MCB. The scope of wiring for a point shall however, includes the wiring work necessary in tapping from another point in the same distribution circuit.

a] Points for ceiling / exhaust fan points, prewired light fittings, and call bells.

b] Modular plate type switch with GI box and plate of specified make.

c] Point wiring proposed with 1.5 sq.mm. PVC insulated copper conductor cable.

SCOPE

a] Control switch.

b] 3 pin or 6 pin socket.

Point wiring for socket outlet points

a] The light plug (6A) point and power (15A / 16A) point wiring shall be measured on liner basis, from the respective tapping points namely, switch box, another socket outlet point, or the sub distribution board as the case may be upto the socket outlet.

b] The GI Box, switch / MCB, socket outlet and other accessories shall be measured and paid as separate item.

c] The Power point outlet may 16A/ 6A or 16A/ 6A six pin socket outlet, where so specified in the tender documents.

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, viz. upto the nearest first switch box.

SUBMAIN WIRING

Submain wiring shall mean the wiring from one main / distribution switchboard to another.

MEASUREMENT OF CIRCUIT AND SUBMAIN WIRING

a] Circuit and submain wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all lengths from end conduit as the case may, exclusive on interconnections inside the switch board etc. The increase on account of diversion or slackness shall not be included in the measurement.

b] 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 the neutral conductor is taken to switchbox or not.
c] When circuit wires and wires of point wiring are run in same conduit/ circuit wiring shall be measured on linear basis depending on the actual number and sizes of wires run in the existing conduit.

d] Protective (loop earthing) conductors, which are run along the circuit wiring and the submain wiring, shall be measured on linear basis as per item.

**SYSTEM OF DISTRIBUTION AND WIRING**

**DISTRIBUTION**

a] Main distribution board shall be controlled by a circuit breaker. Each outgoing circuit shall be controlled by a circuit breaker.

b] The branch distribution board shall be controlled by a circuit breaker. Each outgoing circuit shall be provided with a miniature circuit breaker (MCB) of specified rating on the phase or live conductor.

c] Triple pole distribution boards shall not be used for final circuit distribution, unless specific approval of the Engineer-in-charge is obtained. In such special cases, the triple pole distribution boards shall be of HRC fuse type or MCB type only.

d] 'Power' wiring shall be kept separate and distinct from 'Lighting' wiring, from the level of circuits i.e. beyond the branch distribution boards.

e] Lights, fans and call bells shall be wired in the 'lighting' circuits. 15A/ 16A socket outlets and other power outlets shall be wired in the 'Power' circuits. 5A/ 6A socket outlets shall be wired in the 'lighting' circuits.

**PASSING THROUGH WALLS OR FLOORS**

a] Where a wall pipe passes outside a building so as to be exposed to weather, the outer end shall be mounted and turned downwards and properly bused on the open end.

**JOINTS IN WIRING**

a] There shall be no joints in the through-runs of cables. If the length of final circuit or submain is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.

b] Terminations of multi-stranded conductors shall be done using suitable crimping type thimbles.

**RATING OF OUTLETS (TO BE ADOPTED FOR DESIGN)**

a] Ceiling fans shall be rated at 60 W. Exhaust fan, fluorescent tubes, compact fluorescent tubes, according to their capacity.

b] 6A and 16A socket outlet points shall be related at 100W and 1000W respectively, wiring has been proposed accordingly.

**CAPACITY OF CIRCUITS**
a] "Lighting" circuit shall not have more than a total of 10 points of light, fan and socket outlets, or a total connected load of 800 W.

b] "Power" circuit shall be designed with only one outlet per circuit. The circuit shall be designed based on the load.

WIRING ACCESSORIES

CONTROL SWITCHES FOR POINTS

a] Control switches of 6A/ 16A rating modular plate type.

b] Power (16A) outlets shall be controlled by single pole modular plate type switches or by MCB’s, where specified. Only MCB’s shall be used for controlling industrial type socket outlets, and power outlets above 1 KW.

SOCKET OUTLETS

a] Socket outlets shall be of the same type, namely modular type, as their control switches. These shall be rated either for 6A, or 16A.

ATTACHMENT OF FITTINGS AND ACCESSORIES

CONDUIT WIRING SYSTEM

a] All accessories like switches, socket outlets, call bell pushes and regulators shall be fixed in modular plate inside the switch/ regulator boxes.

FIXING TO WALLS AND CEILING

PVC sleeves/ dash fasteners should normally be used for fixing to walls or ceiling.

FANS, REGULATORS AND CLAMPS

CEILING FANS

a] Ceiling fans including their suspension shall confirm to relevant Indian Standards.

b] For concrete roofs, a 12mm dia. MS rod in the shape of 'U' with their vertical legs bent horizontally at the top at least 19 cm on either side, and bound to the top reinforcement of the roof shall be used.

c] Dash fastener type hooks may be provided.

NON-METALLIC CONDUIT WIRING SYSTEM

APPLICATION

a] Recessed conduit is suitable generally for all applications. Surface conduit work may be adopted in places like wiring above false ceiling/ below false flooring, and at locations where recessed work may not be possible to be done. The type of work, viz. surface or recessed, shall be as specified in the respective works.

b] Flexible non-metallic conduits may only be permitted for terminations, wherever specified.
MATERIALS

CONDUITS

i] All non-metallic conduit pipes and accessories shall be of suitable material complying IS : 2509 - 1973 and IS : 3419 – 1989 for rigid conduit and IS : 9537 (Part 5) 2000 for flexible conduits. The interior of the conduits shall be free from obstruction. The rigid conduit pipes shall be ISI marked.

ii] The conduits shall be circular in cross-section. The conduits shall be designated by their outside diameter.

iii] The maximum number of PVC insulated aluminium / copper conductor cables 650 / 1100V grade conforming to IS : 694-1990 can be drawn in one conduit of various size.

CONDUIT ACCESSORIES

i] The conduit wiring system shall be complete in all respect including accessories.

ii] Rigid conduit accessories shall be normally of grip type.

iii] Flexible conduit accessories shall be of threaded type.

iv] Bends, couplers etc. shall be solid type in recessed type of works and may be solid or inspection type as required in surface type of works.

v] Saddles for fixing conduit shall be heavy gauge non-metallic type with base.

OUTLETS

i] The switch box shall be made of either rigid PVC molding or mild steel, or cost Iron on all sides except at the front the regulator boxes shall however be made only of mild steel or cast Iron.

ii] PVC boxes shall comply with the requirements laid down in IS: 14722 – 2000. There boxes shall be free from burrs, fins and internal roughness. The thickness of the walls and base of PVC boxes shall not be less than 2mm. The clear depth of PVC boxes shall not be less than 60mm.

INSTALLATION

COMMON ASPECTS FOR BOTH RECESSED AND SURFACE CONDUIT WORKS.

i) The erection of conduits of each circuit shall be completed before the cables are drawn in.

BENDS IN CONDUIT

a] All bends in the system may be formed either by bending the pipes by an approved method of heating or by inserting suitable accessories such as bends, elbow or similar fitting or by fixing non-metallic inspection boxes, whichever is most suitable. Where necessary, solid type fitting shall be used.

b] Radius of bends in conduit pipes shall not be less than 7.5cm. No length of conduit shall have more than the equivalent of four quarter bends from outlet to outlet.

c] Care shall be taken while bending the pipes to ensure that the conduit pipe is not injured and that the internal diameter is not effectively reduced.
Outlets
All switches, plugs, fan regulators etc. shall be fitted in flush pattern. The fan regulator can be mounted on the switch box cover if so stipulated in the tender specifications or if so directed by the Engineer-in-Charge

ADDITIONAL REQUIREMENTS FOR SURFACE CONDUIT WORK.

a]  FIXING CONDUIT ON SURFACE

i) Conduit pipes shall be fixed by heavy gauge non-metallic saddles with base, secured to suitable approved plugs with screws in an approved manner, at an internal of not more than 60cm, but on either side of couplers or bends or similar fittings, saddles shall be fixed at a closer distance from the center of such fittings slotted PVC saddles may also be used where the PVC pipe can be pushed in through the slots.

ii] Where the conduit pipes are to be laid along the trusses, steel joints etc. the same shall be secured by means of saddles or girder clips as required by Engineer-in-charge where it is not possible to use these for fixing, suitable clamps with bolts and nuts shall be used.

iii] If the conduit pipes are liable to mechanical damage, they shall be adequately protected.

b]  FIXING OUTLET BOXES

i) Only a portion of the switch box shall be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

ADDITIONAL REQUIREMENTS FOR RECESSED CONDUIT WORK

a]  FIXING CONDUITS IN CHASE

i) The conduit pipe shall be fixed by means of staples, or by means of non-metallic saddles, not more than 60 cm apart, or by any other approved means of fixing.

ii) At either side of the bends, saddles / staples shall be fixed at a distance of 15 cm from the centre of the bends.

b]  FIXING CONDUITS IN RCC WORK

i) The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

ii) Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors.

c]  FIXING INSPECTION BOXES

i) Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

ii) These shall be mounted flush with the wall or ceiling concrete. Minimum 65mm depth junction boxes shall be used on roof slabs and the depth of the boxes in other places shall be as per IS: 2667 - 1977.
**FIXING SWITCH BOXES AND ACCESSORIES**

i) Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified in the Additional Specifications.

e) **FISH WIRE**

i) To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.6mm / 1.2mm (16/ 18 SWG) shall be provided along with the laying of the recessed conduit.

**TABLE - I**

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

Clause 2.2 a]

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area of Conductor</th>
<th>20mm</th>
<th>25mm</th>
<th>32mm</th>
<th>38mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>S  B      S  B        S  B       S  B</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1           2    3     4    5     6    7     8    9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.50       5    4     10    8    18   12     -    -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.50       5    3     8    6    12   10     -    -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4           3    2    6    5    10   8     -    -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6           2    -     5    4    8    7     -    -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10          2    -     4    3    6    5     8    6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16          -    -     2    2    3    3     6    5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25          -    -     -    -     3    2     5    3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35          -    -     -    -     -    -     3    2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50          -    -     -    -     -    -     -    -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70          -    -     -    -     -    -     -    -</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

------------------------------------------------------------------------------------------------------------
SPECIFICATION OF PREWIRED DB

As a general practice only prewired MCB/HRC type DBs shall be used, on account of their superior technical features, compared to conventional DBs, which don’t allow for proper wiring space and wiring termination. Rewirable fuse type DBs shall not be used.

Prewired DBs shall have following feature:

i) Recess/Surface type with integral loose wire box.

ii) Phase/neutral/earth terminal blocks for termination of incoming & outgoing wires.

iii) Din Channel for mounting MCB’s.

iv) Arrangement for mounting incomer MCB/RCCB/RCBO/MCCB as required.

v) Copper Bus bar.

vi) Earthing terminals.

vii) Wiring from MCB’s to phase terminal block.

viii) Interconnection between terminal block/incoming switch/bus bar/neutral terminal block/earth terminal connector with specified size of FRLS pre insulated copper conductor cable duly fitted with copper lugs/thimbles.

ix) Terminal blocks should be suitable for termination of conductor/cable of required size but minimum rated cross section of the terminal blocks should be 6 sq mm.

x) Terminal block shall be made of flame retardant polyamide material.

xi) Colored terminal blocks and FRLS wires for easy identification of RYB Phase, Neutral and Earth.

xii) Prewired DB shall be provided with a detachable cassette for safe removal of MCBs, RCCBs. Terminal connectors from the DB without loosening the internal cable connections of phase and neutral circuits. (This is an optional feature)

xiii) The prewired DB shall have peel able poly layer on the cover for protection from cement, plaster, paints etc during the construction period.

xiv) Detachable plate with Knock out holes shall be provided at the top/bottom of board. Complete board shall be factory fabricated and pre-wired in factory ready for installation at site. The box and cover shall be fabricated from 1.6mm sheet steel, properly pretreated, phosphatized with powder coated finish.

Where specified it shall be of double door construction provided with hinged cover in the front.

Note: Prewired DB will be factory manufactured by reputed manufacturer of MCB DBs.
1. **GENERAL**

The Panel shall be indoor type having incoming, sectionalisation and outgoing switchgear as specified. The design shall be cubicle type. The degree of Enclosure protection shall be IP 54.

2. **CONSTRUCTION FEATURES**

The panel shall be floor mounted free standing type, dust and vermin proof and shall include all provisions for safety of operating and maintenance personnel. The general construction shall conform to relevant IS for factory assembled panel.

The panel shall be fabricated out of sheet steel not less than 2.0mm thick. Wherever necessary, such sheet steel members shall be stiffened by angle iron framework.

General construction shall employ the principle of compartmentalization and segregation for each circuit.

The Compartment door shall be so interlocked that it shall not be possible to open the door with the switch in ON position. An arrangement for defeating this door interlock shall be provided for testing purposes.

Overall height of the board shall not exceed 2.0 metres. Operating levers, handle etc. of highest unit shall not be at a height more than 1.7metres for convenience of operation and cable termination. There shall be gap of at least 13.50mm between the floor level and the bottom most units.

Multi-tier mounting of feeders is permissible. The general arrangement for multi-tier construction shall be such that the horizontal tiers formed present a pleasing and aesthetic look.

All cable entries shall be through gland plates. Suitable numbers of knockouts for cable entry shall be provided to take care of the present and future requirements.

The construction shall include necessary cable supports for clamping the cable in the cable alleys or rear cable chambers.

The design of framework and end covers shall be such as to require a minimum number of screws visible from outside.

All ACB feeders shall be draw out type

The general arrangement shall be got approved before fabrication.
### 3. **BUS BAR:**

The bus bar shall be of copper of high conductivity electrolytic quality and of adequate section.

The minimum cross section of bus bar shall be as per size specified below:

<table>
<thead>
<tr>
<th>Current ratings in Amp. Upto</th>
<th>Recommended rectangular cross-section</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aluminium</td>
</tr>
<tr>
<td>No. Of Strips/ phase</td>
<td>Size in mm.</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>200</td>
<td>1</td>
</tr>
<tr>
<td>300</td>
<td>1</td>
</tr>
<tr>
<td>400</td>
<td>1</td>
</tr>
<tr>
<td>500</td>
<td>1</td>
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<tr>
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<td>1000</td>
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<tr>
<td>1200</td>
<td>1</td>
</tr>
<tr>
<td>1600</td>
<td>2</td>
</tr>
<tr>
<td>2000</td>
<td>2</td>
</tr>
<tr>
<td>2500</td>
<td>3</td>
</tr>
</tbody>
</table>

**Note:**

The sections can be accepted in other rectangular cross-sections and numbers also, provided the total cross-sectional area offered is not less than the total cross-sectional area shown in the above table against the respective bus-bar rating. Necessary tolerance as per relevant IS shall be permissible.

The bus bar system may comprise of a system of horizontal and vertical bus bars run in bus bar alleys. The circuit could be arranged on either side of the bus bar. In the case of rear access, horizontal bus system shall run suitably either at the top or bottom.

Minimum clearance to be maintained for air insulated Panel for medium voltage application shall be as follows:

<table>
<thead>
<tr>
<th>Between</th>
<th>Minimum Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase to Earth</td>
<td>26mm</td>
</tr>
<tr>
<td>Phase to Phase</td>
<td>32mm</td>
</tr>
</tbody>
</table>

Bus bar support insulation shall be made of non hygroscopic, non combustible, tack resistant high strength SMC / DMC material and shall be of suitable size and spacing to withstand the dynamic stress due to short circuit currents.

All connections to individual circuits from the bus bar shall be with solid connections and the same shall be extended upto connector / insulated stud capable of taking cable / Bus-bar trunking of size suitable for that circuit. The connector / insulated stud shall be located near the respective cable entry points in the cable alley.

All bus bars and connections shall be suitably sleeved with PVC Heat Shrinkable sleeves or suitably insulated in an approved manner.
4. **PAINTING:**

All sheet work shall undergo a process of degreasing, pickling in acid, cold rinsing phosphating, passivating and then be sprayed with high corrosion resistant primer. The primer shall be baked in an oven. The finishing treatment shall be by applying a minimum of two or more coats up to a smooth finish of powder coated enamel paint of approved shade.

5. **INDICATION LAMPS:**

5.1 Each INCOMER shall have:

1. A set of three indicators (RED, YELLOW & BLUE) for indicating the healthiness of the incoming phases.
2. A set of two indicators, RED for OFF status and GREEN for ON status of the incoming switches.

5.2 Each outgoing shall have a set of two indicators, RED for OFF status and GREEN for ON status of the outgoing switch.

5.3 Each indicator shall be of multiple LED type.

Supply to the indicators shall be protected through MCB of suitable rating.

6. **CONTROL WIRING:**

All control and indication wiring etc. shall be with suitable copper conductor PVC insulated cables conforming to relevant specifications.

Runs of wires shall be neatly bunched and suitably supported and clamped.

Identification ferrules shall be used at both ends of the wires.

All control wirings meant for external connection are to be brought out on a terminal board to be located near the cable entry meant for such external cables.

7. **INSTALLATION:**

The installation work shall cover assembly of various sections of the panels lining up, grouting the units etc.

In the case of multiple panel switchboards after connecting up the bus bars etc. all joints shall be insulated with necessary insulation tape or approved insulation material.

A common earth bar shall be run at a suitable location in the panel. It will be ensured that all metal parts of the panel are connected to this earth bar system. The recommended size of earth bus bar shall be in accordance with general specification for electrical works (Part I internal as amended upto date). However minimum size of earth lead shall be 20 mm x 4mm copper or 25mm x 5mm GI Strip.
8. TESTING AND COMMISSIONING:

Commissioning checks and tests shall include the following:

(a) Operational checks.
(b) Interlock function checks.
(c) Continuity checks of wiring, fuses etc. as required.
(d) Insulation test: When measured with 500 V meggar the insulation resistance shall not be less than 100 mega ohms.
(e) Trip tests and protection gear test.
All cables shall be aluminium conductor 1.1 KV grade, armoured, XLPE insulated and PVC sheathed conforming to IS: 7098.

Outer sheath shall be of PVC as per IS : 5831 & block in colour.

Core of the cables shall be identified by colouring of insulation i.e. Red, Yellow, Blue and Black. For reduced neutral conductors the core shall be black.

In addition to manufacturer’s identification on cables as per IS, following marking shall also be provided over outer sheath.

a) Cable size and voltage grade to be embossed.

b) Sequential marking of length of cables in meters at every one meter to be embossed / printed.

CABLE LAYING

The work include receiving storing and laying of cables installation of poles supplying and fixing of fitting, earthing as per CPWD general specification for External works, 1974 amended upto 1994 including its safe keeping as per specification below.

INSTALLATION:

Cables shall not be bent sharp to a small radius either while handling or in installation. The minimum safe bending radius for PVC cables shall be 12 times the overall diameter of the cable. At joints and terminations, the bending radius of individual cores of a multi core cable of any type shall not be less than 15 times its overall diameter.

The ends of lead sheathed cables shall be sealed with solder immediately after cutting the cables. In case of PVC cables, suitable sealing tape shall be used for this purpose, if likely exposed to rain in transit storage. Suitable heat shrinkable caps may also be used for the purpose.

ROUTE:

While the shortest practicable route should be preferred, the cable route shall generally follow fixed developments such as roads, footpaths etc. with proper offset so that future maintenance, identification etc. are rendered easy. Cross-country run merely to shorten the route length shall not be adopted.

Cable route shall be planned away from drains & nears the property, especially in the case of LV/MV cables, subject to any special local requirements that may have to be necessarily complied with.

Corrosive soils, ground surrounding sewage effluent etc. shall be avoided for the routes.

Whenever cables are laid along well-demarcated or established roads, the LV/MV cables shall be laid farther from the kerb line than HV cables.

Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of voltage.
PROXIMITY TO COMMUNICATION CABLES

Power and communication cables shall as far as possible cross each other at right angles. The horizontal and vertical clearances between them shall not be less than 60 cm.

LAYING DIRECT IN GROUND

This method shall be adopted where the cable route is through open ground, along roads/lanes etc. and where no frequent excavations are likely to be encountered and where re-excavation is easily possible without affecting other services.

TRENCHING

WIDTH OF TRENCH

a. The minimum width of the trench for laying a single cable shall be 35cm.

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

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

DEPTH OF TRENCH

a. Where the cables are laid in a single tier formation, the total depth of trench shall not be less than 75cm for cables upto 1.1 KV and 1.2 m for cables above 1.1 KV.

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

c. Where no sand cushioning and protective covering are provided for the cables as per above, the depth of the trench as per above shall be increased by 25cm.

LAYING OF CABLE IN TRENCH

a. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 8cm in depth, before laying the cables therein.

b. However, sand cushioning as per above need not be provided for MV cables, where there is no possibility of any mechanical damage to the cables due to heavy or shock loading on the soil above. Such stretches shall be clearly specified in the fender documents.

TESTING BEFORE LAYING

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

The cables shall be tested for continuity of cores and insulation resistance and the cable length shall be measured, before closing the trench. The cable end shall be sealed/covered as per above clause.
SAND COVERING

Cables laid in trenches in single tier formation shall have a covering of dry sand of not less than 17cm above the base cushion of sand before the protective cover is laid.

In the case of vertical multi-tier formation, after the first cable has been laid, a sand cushion of 30cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30cm as stated above. Cables in the top most tiers shall have final sand covering not less than 17cm before the protective cover is laid.

Sand covering as per above need not be provided for MV cables where a decision is taken by the Engineer-in-charge as per above sub clause, but the inter-tier spacing should be maintained as in above with soft soil instead of sand between tiers and for covering.

Sand cushioning as per above shall however be invariable provided in the case of HV cables.

EXTRA LOOP CABLE

At the time of original installation, approximately 3m of surplus cable shall be left on each terminal end of the cable and on each side of the underground joints. The surplus cable shall be left in the form of a loop. Where there are long rungs of cables such loose cable may be left in the form of a loop. Where there are long runs of cables such loose cable may be left at suitable intervals as specified by the Engineer-in-charge.

Where it may not be practically possible to provide separation between cables when forming loops of a number of cables as in the case of cables emanating from a substation, measurement shall be made only to the extent of actual volume of excavation, sand filling etc. and paid for accordingly.

MECHANICAL PROTECTION OVER THE COVERING

a. Mechanical protection to cables shall be laid over the covering in accordance with below to provide warning to future excavators of the presence of the cable and also to protect the cable against accidental mechanical damage by pickaxe blows etc.

b. Unless otherwise specified, the cables shall be protected by second class brick of nominal size 22cm x 11.4cm x 7cm or locally available size, placed on top of the sand (or, soil as the case may be) the bricks shall be placed breadth-wise for full length of the cable. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and project at least 5cm over the sides of the end cables.

c. Where bricks are not easily available, or are comparatively costly, there is no objection to use locally available material such as tiles or slates or stone/cement concrete slabs. Where such an alternative is acceptable, the same shall be clearly specified in the tender specifications.

d. Protective covering as per above need not be provided only for MV cables, in exceptional cases where there is normally no possibility of subsequent excavation. Such cases shall be particularly specified in the Tender specifications.

BACK FILLING

The trenches shall be then back-filled with excavated earth, free from stones or other sharp edged debris and shall be rammed and watered, if necessary in successive layers not exceeding 30cm depth.
Unless otherwise specified, a crown of earth not less than 50mm and not exceeding 100mm in the center and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of the earth however, should not exceed 10cm so as not to be a hazard to vehicular traffic.

The temporary re-statements of roadways should be inspected at regular intervals, particularly during wet weather and settlements should be made good by further filling as may be required.

After the subsidence has ceased, trenches cut through roadways or other paved areas shall be restored to the same density and materials as the surrounding area and re-paved in accordance with the relevant building specifications to the satisfaction of the Engineer-in-charge.

Where road beams or lawns have been cut out of necessarily, or kerb stones displaced, the same shall be repaired and made good, except for turfing / asphalting, to the satisfaction of the Engineer-in-charge, and all the surplus earth or rock shall be removed to places as specified.

LAYING OF SINGLE CORE CABLES

Three single core cables forming one three-phase circuit shall normally be laid in close trefoil formation and shall be bound together at intervals of approximately 1m.

The relative position of the three cables shall be changed at each joint at the time of original installation, complete transposition being effected in every three consecutive cable lengths.

LAYING IN PIPES / CLOSED DUCTS

Stone ware pipes, GI, CI or spun reinforced concrete pipes shall be used for cables in general; however only GI pipe shall be used as protection pipe on poles.

The size of pipe shall not be less than 10cm in dia. for a single cable and not less than 15cm for more than one cable.

Where steel pipes are employed for protection of single core cable feeding AC load, the pipe should be large enough to contain both cables in the case of single-phase system and all cables in the case of poly phase system.

Pipes for MV cables shall be independent one.

In the case of new construction, pipes as required (including for anticipated future requirements) shall be laid along with the civil works and jointed according to the CPWD Building Specifications.

These pipes shall be laid directly in ground without any special bed except for SW pipe which shall be laid over 10cm thick cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate of 40mm nominal size) bed. No sand cushioning or tiles need be used in such situations.

Pipes laid for protection shall be paid extra if not covered in the schedule of quantities.

ROAD CROSSINGS

The top surface or pipes shall be at a minimum depth of 1m from the pavement level when laid under roads, pavements etc.
The pipes shall be laid preferable askew to reduce the angle of bend as the cable enters and leaves the crossing. This is particularly important for HV cables.

When pipes are laid cutting an existing road, care shall be taken so that the soil filled up after laying the pipes is rammed well in layer with watering as required to ensure proper compaction. A crown of earth not exceeding 10cm should be left at the top.

Manholes shall be provided to facilitate feeding/drawing in of cables with sufficient working space for the purpose. Suitable manhole cover shall cover them. Sizes and details shall be indicated in the schedule of work.

CABLE ENTRY INTO THE BUILDING

Pipes for cable entries to the building shall slope downwards from the building. The pipes at the building end shall be suitably sealed to avoid entry of water after the cables are laid.

Cable-grip/draw-wires, winches etc. may be employed for drawing cables through pipes/closed ducts.

Measurement for drawing/laying cables in pipes/closed duct shall be on the basis of the actual length of the pipe/duct for each run of the cables, irrespective of the lengths of cables drawn through.

LAYING IN OPEN DUCTS

Open ducts with suitable removable covers (RCC slabs or chequered plates) are generally provided in substations, switch rooms, plant rooms, workshops etc., for taking the cables. The cable ducts should be of suitable dimensions for the number of cables involved.

Laying of cables with different voltage rating in the same duct shall be avoided. Where it is inescapable to take HV & MV cables same trench, they shall be laid with a barrier between them or alternatively, one of the two (HV/MV) cables may be taken through pipe(s).

Splices or joints of any type shall not be permitted inside the ducts.

The cables shall be laid directly in the duct such that unnecessary crossing of cables is avoided.

Where specified, ducts may be fixed with clamps on the walls of the duct or taken in hooks/brackets/through in ducts.

Where specified, ducts may be filled with dry sand after the cables are laid and covered as above, or finished with cement plaster, especially in high voltage applications.

Providing duct is not in this scope of work.

LAYING ON SURFACE

This method may be adopted in places like switch rooms, workshops, tunnels, rising (distribution) mains in buildings etc. This may also be necessitated to the existing installation, where other methods of laying may not be feasible.
Cables may be laid in surface by any of the following methods as specified.

a. Directly clamped by saddles or clamps,
b. Supported on cradles,
c. Laid on troughs/trays, duly clamped.

The saddles and clamps used for fixing the cables surface shall comply with the requirements.

Saddles shall be secured with screws to suitable approved plugs. Clamps shall be secured with nuts on the bolts, grouted in supporting structure in an approved manner.
a] Safe earthing electrode with back filling compound shall be provided as per IS 3043.

b] When more than one electrode is to be installed, a separation of not less than 2 m shall be maintained between two adjacent electrodes.

c] i) The strip or conductor electrode shall be buried in trench not less than 0.5m deep.

ii) If conditions necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible. In a single trench where feasible, or preferably in a number of trenches radiating from one point.

iii) If the electrode cannot be laid in a straight length, it may be laid in a zigzag manner with a deviation upto 45 degrees from the axis of the strip. It can also be laid in the form of an arc with curvature more than 1 m or a polygon.

WATERING ARRANGEMENT

a] The watering funnel attachment shall be housed in a masonry enclosure of size not less than 30cm x 30cm x 30cm.

d] A cast iron/ MS cover, 6mm thick, and having locking arrangement shall be suitably embedded in masonry enclosure.

EARTHING CONDUCTOR (MAIN EARTHING LEAD)

a] In the case pf pipe earth electrode, wire type earthing conductor shall be secured, using a through bolts, nuts and washers and terminating socket.

b] The earthing conductor from the electrode up to the electrode upto the building shall be protected form mechanical injury by a medium class, 15mm dia. GI pipe in the case of wire, and by 40mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.

PROTECTIVE (LOOP EARTHING/ EARTH CONTINUITY) CONDUCTOR.

a] Earth terminal of each switchboard in the distribution system shall be bonded to the earth bar/terminal of the upstream switchboard by protective conductor(s).

b] All the mountings of industrial type switchboards shall be bonded to the earth stud/earth bar using a protective conductor looping from one to another. Loop earthing of individual units will not be however necessary in the case of cubicle type switchboards.

c] All metallic switch boxes and regulator boxes in a circuit shall be connected to the earth connector in the DB by protective conductor (also called circuit protective or loop earthing conductor), looping from one box to another upto the DB.

d] The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the earth stud in switch boxes by protective conductor. Where the switch boxes are of non-metallic type, these shall be looped at the socket earth terminals, or at an independent screwed connector inside the switch box. Twisted earth connections shall not be accepted in any case.
e) Double earthing strips in the rising mains, bus trunking etc. shall be securely connected to the earth bar/earth stud at the sending end switchboard. In the case of overhead busbar systems, protective conductors shall be provided in addition to feeder cable armouring connection.
SYSTEM AND SYSTEM REQUIREMENTS.

The proposed hostel building is to be provided with following arrangements as per latest National Building Code by guidelines modified up to November 2005. Since, the height of the building is more than 24 mtr. The equipment are as follows:

1. Fire Extinguishers of all type.
2. Down comer with single hydrant & hose reel are required.
4. Terrace tank for the individual hydrant – 25000 ltr.
5. Terrace pump – 900 LPM.

To provide the above systems, Fire extinguishers shall be fitted as per item and list of recommended make. The Fire extinguisher of the required capacity shall be only ISI marked.

The Down comer shall be strictly as per description of the item and CPWD specifications 2005, National Building Code and Tariff Advisory Committees recommendations and State Government by laws.

Down Comer:-

1. The operating pressure of individual hydrant shall be 3 kg per cm square. At terrace level hydrant, minimum 3 kg per square cm pressure shall be maintained.

2. The pipe line will be designed in such a way that it should be possible to get designed, discharge at any location. Design parameters shall be as under:
   i) Maximum flow velocity 2.5 m/s.
   ii) Maximum Friction 5 m per 100 m. run.

3. Terrace pump shall be selected for
   i) Discharge 900 lpm.
   ii) Head 35 m + 6% of the maximum length of pipe from terrace pump to any hydrant at terrace level.

4. No. of Risers:- Risers will be provided in such a way that no corner of the building is farther than 30 m. from nearest riser. The horizontal distance between two risers shall not be more than 50 m.

5. Internal Hydrant: - Every riser will be provided with the following at every floor i/c terrace and basement over and above sprinkler system.
   i) Single headed outlet 2 Nos.
   ii) First Aid Hose Reel 1 No.
   [Length of pipe shall be such that nozzle of the hose can be taken into every room and within 6 Mts. Of any part of the rooms keeping in view layout & obstruction.]
   iii) Hose pipe 63 mm dia. 15 m. long with male & female coupling at both ends. 2 Nos.
   iv) Branch pipe 63 mm dia with 20 mm nozzle and suitable for instantaneous connection. 1 No.
6. Air vessel: - To counteract the water hammer effect, air vessels shall be provided one in the fire pump room and one at top of each riser.

7. Alarm: - To indicate the flow of water in the system, turbine type alarm shall be provided outside the pump house in the main line before any connection is taken. The alarm will indicate the healthiness of the system and shall not be silenced till the main fire a pump is in operation.

8. Control System: - The system shall be designed for operation automatically so that as and when water is drawn from the system through any hydrant, the pumps will operate automatically and feed water into the system. Facility shall also be provided for manual operation. A selector switch for auto/manual selection shall be provided in each pump.

9. For each set of Down Comer-
   i) A minimum of two terrace pumps (electrical) shall be provided. One pump shall act as standby.
   ii) All down comer pipes shall be interconnected at the terrace level. In case terraces are not connected, all building will be treated as individual buildings.
   iii) Control system: - The starting of terrace pump shall be automatic i.e. with the opening of any hydrant valve or hose reel on any floor, the pump will start automatically with fall in line pressure. In addition start/stop push buttons shall be provided at ground floor near internal hydrant for starting the pump manually. Where fire control room has been provided, remote operation of terrace pump may be done from fire control room in place of internal hydrant. The control panel for terrace pumps shall be provided near the pumps in a suitable enclosure to avoid unauthorized operation.

PIPE WORK

1. SCOPE

This chapter covers the requirements of pipe work in fire fighting installations.

2. PLUMBING DESIGN

   i) Pipe sizes shown in tender documents are purely for contractor’s guidance. The contractor shall be responsible for selection of sizes as per detailed engineering to be done by him. Plumbing design to be done by the contractor shall incorporate the following:-

      a) Sluice valves shall be provided at suction and delivery sides of pumps. (If positive suction is not provided valve at suction is not to be provided).
      b) External hydrant
      c) Fire service connection / inlet.
      d) Test valve
      e) Drain connections.

   ii) For testing the system healthiness & automatic operation on daily basis, one test pipe with sluice valve shall be provided in common discharge header. For avoiding wastage of water, this pipe shall discharge water in the tank.

   iii) Non return valve shall be provided at the delivery of each pump and fire service inlet. This shall be of swing type.

   iv) Air release valves with ball valve shall be provided in the piping system for venting trapped air with a size of 25 mm for pipes up to 100 mm and 40 mm for larger pipes.
v) Plumbing drawings showing the sizes of pipe, valves, layout and other details shall be prepared and shall be got approved from the Engineer-in-Charge before the execution of the plumbing work.

3. PIPE MATERIALS

i) Pipes shall be of the following materials.

   a) Mild steel heavy class (C-class) confirming to IS: 1239 for sizes up to 150 mm.
   b) Welded black steel pipe, class 2, confirming to IS: 3589, for sizes greater than 150 mm. These pipes shall be factory rolled & fabricated from minimum 6mm thick M.S. Sheet for pipes up to 350 mm dia & from minimum 7 mm thick M.S. sheet for pipes of 400mm dia & above.
   c) Cast iron double flanged class-'A' confirming to IS-1536 or IS-1537 (To be provided only in under ground application).

ii) Cadmium plated steel nuts/bolts/washers shall be used.

4. PIPE JOINTS

i) Electric welding joints shall be provided in the M.S. pipe work. Flanged joints shall be provided for connections to valves, pumps, air vessels etc. and also on straight lengths at suitable points to facilitate erection and subsequent maintenance.

ii) For connection of C.I. Pipe, fittings shall also be of C.I. heavy grade conforming to IS-1538. The flanges shall be smooth faced and neoprene gasket shall be provided. Where unavoidable and to connect under ground pipe with risers, M.S. pipe may be used in the form of distant pieces. The joint between C.I. & M.S. pipe shall be flanged type M.S. pipe laid at such locations shall be provided anti corrosive treatment.

iii) Mild steel flanges shall be in accordance with table 17 of IS 6392 i.e., “Plate Flanges for welding” and flange thickness shall be as under. Gasket thickness shall not be less than 3 mm.

<table>
<thead>
<tr>
<th>Pipe dia</th>
<th>Flange Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mm</td>
<td>24 mm</td>
</tr>
<tr>
<td>150 mm &amp; 125 mm</td>
<td>22 mm</td>
</tr>
<tr>
<td>100 mm &amp; 80 mm</td>
<td>20 mm</td>
</tr>
<tr>
<td>65 mm</td>
<td>18 mm</td>
</tr>
<tr>
<td>40 mm &amp; above</td>
<td>16 mm</td>
</tr>
</tbody>
</table>

All hardware items such as Nuts, Bolts, and Washers shall be of appropriate size and galvanized. Washers shall be used on both sides of the bolts.

5. VALVES: - Sluice valve confirming to IS: 780 shall be provided. All valves shall be suitable to withstand the pressure in the system and rating shall be PN. 1.6. All valves shall be right handed (i.e., handle or key should be rotated clock wise to close the valve), the direction of opening and closing shall be marked and an open / shunt indicator fitted.

i) The material of valves shall be as under:
   Body- Cast iron
   Disc- Cast Bronze or Stainless Steel
   Seat- Either integral or Nitrile rubber
   O-ring- Nitrile/ Silicon
ii) Non return valves shall be swing check type in horizontal run and lift check type in vertical run of pipes.

iii) Air release valves shall be of gunmetal body.

6. STRAINERS

i) Stainless steel strainers shall have minimum 1mm thick screen with 3 mm perforations. Strainers shall be provided with flanges.

7. ORIFICE PLATE

Orifice plate shall be made of 6 mm thick stainless steel and shall have an identification tag projecting beyond any flange between which it is clamped. The orifice shall be plain central hole without burrs and diameter not less than one-half of the internal diameter of the pipe to which it is fitted.

8. INSTRUMENTS

i) Pressure gauge of appropriate range and 150 mm dial size shall be provided.

ii) The pressure gauge shall be duly calibrated before installation and shall be complete with shut off valve.

9. AIR VESSEL

Air vessel shall be provided in fire pump room and on top of each riser and shall be fabricated of 8 mm thick M.S. Sheet. The ends shall be dished. This shall be 250 mm dia and 1.2 m high and installed vertically on suitable legs. The legs shall be provided with M.S. plate of size 75mm x 75mm x 5mm at the bottom so that the legs do not puncture the roof. The legs shall be grouted in CC foundation. Flange connection shall be provided for connection with wet riser pipe. Air release valve shall be tested at 25 kg per cm square pressure before installation.

10. INSTALLATION

i) The installation work shall be carried out in accordance with the detailed drawings prepared by the contractor and approved by the Engineer-in-charge.

ii) In pipe above ground level, expansion loops or joints shall be provided to take care of expansion or contraction of pipes due to temperature changes.

iii) Tee-off connections shall be through equal or reducing tees, otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.

iv) Open ends of piping shall be blocked as soon as the pipe is installed to avoid entrance of foreign matter.

v) Piping installation shall be supported on or suspended from structure adequately. The contractor shall provide, clamps, hangers etc.

vi) Pipe supports in pump house shall be floor mounted and of mild steel/G.I. Spacing of pipe supports shall not be more than that specified below:-
<table>
<thead>
<tr>
<th>NOMINAL PIPE SIZE</th>
<th>SPACING (m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 and 25</td>
<td>2.00</td>
</tr>
<tr>
<td>32 to 125</td>
<td>2.50</td>
</tr>
<tr>
<td>150 and above</td>
<td>3.00</td>
</tr>
</tbody>
</table>

Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stress on the pipes.

vii) Anti vibration pads, springs or liners of resilient and non-deteriorating, material shall be provided at each support, so as to prevent transmission of vibration through the supports.

viii) Pipe sleeves of diameter larger than the pipe by least 50 mm shall be provided wherever pipes pass through walls and the annular spaces shall be filled with felt and finished with retaining rings.

ix) a) Vertical risers shall be parallel to walls and column lines and shall be straight and in plumb. Risers passing from floor to floor shall be supported at each floor by clamps.

b) The space in the floor cut outs around the pipe work shall be closed using cement concrete (1:2:4 mix) or steel sheet, from the fire safety considerations, taking care to see that a small annular space is left around the pipes to prevent transmission of vibration to the structure.

c) Riser shall have suitable supports at the lowest point.

x) Where mild steel pipes are to be buried under ground the same shall be treated before laying. The top of the pipes shall be not less than 100 cms. below the ground level. Where this is not practicable, permission of the Engineer-in-charge shall be obtained for burying the pipes at lesser depth. Masonry or C.C. blocks shall be provided for supporting the pipes at interval. After the pipes have been laid, the trench shall be refilled with the excavated soil in layers of 20 cm. and rammed and any extra soil shall be removed from the site of work by the contractor.

xi) Underground pipe shall be laid at least 2 m. away from the face of the building preferably along the roads, foot paths. As far as possible laying of pipes under road, pavement, large open spaces shall be avoided. Pipes shall not to laid under building and where unavoidable these shall be laid in masonry trenches with removable covers.

xii) To facilitate detection of leak and isolation of defective portion of pipe, valves shall be provided in under ground pipe at suitable locations. As far as possible such valves shall be provided over ground. If the valves are to be provided below ground, suitable masonry chamber with cover plate shall be provided. Locations where vehicles can pass shall be avoided for provision of valve below ground.

xiii) Pipe over ground is identified with colour. Suitable identification shall be provided to indicate the run of under ground pipe.

xiv) It shall be made sure that proper noiseless circulation is achieved in the system. If proper circulation is not achieved due to air-bound connections, the contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification, i/c the tearing up and refinishing of floors, walls, etc. as reqd.
11. PRESSURE TESTING

   a) All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg per cm square for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge.
   b) Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.
   c) System may be tested in sections and such sections shall be securely capped.
   d) Pressure gauges may be capped off during pressure testing of the installation.

12. ANTI-CORROSIVE PROTECTION ON UNDER GROUND PIPE

   Corrosion protection tape shall be wrapped on M.S. Pipes to be buried in ground. This corrosion protection tape shall comprise of coal tar/asphalt component supported on fabric of organic or inorganic fibre and minimum 4mm. thick and conform to requirement of IS 10221-Code of practice for coating and wrapping of under ground mild steel pipe line. Before application of corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall than be wound around the pipe in spiral fashion and bounded completely to the pipe. There shall be no air pocket or bubble beneath the tape. The overlaps shall be 15 mm and 250 mm shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated insitu after the pipe line is installed. The tapes shall be wrapped in accordance with the manufacturer’s recommendations. If application is done in cold weather, the surface of the pipe shall be pre-heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.

13. PIPE SUPPORTS

   For installing pipes vertically or horizontally inside the building standard pipe supports of reputed make shall be used. Following supports shall be used.

   i) Split pipe support clamps with rubber lining for vertical, horizontal & roof hanging.
   ii) Clevis Hangers for horizontal supports to adjust varying heights.
   iii) Sprinkler Hangers for horizontal supports for pipes from 15 mm. dia to 150 mm. dia.

   Fasteners and fully threaded rods shall be used for installing the pipe supports. The sizes of pipe supports and installation shall be in accordance with manufacturer’s recommendations.

   For pipes of sizes 100mm and above, with the prior approval of Engineer-in-Charge ‘U’ clamp with dash fastner may be used for supporting horizontal pipe from ceiling.

14. MEASUREMENT

   Measurements of plumbing work shall be on following basis:-

   a) Piping shall be measured along the centre line of installed pipes i/c all pipe fittings and accessories but excluding valves and other items for which quantities are specially indicated in the schedule of work. No separate payment shall be made for fittings and accessories.

   b) The rates for piping work shall include all wastage allowances, flanges pipes, supports, hangers, excavation, refilling, testing, nuts and check nuts, vibration isolators, suspension where specified or required, and any other item required completing the piping installation. None of these items will be separately measured and paid.
FIRE FIGHTING ACCESSORIES

1. SCOPE: - This chapter covers landing valves, first aid hose reels, hose pipes, branch pipes etc. which are vital tools for fire fighting.

2. Landing Valve: - Landing valves are provided in the system foe connection of hose pipes for discharging water for fighting fire by fire brigade or trained personal.
   i) The landing valves shall be as per IS: 5290.
   ii) The landing valves are of single outlet type & double head outlet type.
   iii) Material of construction
       a) Body, outlet and cap etc: - Bronze or Aluminium alloy or strain less steel.
       b) Spindle :- Brass for Bronze body, stain less steel for Aluminium alloy and stain less steel body.
       c) Hand wheel: - Mild steel or cast iron.
   iv) The water discharge shall be not less than 900 lpm for single head & 1800 lpm for double head valves at 7 kg per square cm pressure.
   v) Installation –
       a) The landing valve shall be fitted to a T connection of the riser at the landing in such a way that the valve is in the centre of the internal hydrant opening and at a height of 1 m from floor level.
       b) The valve base shall be vertical and the valve facing out side. There should be no hindrance in operation of the handle.

3. First Aid Hose Reel: - First Aid Hose Reel is meant for delivering small quantity of water in early stage of fire and can be operated even by untrained personnel, and thus provide a most effective fire fighting facility. It consists of a length of 20 mm dia hose tubing warped around a reel with water inlet pipe, stop valve, shut off nozzle. The entire assembly is mounted on a wall bracket and can swing 180 degree. The water inlet is connected to the riser pipe by mean of 37 mm socket and valve. The hose tube can be pulled out easily for the purpose of discharge of water on fire.
   a) First aid hose reel shall be as per IS- 884. The coupling, branch pipe & nozzle shall be as per IS: 8090.
   b) Material of Construction:-
      i) Hub & sides : - Aluminium Alloy / Mild Steel / Aluminium sheets.
      ii) Wall Bracket : - Cast iron / Mild steel.
      iii) Hose tube (20 mm) :- Thermoplastic (Textile Reinforced) Type-2 as per IS- 12585.
      iv) Nozzle with branch pipe: - Brass.
   v) Stop Valve (Ball Valve):- Gun metal.
   b) The water flow rate shall be not less than 24 lpm and the range of jet shall be not less than 6 m.
c) Installation
i) The length of hose tube shall be such that the nozzle of the hose can be taken into every room and within a range of 6 m from any part of the room (This is normally between 30 m to 40 m)

ii) There shall be no obstruction in swinging the hose reel and should be installed above landing valve where provided.

iii) The inlet valve shall be at 900 mm above floor level.

iv) Hose reel bracket should be firmly grouted on the wall with the help of rawl bolts.

4. Fire Hose Delivery Coupling, Branch Pipe and Nozzles:-
   a) These are important accessories used for fire fighting operations.
   b) Material of construction
      i) Copper Alloy.
      ii) Aluminium alloy.
      iii) Stainless steel.
   c) Delivery Hose Couplings:-
      i) The delivery hose coupling consist of male half coupling and female half coupling. Groves are provided on outer side on both coupling for binding hose pipes with wires. In female coupling spring, loaded cam tooth is provided for holding male half coupling in position. Male half coupling & female half coupling are provided on both sides (i.e. on one side male and on other side female) of hose pipes. Two or more pipes can be joined together with the help of these couplings instantaneously.
      ii) Sizes: - These are available in two sizes i.e. 63 mm and 70 mm. Normally size 63 mm is used.
   d) Branch Pipe & Nozzle :-
      Branch Pipe with nozzle is mounted at the end of hose pipe. Branch pipe is properly finished and free from sharp edges. During operation, a fireman has to hold the branch pipe. One end of branch pipe is fixed with hose coupling and the other end is threaded to fit the nozzle.

      Nozzle is tapered pipe with one end threaded internally which is fixed on branch pipe. The size of other end i.e. nozzle shall be 20 mm.

5. Fire service Inlet and fire service connection:-
   a) These are provided for connection of fire service hose pipes for either directly pressurizing the system with their pumps or filling water in the tank from a distance. In the first case non return valve with butterfly valve shall be provided for holding water pressure. These are fixed to 150 mm dia pipe and located in MS Box made of 2 mm mild steel, sheet with operable glass cover.
   b) These shall be as per IS: 904.
   c) Material of construction.
   d) Copper Alloy.
   e) Aluminium Alloy.
6. Hose Pipes :-

a) Hose pipes shall be rubber lined woven jacketed and 63 mm in diameter. They shall conform to Type A (Re-inforced rubber lined) of IS: 636. They shall be flexible and capable of being rolled. Length of hose pipe will be 15 m.

b) The hose pipe shall be complete with male and female coupling at the ends.
1. Scope:-
The Supply, installation, testing and commissioning of the complete automatic fire alarm system equipment and associated items shall be in accordance with the CPWD General specification for electrical works part VI fire alarm system 1988 and in conformity with the fire regulation. The electrical installation shall conform to CPWD General Specification for electrical works part. I (Internal) 2005 and part II (External) 1994 and Indian Electricity Rule 1956 amended up to date.

2. Technical specifications

A. AUTOMATIC FIRE DETECTORS AND CONTROL PANELS.
   
a) Heat detectors shall conform to IS-2175-1977 AS AMENDED UPTO DATE. BS5445 (EB54) Part 5 1977 or any other relevant foreign standards.

b) Smoke detectors shall conform to IS-11360-1985. BS 5446 PART-I-1977, BS 5445 (EN54) part-7-1984 or any relevant foreign standards.

c) The detectors and control panels shall be on the approved list of one of the following:
   
i) UL,
   ii) FOC,
   iii) NEPA,
   iv) F.M.,
   v) T.A.C.

d) Wherever imported detectors are specified documentary evidence for such imports like bill of entry / landing or similar certificate should be submitted by the contractor to the satisfaction of Engineer-in-charge, failing which the detectors are liable to be rejected forthwith.

e) The detection system should be so designed that may make of heat / smoke detectors can be replaced with any other make in any of the circuits i/c replacement of the original with another make without needing any modification in SIP/MCP and even if any changes are required to be done the same should be included in the tender cost.

f) Arrangement should exist for isolation with visual indication of any particular room or area from A.F.A.S. monitoring system with the indication in the SIP and M.C.P. This will facilitate execution of repair works in these area / rooms without affecting the A.F.A. system in the balance areas.

g) The detectors and response indicators as well as manual call boxes should be provided with a continuous monitoring system like LED indication or similar arrangement so that the operational readiness of the detectors or the manual call points can be noticed at a glance.

h) The detailed drawings as well as system configuration of the sector indicating panel and main control and indicating panel shall be submitted by the contractor to the department fee approval well in advance.

B. FIRE ALARM SOUNDERS

a) The fire alarm sounders shall be installed on surface of the walls at about lintel level directly above or near every manual call points. The fire alarm sounders should be painted red & marked ‘Fire Alarm’.
b) The fire alarm sounder should be actuated from the control and indicating panel facilities should also be provided in the control panel for actuating the fire alarm sounders in any particular zone or zones.

C. Standby battery shall be provided by the contractor with the C&I panel with automatic change over arrangement to feed the A.F.A.S. in the event of main supply failure or variations. In the input supply voltage beyond the permissible limits.
The capacity of the battery shall be such as to sustain the load of the fire system for a period of at least 48 hrs. followed by the load of all the sounders all the zones for a period of at least 30 minutes there after.
The batteries shall be provided with a trickle and boost charge arrangement. The charger shall be complete with necessary voltmeter, indicating lamps fuses etc.

D. Sample of detectors up to 5 shall be taken from the supply of each lot of 500 detectors and sent to central building research institute Roorkee/any other Govt. test were approved by Engineer-in-charge for testing as per relevant I.S. if the results of the test performed on the samples are not in accordance with relevant I.S. the whole lot shall be rejected. The payment for the detectors shall not be released till the receipt of satisfactory results from the above test wares. Necessary expenditure for the testing shall be borne by the contractor.

E. Imported detectors with local made base shall not be accepted.

F. Wiring

G. P.A. System

a) Amplifier
   i) Configuration: Channel mixing amplifier.
   ii) Power rating: 250 Watts (250 watts r.m.s.).
   iii) Frequency response: 20 HZ to 20 KHZ
   iv) Distortion: Not exceeding 0.5% at rated o/p at 1 KHZ.
   v) Load condition: O/P protected against short for un-defined period.
   vi) Signal to noise ratio: Not exceeding 80 db all control.
   viii) Priority circuit: Should actuate channel 2 to 6 by 40 db when activated.

b) Talk back Master station:
   i) Talk back master station must have provision for audio and visual indication when called by slave station.
   ii) Master Station must operate on simplex communication mode through built in loud speaker.
   iii) It must meet IEC-268-3 Standards.

c) Goose neck Microphone
   Goose neck microphone must meet the following specifications.
   i) Impedance (at 1 KHZ) – 220 ohms.
   ii) Sensitivity (at 1 KHZ) – 135 MV/pa.
   iii) Frequency Response – 90 HZ – 15 KHS.
   iv) Recommended load – Over 600 ohms.
   v) Switch – DP Dt. ON/OFF
   vi) Cables – 2 core shield – 3 meters.
d) **TALK BACK (SLAVE)**
   The talk back slave should be provided with suitable tamper proof metallic, break glass box, meeting the following specifications.
   
   i) Required activation: - Through simplex operation of press lock switch.
   ii) Talk back: - In simplex mode of communication through built in loud speaker.
   iii) The amplifier, microphones and loud speaker shall confirm to relevant IS specifications does not exist relevant specifications shall be followed.


e) **Junction Box**
   i) There shall be bakelite strips inside the junction boxes with brass screws for connections. All connections shall be carried out with suitable size of copper thimbles / ferrules etc.
   ii) Nothing extra shall be paid for recessing / grouting the junction box in the hall.