TENDER DOCUMENT
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FOR

CONSTRUCTION OF CLASS ROOM COMPLEX
AT
SVNIT, SURAT-GUJARAT

FOR

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

VOLUME – IIB

TECHNICAL SPECIFICATIONS

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### VOLUME – II B

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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 other wise 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 anodized 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 Anodizing /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
Department the manufacturer’s certificate for compliance of the polycarbonate sheets as per the manufacturer’s specifications and also copy of the manufacturer’s test report for the record.

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 withstand 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/discolor 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 Watertight 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 losing 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**

A. **Composition**

Skin material 0.5mm thick aluminum sheet (3005 H6) core material natural polyethylene.

B. **Dimensions**

Panel thickness: 4mm
Panel size: Width 1000/1250/1500mm
Length between 1500 and 5000mm

Tolerance
Width + 2.0mm
Length + 4.0mm
Thickness + 0.02mm

C. **Principal Properties**

Panel weight: 5.5 kg/sq.m
Thermal expansion: 1mm/M/60 deg.C.

D. **Acoustic Properties**

Average airborne sound transmission loss 26 db.

E. **Mechanical Properties**

Tensile Strength RM> 160 MPa.
0.2% Proof stress RP> 130 MPa.
Modulus of Elasticity E 70,000 MPa.
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 form 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 Program**

The tenderer shall also submit a preliminary program 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 + 13mmm 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></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
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 upto 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.

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.
CLASSROOM COMPLEX AT SVNIT, Surat

TECHNICAL SPECIFICATIONS FOR CIVIL WORKS

1. GENERAL SPECIFICATIONS

1.1 The work in general shall be carried out as per CPWD specifications, 2007 (Volume I to VI) (Updated with correction slips issued up to last date of submission of tender) and 2007 for Electrical Works (updated with correction slips issued up to last date of submission of tender).

1.2 All installations shall comply with the requirements of Indian Electricity Rules, 1956 and Indian Electricity Act –1910 as amended up to date, and bye laws of authority of State Government or any other Department.

1.3 All Mechanical works related to Public Health Engineering will conform to the requirements of manual of Water Supply by the Ministry of Urban Development and various Indian Standards as listed in the manual.

1.4 All Electrical works will conform to various Indian Codes as listed in Technical Specifications.

1.5 For items not covered under the Specifications as stated above, the work shall be done as per relevant IS Codes of Practice.

1.6 For items not covered under any of the specifications stated above, the work shall be carried out as per Manufacturer’s Specification/ General Engineering Practice and / or as per direction of Engineer-in-Charge.

1.7 In the absence of any definite provisions or any particular issue in the aforesaid specification, reference may be made to the latest codes and specifications of IRC, BIS, BS, ASTM, AASHTO and CAN/ CAS in that order. Where even these are silent, the construction and completion of works shall conform to sound engineering practice as approved by the Engineer-in-Charge. In case of any disputes arises out of the interpretation of the above, the decision of the Engineer-in-Charge shall be final and binding on the contractor. Wherever reference is made in the contract to specific standard codes to be met by the material, plant and other supplies to be furnished, and work performed or tested, the provisions of the latest edition or revision of the relevant standards and codes in effect shall apply, unless otherwise explicitly stated in the contract. Where such standards and codes are national, or related to a particular country or region, other internationally recognized standards which ensure a subsequently equal or higher performance than the standards and codes specified will be accepted subject to the Engineer-in-Charge prior review and written approval. Difference between the standards must be fully described in writing by the contractor and submitted to the Engineer-in-Charge at least 15 days prior to the date when the contractor desires the Engineer-in-Charge’s approval. If the Engineer-in-Charge determines that such proposed deviations do not ensure substantially equal performance, the contractor shall comply with the standards specified in the documents.
2. PARTICULAR SPECIFICATIONS

2.1 SAND FILLING
(a) Material: Sand shall be clean and free from dust, organic and foreign matter and its grading shall be within the limits of grading zone IV or V.
(b) Filling: Sand filling shall be done in a manner similar to earth filling in plinth and consolidation shall be done by flooding with water.
(c) Measurement: Length, breadth and depth of consolidated sand shall be measured with steel tape correct to the nearest cm and cubical contents worked out in cubic meters correct to two places of decimal.
(d) Rate: The rate shall include the cost of material and labour involved in all operations described.

2.2 GOOD EARTH FILLING
(a) Material: Sand shall be clean and free from dust, organic and foreign.
(b) Filling: The earth shall be stacked at site in stacks not less than 50 cm high and volume not less than 3.0cum.
(c) Measurement: Length, Breadth and Height of stacks shall be measured correct to a cm. The volume of the stacks shall be reduced by 20% for voids before payment, unless otherwise described.
(d) Rate: The rate shall include the cost of excavating the earth from areas lying at distances not exceeding one km from the site, transporting the same at site, breaking of clods and stacking at places indicated. The rate shall also include royalty if payable.

2.3 WOOD WORK
2.3.1 Material: The thickness of panel should be 19mm. Solid wood panels should be made out of one or more pieces of timber of appropriate length. The wood used should be properly seasoned and free from any decay.
2.3.2 Planks shall be planed on all faces and edges. And proper fixing of frame, shutters and partitions should be done as per the drawings.
2.3.3 Measurements: Length and Breadth should be to the nearest cm and area shall be calculated upto two places of decimals.
2.3.4 Rate: The rate includes cost of material and labour required for all the operations described.

2.4 FLOORING
a. All works in general shall be carried out as per latest CPWD Specifications with up to date correction slips.
b. 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.

c. 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.

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

2.4.1 GRANITE / KOTA STONE FLOORING

2.4.1.1 Material: The slabs shall be of selected quality, hard, sound, dense and homogenous in texture free from cracks, decay, weathering and flaws. Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth. The top (exposed) surface of slabs should be pre polished.

2.4.1.2 Laying: The joints in the surface, to be laid upon, shall be raked to a depth of at least 15mm in masonry walls. Concrete surface shall be hacked and roughened with wire brushes. The surface shall be cleaned and washed with water and kept wet before laying. The slabs shall be laid on 15mm thick mortar of 1:3 mix. The joints shall be as fine as possible.

2.4.1.3 Finishing: The joints shall be cleaned off the grey cement grout with wire/ coir brush upto 2mm depth and all dust and loose particles should be removed. The joints shall be then pointed with white cement and if required colour pigments can be added.

2.4.1.4 Measurements: The length and height shall be measured correct to a cm. Area shall be calculated in sqm. Correct to two places of decimal.

2.4.1.5 Rate: The rate shall include the cost of material and labour involved in all operations described.

2.4.2 VITRIFIED TILES

2.4.2.1 Material: 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.
2.4.2.2 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.

2.4.2.3 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.

2.4.2.4 Pointing: The joints shall be thoroughly cleaned and grouted with polymer based non-shrink grout of desired colour of approved make.

2.4.2.5 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.

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

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

2.4.3 VACUUM DEWATERING (Tremix Flooring)

2.4.3.1 Material: The material used for Vacuum Dewatering is the conventional one used for RCC flooring. The mix used is 1:2:4 with nominal reinforcement.

2.4.3.2 Process: The floor shall have high wear resistance, high compressive strength, reduced shrinkage, minimum water permeability and should be free of pores. Concreting in the conventional way but with a higher slump so that workability is good and concrete pouring and spreading is done fast. Poker Vibration (especially on both sides of the panel) is always essential for floor thickness of 100 mm and above. Surface Vibration shall be done using Double Beam Surface Vibrator. Leveling the vibrated surface with a straight Edge. Vacuum Dewatering shall be done using Vacuum Pump and Suction Mat Top Cover & Filter Pads. Floating and Trowelling of the concrete pavements using Skimfloaters

2.4.3.3 Measurements: The Length, Breadth and Depth should be measured correct to the nearest cm and area should be calculated upto 2 decimal places.

2.4.3.4 Rate: The rates shall be inclusive of all operations including labour, material, bar binding etc.
2.5 ALUMINIUM DOOR, WINDOW AND VENTILATORS

2.5.1 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.

2.5.2 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.

2.5.3 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.

2.5.4 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.

2.5.5 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.

2.5.6 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

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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.

2.5.7 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.

2.5.8 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.

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

2.5.10 Handling and Stacking: 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.

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.

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.

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

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

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

2.5.13 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.

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

2.5.15 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.

2.5.16 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.

2.5.17 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.

2.5.18 Details of Tests: The various tests on aluminium sections shall be conducted in accordance with the relevant IS codes. The minimum number of tests for anodic/powder coating and corrosion resistance for Doors, Windows & Ventilators shall be 5% of Nos. manufactured.

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.

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

2.5.19 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.

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

2.5.21 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.

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

PART 1 - GENERAL

1. SECTION INCLUDES

   Fabrication & Erection of support frame structure and providing & fixing of 16 mm thick LEXAN multi-wall or equivalent easy clean Polycarbonate Sheet in approved colour on support frame structure with Aluminium profiles of base width min 60mm and MS cleats.

2. SUBMITTALS

   (a) Shop Drawings: Submit for all structural work including sheeting with necessary calculation. Take approval from the Engineer-in-charge.

   (b) Samples: Submit 16 mm thick LEXAN or equivalent multi-wall polycarbonate sheets of bronze colour and take prior approval from the Engineer-in-charge.

   (c) Submit manufacturer's specification.

3. QUALITY ASSURANCE

   (a) Fabricator & Erectors Qualifications: The firm fabricating & erecting support frames must have specialisation in this field or approved by the manufacturer / consultant.

   (b) Measurements: Prior to commencing work field measurement and verification of actual dimension shall be done and co-ordinate with all shop drawing details as required for an accurate fit,

PART 2 - MATERIALS

1. SUPPORT FRAME

   (a) Pipes: MS tubular sections.

   (b) Welding: As per relevant codes.

   (c) Bolts: High tensile bolts of minimum 8.8 grade.

   (d) Connector node: High strength MERO type spherical node connectors of approved make manufactured out of c-45 grade conforming to ASTM-1940/ EN8D.

   (e) Aluminium profiles of base width min 60 mm with EPDM gaskets and self tapping steel screws with neoprene/steel washers

Signature of tenderer

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EPI
2. SHEET

   Sheets: 16mm thick LEXAN multi-wall or equivalent Easy Clean Polycarbonate sheets in approved colour as made by GE Plastics.

   Impact Strength: Energy absorption capacity shall be around 4 KgM over a wide temperature range (-40 degree C to +100 degree C).

   Light Transmission: The sheet should allow 35% (translucent or transparent) light transmissions.

   Thermal Insulation: K value shall be 3.

   Sound Insulation: (As per DIN 52210) shall be 19 dB.

   Weather ability: Sheets should have a surface coating to protect the damaging effects of UV rays.

   Weight: Weight shall be 1.7 Kg/sqm (Approx).

   Fire Protection: Sheets shall be self-extinguishing & non-propagating and shall have an Oxygen Index of 25.

PART 3 - EXECUTION

1. INSTALLATION

   (a) The fabrication and erection of support frame shall be measured and paid in respective item.

   (b) The installation shall be done by a specialised agency and as per the manufacturer's specification.

   (c) Before installation peel off the masking from the critical area and remove the rest of it only after the installation is over.

   (d) Read the instruction on masking and place the UV protected side facing outwards.

   (e) While drilling the sheets care should be taken to make the drill-holes slightly oversized so as to facilitate thermal expansion.

   (f) Avoid using the sheets to support installer/cleaner's weight. Use only temporary beam supported by the roof members while installing/cleaning.

   (g) Provide MS anchorage welded to MS frame for fixing sheets.
(h) Aluminium sections shall be fixed on a MS cleat installed on the tubular section of support frame.

(i) Provide specially designed bronze anodised aluminium ridges fixed between sheets with self-tapping SS screws and EPDM gaskets as per standard detail.

(j) All works shall be done in accordance to approved detailed shop drawing.

(k) The installer shall examine the space frame supports, work area and condition under which space frame is to be installed prior to assembly and erection. If the support area or conditions are unsatisfactory, erection shall not proceed under until satisfactory correction have been made.

2. CLEANING

Use mild soap solution and a soft cloth or sponge to clean the sheets, if required.

3. PRECAUTION

(a) Avoid exposing the sheets with masking to the sun for a long period.

(b) Peel off the masking at suitable time as stated above.

(c) UV protected surfaces must be placed out wards.

(d) While drilling holes shall be made slightly over-sized so as to facilitate thermal expansion.

(e) Avoid using the sheet to support weight of any person for any reason.

**INSPECTION:** The completed space frame structure shall undergo 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.

**2.7 CURTAIN WALL SYSTEM**

**2.7.1 SCOPE OF WORK**

A. The contractor shall design, engineer, test, fabricate, deliver, install, and guarantee all construction necessary to provide a complete curtain wall 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, not withstanding any omissions or inadequacies of the Drawings and/or

Without limiting the generalities of the foregoing, the Curtain Wall Systems shall include, without" being-limited to, the followings:
a) Metal frames, glass glazing, spandrels, ventilators, finish hardware, copings metal closure, windows etc.

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

c) All thermal insulation associated with the system

d) All fire protection associated with the system.

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

f) All sealing and flushing including sealing at junctions with other trades to achieve complete water tightness in the system.

g) Isolation of dissimilar metals and moving parts.

h) Anticorrosive treatment on all metals used in the system

i) Polyester powder coating aluminium sections.

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

a) Engineering Proposals, Shop Drawings, Engineering data and Structural Calculations In connection with the design of the Curtain Wall System.

b) Scheduling and Monitoring of the Work.

c) Mock-ups, samples and test units.

d) Performance Testing of the Curtain Wall framing and glazing assembly.

e) Co-ordination with work of other trades.

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

g) Protection.

h) All final exterior and interior cleaning and finishing of the Curtain Wall System

i) As-built record drawings and photographs.

j) Guarantees and Warranties.

k) All hoisting, staging and temporary services.

l) Conceptualizing and design of a suitable maintenance system for curtain, glazing.
C. The water tightness and structural stability of the whole Curtain Wall 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 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.

2.7.2 BUILDING REGULATIONS

Curtain Wall shall comply with all Government Codes and Regulations if any/I.S. Codes. All curtain walling, individual aluminium 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 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 system shall confirm 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 nor evidence of structure failure.

2.7.3 MEASUREMENTS

Measurements of the Curtain Wall 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 including openable windows as part of curtain wall. The contractor shall be responsible for verifying all the dimensions and actual conditions on site.

2.7.4 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.

2.7.5 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 Curtain Wall System without limiting the Contractor to the method of achieving desired performance.

2.7.6 TENDER REQUIREMENTS

a) Preliminary Design Proposals

As a condition of tendering, preliminary design proposals must be submitted with the tender. Basic design requirements as described the Specification and other Architectural requirements such as the size of window, net glass area, ventilator, V configuration of windows and spandrels shall be retained. However, the tenderer may propose alternatives on the construction details provided that all basic functional and architectural requirements are fulfilled. The preliminary design proposals shall be in the form of drawings, drawn to full 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. Tender proposals without such detail drawings may lead to disqualification of the tender.

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 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 for connection and incorporation into the lightning conductor system of the building (lightning conductor system of the building done by others). Design concept must be stated in the proposal.
xiv) 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 pans of the curtain wall, when completed, shall be within the following tolerances

1. 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

2. Deviation from theoretical position on plan or elevation, including deviation from plumb, level or dimensioned angle, must not exceed 9mm total at any location

3. Change in deviation must not exceed 3mm for any 3.5mm 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 as the tender proposals and 300mm x 300mm 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 Owner's approval, of the shop drawing atleast 4 copies shall be submitted by the Contractor for the Owner.

e) The Contractor / Sub-contractor shall submit a maintenance manual for the curtain wall 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 Owner.

2.7.8 EXECUTION

Performance Testing

a) General Requirements

1) 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 facade.

2) After approval of structural calculations and shop drawings for the curtain wall, one (1) Test Unit for performance testing of the curtain wall shall be constructed by the contractor at an independent laboratory or at a laboratory approved by the Owner.
3) 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.

4) Test procedures test schedules and test locations shall be submitted to the Owner for approval before testing.

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

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

7) The Owner shall be the sole judge of the mock-up test conditions.

b) Test of Wind Pressure

1) 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.

2) The static wind pressure shall be applied up to 1.5 Kpa at maximum wind pressure.

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

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

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

6) The deflection on the main structural parts in this conditions shall not exceed:
   i) 1/175 of the span between supports or 20mm, whichever is the lesser for vertical elements.
   ii) 1/250 of the span between supports for horizontal elements.
   iii) 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

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

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

3) The dynamic deflection shall be applied upto ±13mm.

4) The variation of dynamic deflection shall be of an approximate sine-curve-line, one period of 3 seconds.
5) 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.

6) Any damage and harmful permanent deformation shall not be found in any parts, of the curtain wall except sealant at maximum deflection.

d) Test of Water-tightness

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

2) Pressure shall not be applied to the Test Unit.

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

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

4) Hold the test 2 times, in sequence as described below, conforming to the above mentioned conditions.
   i) Install the test unit.
   ii) Hold 1st water-tightness test.
   iii) Hold test of wind pressure as described above.
   iv) Host 2nd water-tightness test
   v) Lateral deflection test.

6) Water leakage at all parts of the Test Unit shall not be observed inside during the 1st water-tightness test.

c) Test Report

   The Contractor is required to submit live (5) copies of test reports to the Owner

e) Cost of Performance Test

1) 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.

2) All reasonable travel and accommodation expenses incurred by the Owner and Consultant, (total number not exceeding 4 persons) in attending any such tests shall be paid by the Contractor and deemed included in the tender.

3) The Contractor shall allow for amendments and adjustments to the mock-up as, required by the Owner.
4) If the Test Unit fails to pass the initial testing; the Contractor shall make the necessary corrections to the Test Unit and shall have the Test Unit retest by the Testing Laboratory until it passes the tests.

5) Cost of corrections to the Test Unit and cost of resisting shall be paid for by the Contractor at no additional cost to the Owner.

6) The Contractor will have six (6) months after the award of tender or as directed by the Owner to set up the test unit, and earn' out all required tests.

Upon expiry of the said testing period, if the testing results still fail to meet the required standard, then the Owner may cancel the awarded tender.

e) Shop Drawings and Calculations for the Performance testing

1) Prior to fabrication of Test Unit, the Contractor shall submit shop drawings and calculations of the test Unit for Owner's approval

f) Record Drawings

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

2) 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

3) At completion of testing and after approval of test reports the testing laboratory shall submit the marked-up record drawings to the Owner.

i) Contractor’s Representatives

1) Full time attendance by Approved Representatives of the Contractor specifically those interested with the erection of curtain wall shall be provided for the erection of the Test Unit and for all testing of the Test Unit.

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.
CURTAIN WALL SYSTEMS

Material Specification of Curtain Wall:

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<td>1.</td>
<td>Glazing</td>
<td>As specified in the description of item and tender.</td>
</tr>
<tr>
<td>2.</td>
<td>Framing System</td>
<td>Galvanised steel bracket, polyester coated aluminium mullion, transom and frames. Polyester coating will be minimum 50 micron.</td>
</tr>
<tr>
<td>3.</td>
<td>Window</td>
<td>Aluminium top hung, and side hung with all accessories - catches, stag, lock handles etc.</td>
</tr>
<tr>
<td>4.</td>
<td>Sealant</td>
<td>As specified in the description of item.</td>
</tr>
<tr>
<td>5.</td>
<td>Insulation</td>
<td>50mm thick glass wool of minimum density 48 Kg./cu.m. sandwiched with &quot;black&quot; polythene sheet 100 micron on one side and aluminum foil of 100 micron on other side or as specified by manufacture at spandrel area. The surface after fixing of insulation shall be plain without any distortion.</td>
</tr>
</tbody>
</table>
   b) Glaverbel/Glavermas-Super silver.  
   c) Visteon, Ford  
   Brown or Grey colour of any shade approved by owner. |

2.8 STEEL WORKS

2.8.1 Material: All finished steel shall be of grade 304 and shall be well and cleanly rolled to the dimensions and weight specified by BIS subject to permissible tolerances as per IS:1852. The finished materials shall be reasonably free from cracks, surface flaws laminations, rough and imperfect edges and all other harmful defects.

2.8.2 Fabrication & Erection: The fabrication of the material should be as per the drawings. The lengths shall be correctly cut and measured with a steel tape. All welding should be fillet welding and in stainless steel only. Steel works shall be hoisted and placed in position carefully without any damage to itself or the building works and injury to workmen. The erection shall be done in accordance to the drawings and to the satisfaction of the engineer-in-charge.
2.8.3 Measurements: The work fixed in place shall be measured in running meters correct to a millimeter and weights calculated on the basis of standard tables correct to the nearest kilogram.

2.8.4 Rate: The rates shall include the cost of labour and materials required for all operations described.
GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS

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. Contractor / Sub-Contractor to furnish copy of license before execution of electrical works at site.

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 separate 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 cast 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.
d] **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 in sq.mm.</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>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1.50</td>
<td>5</td>
<td>4</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>2.50</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>6</td>
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<td>4</td>
<td>3</td>
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<td>6</td>
<td>5</td>
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<td>6</td>
<td>2</td>
<td>-</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>-</td>
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<td>2</td>
<td>2</td>
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<td>25</td>
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<td>35</td>
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<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>70</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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Signature of tenderer: TS (EL) 8

EPI
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.
TECHNICAL SPECIFICATIONS
(MV PANEL / CUBICLE BOARDS)

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. Degree of protection shall be IP- 54.

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 2.2 metres. Operating levers, handle etc. of highest unit shall not be at a height more than 1.8metres for convenience of operation and cable termination.

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 current density shall be $1.25 \text{ A/mm}^2$

**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 upto 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) High voltage test with 2.5 KV for one minute for power circuit.
CABLES

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 titles 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.
EARTHING

INSTALLATION

VARIOUS TYPES OF ELECTRODES

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 laid in a zigzag manner with a deviation up to 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 of pipe earth electrode, wire type earthing conductor shall be secured, using through bolts, nuts and washers and terminating socket.

b] The earthing conductor from the electrode up to the electrode up to the building shall be protected from 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 coordination 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 mps.
   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 in to 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 then 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.

   Fastners 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 for 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 stain 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 outside. 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 Coupling’s:-**
   
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 butter fly 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.
TECHNICAL SPECIFICATIONS

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 changed 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 for 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.

j) 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.
SARDAR VALLABHBHAI NATIONAL INSTITUTE OF
TECHNOLOGY, SURAT,
GUJARAT

TECHNICAL SPECIFICATIONS

OF

PASSENGER LIFTS
1.0 SCOPE OF WORK

These specifications cover the details of 4(four) nos. 13 persons capacity Passenger lifts including suitable Brake release tools (total 2 sets) to be designed supplied, inspection as may be necessary before despatch, delivery at site, installation, testing, commissioning and handing over to SVNIT and the defects liability for a period of 1 year after completion of all works & handing over to client. Scope of work shall also include AMC (Annual maintenance contract) for 5 years after one year of defect liability period after handing over to client.

These specifications shall be read in conjunction with the General Conditions of Contract, Additional Conditions of Contract.

2.0 GENERAL

The equipment and installation covered by these specifications shall conform to codes of practice in force and highest standards of workmanship and materials. This work shall be done in accordance with the provisions of the Local Lifts Authority rules and shall also conform to requirements of local municipal by laws, and subsequent provisions, as also any state or local Act in force and latest Indian Standard 14665 and all latest applicable BIS, NBC code and ‘CPWD General Specifications for Electrical Works (Part III, Lifts & Escalators) 2003’.

The Entire electrical installation shall be done in accordance with the Indian Electricity Act 2003, Indian Electricity Rules 1956 as amended to-date. The Electrical wiring shall strictly comply with IS:732 and latest applicable BIS and NBC code. The electrical works shall also conform to CPWD General Specification for Electrical Work Part-I (Internal) 2005 and Part-II (External) 2008 as amended up to date.

The Contractor shall follow all Statutory Requirements as well as best trade practices in the manufacture & installation of lifts. The Contractor shall arrange to obtain the statutory approval of the Inspectorate of Lifts as may be required for installation and commissioning of the lifts and handover for operation after satisfactory tests.

3.0 DRAWINGS

Before commencing work, the Contractor shall prepare and submit all drawings for individual lifts in required nos. necessary to show the general arrangement and details of lift installation, electrical etc. The lift contractor must get approval before installation necessary drawings and details from SVNIT, Surat.

The Contractor shall, within 3(three) weeks of receipt of a Letter of award of contract, submit 4(four) copies of all working drawings showing pit, hoistway and machine room layouts clearly indicating and specifying all connected structural, electrical and architectural works including imposed structural static / dynamic loads (including breaking load on guides, reaction of buffers on lift pits, reaction on support points in machine room, lift well etc.) and electrical ratings including calculations for selection of KW rating of motor. Within 10 days of receipt of letter of award of contract, the
Contractor shall obtain from the EPI/SVNIT all the information he needs to prepare his drawings and shall have any interaction with the EPI/SVNIT to finalise all parameters and data for design. The Contractor will be responsible for any discrepancies, errors and omissions in the drawings or particulars submitted by him even if these have been approved by the EPI/SVNIT. On approval of these drawings (within 2 weeks of submission of full documentation), the Contractor shall submit 8(eight) copies of approved working drawings incorporating corrections / comments, if any, and shall immediately commence work.

On completion of work, the contractor shall supply four sets of CD’s and 8 (eight) copies of the detailed wiring diagram, ‘As built’ drawings and equipment operation & maintenance manuals and original certificates from ‘Inspector of Lifts’ for all the lifts. Further, a copy of such detailed diagram and a set of instructions for evacuation of passengers in case of breakdown of the lifts shall be framed and installed in the respective machine room by the Contractor.

The Contractor shall carry out all the work strictly in accordance with drawings, details and instructions of EPI/SVNIT.

4.0 WORKS TO BE ARRANGED BY EPI/SVNIT

The following items shall be provided to the Lift Contractor under instructions of the Department to suit the requirements of the lift Contractor.

i. Hoistways, machine rooms and pits of specified dimensions (within normal building tolerances).

ii. Floor, wall and ceiling finishes in hoistways, pits and machine rooms; including painting (except painting of equipment and materials supplied by lift Contractor) and waterproofing, as well as doors and windows in machine room.

iii. Free 3 phase power supply for group testing and commissioning of lifts after erection is completed.

iv. Lighting installation within machine rooms as required by the lift Contractor.

vi The equipment shall be suitable to operate on 415 Volts 3 phase, 4 wires, 50 Hz. A.C. supply with a variation of ±10% in Volts and ±5% in frequency respectively. The supply for illumination and single phase equipment shall be 230 Volts A.C.

vii Lighting installation within hoistways and pits as required by the lift Contractor.

viii. Ventilation system of machine rooms with minimum 18” heavy duty exhaust fan in each machine room as per the requirement of NBC / BIS codes.

ix. Providing of hoisting beam in the machine room for hoisting of equipment during erection and to facilitate maintenance in future.
5.0 LIFTS CONTRACTOR’S RESPONSIBILITIES : ANCILLARY WORKS

i. All cabling, wiring and earthing from 3-phase main DB in machine room to Lift Contractor’s equipment.

Power cables from main L.T. Panel Board Main Switches of required rating for 3 phase supply in Machine Rooms shall be done by other contractor. Main switches (MCCB) in sheet steel enclosure shall be provided by lift contractor. Earthing up to main switch in machine room shall be done by other contractor.

ii. All steel items i.e. machine beam/bases, pedestals/ bearing plate in the machine room, separators wherever required and buffer support channels, vertical iron ladder in lift and structural steel supports and brackets for the installation in etc., to suit the sizes of the hoistways.

iii. Sill tracks including sill supports, supporting protection at all landings.

iv. Screen guards, facia plates and other protection for installation.

v. To carry out minor civil work, such as chipping & making openings in slabs, grouting of foundation bolts in shaft, pit and machine room, modification and making rail bracket, hall buttons indicators and laying of sills in positions. Or any other work required for smooth operation/commissioning of lifts. All chiselling and cutting of pockets and making good. (All cutting shall be as approved by EPI/SVNIT).

vi. Ensuring safety against accidents including barricading all openings and caution signs.

vii. Scaffolding and other Tools & Tackles required for installation in the hoistway required for erection of lifts.

viii. All other items necessary for satisfactory execution & completion of works, whether specified or not.

ix. Power shall be provided at incoming of main DB for lifts. Main DB in the machine room shall be provided by the lift contractor. From main DB to lifts, cables shall be in the scope of lift contractor. However, lighting for machine room shall be done by others.

x. Trap doors, floor gratings, steps / ladders and openings in machine rooms and ladders for pits as required by the lifts Contractor. Contractor shall furnish the details of these items in the layout drawing for lifts to submitted after award of the job.

xi. Temporary power supply connection(s) for erection work shall be arranged by the lift Contractor.
6.0 SOUND REDUCTION

The Contractor shall provide necessary sound reduction materials, such as rubber pads/anti vibration pads of proper density to effectively isolate the machine from the machine beams and/or flooring.

Noise level inside cars and in the machine room shall be maintained at minimum levels as laid down in the relevant codes and in any case not more than specified under PERFORMANCE PARAMETERS.

7.0 TRACTION MACHINE

The machine shall be worm geared traction type with motor (steel worm, bronze gears, steel sheave shaft & Ferro molybdenum sheave), electro-mechanical type of brake and driving sheave mounted in proper alignment on a single heavy cast iron base or steel bedplate.

The worm shaft shall be fitted with roller bearings to take end thrust. The sheave shaft shall also be fitted with roller bearings to ensure proper alignment. All shafts shall be provided with well-designed keys.

Rotating parts shall be statically and dynamically balanced.

The drive sheave shall be designed with machined V-grooves to ensure adequate traction with minimum wear on rope. All sheaves including deflector sheaves, where used, shall conform to I. S. 14665 (Part 4 section 3)

Adequate and dust – proof lubrication shall be provided for all bearings and worm gears.

The brake shall be suitably curved and provided with fire proof friction lining. The operation of brake shall be smooth, gradual and with minimum noise. The brake shall be designed to be of adequate size and strength to stop and hold the car at rest with rated load. The brake shall be capable of operation automatically by various safety devices, current failure and by the normal stopping of the car. The brake shall be released electrically. It shall also be possible to release the brake manually so as to move the lift car in short stops. Suitable Brake release tools (total 5 nos.) shall be supplied and stored in the machine rooms.

For manual operation of lifts, up & down direction of the movement of the car shall be clearly marked on the motor or traction machine. A warning plate in bold signal red colour to switch off the mains supply before releasing the brake and operating the wheel shall be prominently displayed.

8.0 HOIST MOTOR

The motor shall be suitable for 415 Volts +10% to –10%, 50 Hz. ± 5%, 3 Phase A.C. Supply. The motor must be designed for arduous lift duty, rapid reversals and constantly repeated starts & stops as defined in the relevant codes of practice. All windings must be heavily insulated, adequately impregnated for tropical climate and mechanically strengthened and must be specifically designed to have a high starting torque and low starting current characteristics within the limits acceptable to
electricity supply co. requirements and I.E. Rules. The motor shall be designed in such a way as to withstand occasional overloading above its rated capacity and shall have overload protection. The motor shall have good speed regulation under different conditions of load and shall be designed to give a noiseless and vibration-free operation. Insulation shall be class F.

9.0 MOTOR CONTROL AND DRIVE

The lift motor shall be controlled by a variable voltage variable frequency (V.V.V.F.) micro-processor control system which shall control and monitor every aspect of lift operation at all stages of the car motion cycle on real time basis.

The A.C. V.V.V.F. drive system shall control A.C. voltage and frequency concurrently with the hoist motor to regulate the lift's actual performance to match closely the ideal speed pattern, obtain maximum efficiency of operation and provide a very smooth ride.

Frequency shall range fully between zero and rated value.

The Controller shall be provided with a self diagnostic programme to keep downtime to a minimum possible.

The controller shall intelligently adjust door times in response to car calls, hall calls and “Door Open” button operation.

An Inspector’s changeover test switch and set of test buttons shall be provided in the controller. Operation of the Inspector’s changeover switch shall make both the car and landing buttons inoperative and permit the lift to be operated in either direction from machine room for test purposes by pressing corresponding test buttons in the controller. It shall not, however, interfere with the emergency stop switches inside the car or on the top of the car.

10.0 GUIDES AND FASTENINGS

i. Guide-rails for car and counterweight shall consist of machined mild steel Tee sections, erected plumb, and securely fastened to the lift well framing by heavy steel brackets, suitably spaced, to limit deflection of guide rails to 3 mm under normal working conditions.

ii. The guide-rails shall be of suitable section with ends tongued and grooved, forming matched joint and shall be connected with steel fish plates.

iii. Guide-rails shall cover the full height of the hoistway and pit, such that it shall be not be possible for any of the car or counter weights shoes to run off the guides.

iv. Guides shall be designed to withstand the action of safety gear when stopping a counter weight or fully loaded car.

v. The max. deviation from true plumb and alignment of guide rails shall be 2 mm.
vi. All support framing shall be rigid and shall be designed to restrict displacement of the point of support of brackets to 3 mm under normal working conditions.

vii. The whole guide rail installation, including expansion joints, shall be designed for a smooth ride.

viii. The guide-rails shall be protected during storage and installation with a rust inhibiting coating which shall be cleaned off on completion of installation.

ix. Guide-shoes shall be adjustable type & mounted so as to provide continuous contact with guide rails under all conditions.

Guide shoes shall be provided at top and bottom of each side of car and counterweight and shall be designed for quiet operation.

Additional guide shoes shall be provided on each side of buffer frame in case of oil buffers.

Each lift shall be equipped with roller guides for up and down travel. There shall not be any metal-to-metal contact between Car and rail. Roller shall be mounted on ball bearings to provide quiet operation and excellent ride quality. (It is not required in case the design varies however the ride quality shall not be compromised for any other design).

11.0 SAFETY

In addition to other specifications, the lift shall be provided with safety devices as follows :-

i. Against overload

ii. Safety gear on car so that in the event of rope breaking or loosening, the car will be brought to rest immediately by means of grips on the guides.

The overspeeding car shall be automatically brought to a gradual stop on guide rails and power supply to the hoist motor shall be switched off.

iii. Overspeed centrifugal governor operating the safety gear in case of overspeeding of car in the down direction.

iv. Car gate lock so that in the event of car gate being opened when passengers are in the car, the lift will be brought to rest.

v. Overtravel limit switches at top and bottom limits of travel to disconnect the power supply and apply brakes to stop the car within a defined safe distance in case of overtravel in either direction.

vi. Ultimate terminal switches to stop the car automatically within top & bottom clearances independently of normal overtravel limit switches but with buffers operative.
vii. Protective guards to counterweights in pit, rope sheaves and wherever required.

viii. Toe guard apron to the car platform.

12.0 CAR

a. Cabin Size

The internal clear dimensions of the cabin shall not be less than those specified in IS 14665-Part I, NBC & CPWD General specifications for electric work (Lifts). The car shall be so mounted on the frame that vibration and noise transmitted to the passengers inside is minimised.

b. Frame and Safety Device

The car frame shall consist of mild steel channel/structural steel top and bottom securely riveted or bolted and substantially reinforced and braced so as to relieve the car enclosure of all strains when the safety device comes into action due to overspeed or when the capacity loaded car is run on the buffer springs at normal speed.

The safety device mounted on the bottom members of the frame operated by a centrifugal speed governor shall be arranged to bring the car to a gradual stop on the guide rails in the event of excessive descending speed; and provision shall be made to shut off the power supply to the motor.

c. Buffers

Substantial spring buffers (2 Nos.) shall be furnished and installed in the pit under the car and counterweight. These buffers shall be mounted on RCC Pedestals in the pit. The car buffer spring must be of correct design to sustain the car with capacity load without damage should the car terminal limits become inoperative. The car buffers must be located symmetrically with reference to centre of car.

The Contractor may alternatively offer oil type buffers. The plunger shall be mild steel, designed for a very high factor of safety and accurately machined. A toughened rubber bumper shall be fitted to the plunger top to cushion the impact of steel buffer plates attached under the car and the counterweight. An oil gauge shall be provided to check the oil level.

d. Counterweight

The lift shall be suitably counter-balanced for smooth and economical operation. Cast iron weights shall be contained in a structural steel frame properly guided with suitable guide shoes (minimum 4 Nos). It shall be equal to the total weight of lift plus approx. 50% of the contract load.

Substantial expanded metal counter-weight screen guard shall be furnished and installed at the bottom of hoist way, as required by Lift Inspector.
e. **Hoisting and Governor Ropes**

Bright steel wire ropes with fibre cores suitable for Lift duty as per BIS Code shall be used for hoisting ropes.

Not less than 3 independent suspension ropes shall be provided and designed to share load equally by means of adjustable shackle rods with equalizer springs at each end of hoisting ropes.

Each rope shall have adequate section to provide a minimum factor of safety of 4 based on the max. force on the rope.

Governor ropes shall be similar to hoisting ropes. Their ends shall be securely attached to the car and to the safety gear. The governor ropes shall be tensioned by a weight loaded device in the pit.

The contractor shall submit the technical details and source of supply of ropes to the EPI as well as a certificate of performance of ropes from an approved test laboratory or Authority.

Compensation for travel shall be provided for all lifts having a travel of more than 30m.

f. **Enclosure**

The car enclosure shall be as specified in technical data sheet. The cabin floor, roof and walls shall be free of distortion and undue deflection as per IS 14665 – Part 4, Section 3.

g. **Brakes**

D.C. brakes will be spring-applied and electrically released. They shall be designed to provide smooth stops under variable loads.

h. **Doors**

Provision shall be made for vertical and horizontal fine adjustment of doors as per the specifications given in technical data sheet.

i. **Door Operators**

The door operators shall be VVVF inverter controlled heavy duty A. C. motor, allowing variable opening and closing speeds, and full synchronization of car and landing doors.

j. **Travelling Cables**

The traveling cables shall be multi-core with high conductivity stranded conductors specifically designed for lift duty. The cables shall be provided with retaining straps and individual cable clamps.
k. **Emergency Lighting**

A self-contained, non-maintained emergency light with a trickle boost charger shall be provided.

l. **Intercom**

An Intercom system shall be provided between the car, main landing, machine room.

m. **Manual Cranking Facility**

Manual cranking facility shall be provided in the machine room to facilitate evacuation of passengers in case of power failure. The manual mode shall be in addition to automatic car failure operation specified elsewhere.

n. **Emergency Stop Switch**

A stop switch in the machine room / top of car shall be provided for use by maintenance crew to cancel all car and landing calls for a particular lift.

o. **Maintenance Switch**

On operation of the maintenance switch located on top of the car by the maintenance crew, the car shall travel at slow speed not exceeding 0.85 m / sec by continuous operation of a button.

p. **Landing Door Interlocks**

Electrical interlocks shall be provided to ensure that the car does not operate unless all doors are closed and unless the car reaches a landing zone.

q. **Overload Indicator (Only in Passenger elevator)**

An overload indicator with buzzer shall be provided in the cabin to indicate to the passengers that the car will not start as it is overloaded.

r. **Other Features**

All features specified in the BIS/NBC/CPWD and in the enclosed technical specifications shall be provided.

s. **Lift for Disabled**

All the Passengers lifts shall be suitable for use by disabled persons. The following additional facilities shall be provided in this lift:

i. Full length handrails shall be provided on the rear and side wall panels.

ii. The door closing time shall be set for min. 5 seconds and the door closing speed shall not exceed 0.25 m/sec.

iii. The “door open” and “door closed” announcements shall be audibly made in the car.

iv. Braile signs / buttons.
t. Operating Panels, Buttons & Switches

Main and secondary car operating panels, buttons and switches shall be located on one of the two front wall panels next to the car door and as specified in the Schedule of lifts & as per approved G.A. drawings.

All buttons and switches shall be clearly legible with fade-proof text and figures, and shall be easily accessible, (especially for disabled persons in the lift designated for them).

13.0 ELECTRIC WIRING

Necessary insulated wiring to connect all parts of the equipment shall be furnished and installed. Insulated wiring shall be flame retardant and moisture resistant and shall be run in G.S. conduits. All cables shall be flame – retardant with copper conductors.

Trailing cables shall be PVC sheathed copper conductor multi-core ribbon type designed for lift service and shall be flame retardant and moisture resistant. They shall be flexible and shall be suitably suspended to relieve strains on individual conductors. All copper conductors shall be of appropriate gauge copper to avoid excessive voltage drop. All wires, cables, conduits, metal boxes, fittings and earthing shall comply with statutory requirements and BIS specifications.

The controller unit comprising of the MCCB, 25KA, adjustable overload and phase reversal and phase failure protection, all the circuit elements, transformer, rectifier for D.C. control supply, inverter power pack, terminal blocks etc. shall be enclosed in an insect vermin proof, sheet steel floor or wall mounted cabinet with hinged doors at front or at both front and rear. Proper warning boards and danger plates shall be provided on both sides of the controller casing. Sheet steel used for controller cabinet shall not be less than 14 gauge and shall be properly braced, where necessary. Suitable gland plate shall be provided for cable entry. The battery for the charger unit shall be suitably placed in the machine room. Degree of protection of Enclosure shall be IP54. Enclosure shall have provision of earthing studs.

All sheet steel work shall be painted with two coats of synthetic enamel paint of suitable shade both inside and outside over two coats of zinc primer.

Apart from lift controller enclosure, 5 DBs (distribution boards) are required as per BOQ. Cables to incomer of these DB’s shall be terminated by civil contractor, whereas outgoing cables for lift shall be in the scope of lift contractor. Contractor shall furnish the sizes of cables alongwith KW rating of motors.

14.0 PAINTING

All exposed metal work furnished in these specifications, except as otherwise specified, shall be given one shop coat of anti-corrosive primer after approved surface treatment of metal surfaces and two coats of approved enamel paint of approved shade. After installation of Lifts, a final Touch-up Coat of paint shall be applied.
15.0 WORKS TESTS

The following tests shall be carried out at Works. EPI shall be given notice of the time and procedure of the tests before they are carried out, and shall be given facilities for observing the tests at Works.

a. High voltage works tests of equipment which is not already tested in accordance with appropriate IS codes.

b. Buffer test.

16.0 TESTS ON COMPLETION

The following tests shall be carried out to the satisfaction of the EPI/SVNIT.

i. Insulation resistance and earth test for all electrical apparatus.

ii. Continuous operation of the lift under full load conditions and simulated starts and stops (150 nos. per hour each) for one hour at the end of which time the service temperature of the motor and the operating coils shall be tested. This shall be as per B.I.S. specification.

iii. The car shall be loaded until the weight on the rope is twice the combined weight of the car and the specified load. The load must be carried on for about 30 minutes, without any sign of weakness, temporary set or permanent elongation of the suspension rope strands.

iv. The following items shall be tested:
   a. Levelling accuracy at each landing in conditions of fully loaded and empty car.
   b. No load current and voltage readings both on ‘Up’ and ‘Down’ Circuits.
   c. Full load current and voltage readings both on ‘Up’ and ‘Down’ Circuits.
   d. One and quarter load current and voltage readings both on ‘Up and ‘Down’ Circuits.
   e. Stalling current and voltage and time taken to operate overload.
   f. Overload protection.
   g. Gate sequence relays, if provided and installed.
   h. Car and landing door interlocks.
   i. Collective control and priority sequences, if installed.
   j. Safety gear mechanism for car and counterweight with fully loaded car and also with only 68 kg load.
   k. Speeds on Up and Down travel with full load, half load and empty car.
   l. Door contacts.
   m. Final terminal stopping device.
   n. Normal terminal stopping device.
   o. Car and counterweight buffers with contract load and contract speed.
   p. Operation of controllers.
   q. Manual operation of lift at mid-way travel.
   r. Emergency operation.
   v. Tests on completion shall also be performed to the satisfaction of Inspector of Lifts and a certificate will be obtained from the ‘Lift Inspector’ by the contractor.
17.0 STATUTORY APPROVALS

All statutory approvals from commencement to commissioning of lifts shall be obtained by the Contractor from the ‘Office of the Chief Inspector of Lifts and Escalators (South Zone), Vadodara, Gujarat’ and / or other authorities. However, the client will provide all necessary assistance for providing documents, drawings and certificates pertaining to other contractors, if required.

Necessary fees in connection with the approval of installation of lifts shall paid by Client.

18.0 FEATURES REQUIRED FOR VVVF LIFTS

(a) **Group / Independent / Attendant Operation**

It shall be possible to group specified cars in a group wherever required with dynamic disposition of cars as required by the traffic pattern. A smart car dispatching system with ring communication shall be provided for optimum passenger comfort and lift performance under all traffic conditions. Any defective car shall be automatically eliminated from the group.

Each car shall be provided with a keyswitch for independent operation housed in a service cabinet. In this mode, the lift shall respond only to car calls. Hall calls will not be registered.

It should be possible for an attendant to operate any car.

(b) **Fireman’s Switch**

A fireman’s toggle switch shall be provided in a break glass for the specified lift at ground floor to enable firemen to bring the lift non-stop to ground floor from any location and to cancel hall calls until the car is operated on attendant control.

(c) **Emergency Power Operation**

In case of power failure, standby power equipment shall enable lifts to reach a pre-determined floor, in a pre-determined sequence, and then permit operation of one or more lifts on emergency power.

A trickling battery shall be provided to supply power to light fixtures, fan, alarm and intercom.

(d) **Profile Generator**

A profile generator or similar device shall be provided to use the car at an optimum speed level and to improve levelling accuracy.

(e) **Predictive Car Selection**

Once a hall call is registered, a dynamic car algorithm shall transfer the call to an optimally selected car to provide the maximum traffic efficiency.
(f) **Home Landing Facility**

A car shall return to a pre-determined landing after the last call is answered.

(g) **Door Safety**

Multi-beam infrared / ultrasonic electronics curtains shall be provided to scan the doorway and reverse the door closing in case of any obstruction.

(h) **Double Door Operation**

If both up and down calls are registered at a hall which is the last registering hall in the direction of the car, the lift shall travel to that hall and open / close the doors. After this, the car shall reverse its travel and shall open / close the doors again unless no car calls are registered at that floor.

(i) **Nudging Door Operation**

When the doors remain open for more than a predetermined period, a buzzer shall sound and the door shall close automatically. The door sensing device shall be rendered inoperative but the Door Open button and the safety shoe shall remain operative.

(j) **Selective floor Service**

Programming for selective floors services shall be software driven.

(k) **Manual Cranking & Slow speed Travel**

A manual cranking facility shall be provided.

Slow speed operation shall be possible from machine room and car top.

(l) **Auto Fan Off**

In case no calls are registered for a pre-set time, the cabin fan shall be automatically switched off.

(m) **Automatic Rescue Device**

In case of mains power failure and Lift control system failure, the Lift's own rechargeable and maintenance free battery power shall move the car to the nearest floor and the door shall open automatically for automatic rescue of passengers. A battery run-down indicator shall be provided.
19.0 PERFORMANCE PARAMETERS

The following parameters shall be achieved in the installation:

* Levelling Accuracy
  - ± 3 mm for 1.5 m/s speed
  - ± 4 mm for 0.75 m/s speed

* Jerk level
  0.9 – 1.5 m/s³

* Noise level in car
  58 dB

* Noise level at 1 M in machine room
  60 dB

* Acceleration rate
  0.6 – 1.0 m/s² (adjustable)

* Max. car vibration
  20 milli gals.

20.0 SUBMITTALS ‘ALONGWITH TENDER’ AND ‘POST AWARD’

(a) The following items are required to be submitted in duplicate along with the Tender.

   (i) Catalogues with offered items highlighted.

(b) The successful contractor, after award of the contract, shall furnish following technical particulars of the equipment/devices for the approval by SVNIT/EPI.

   (i) Layout of Hoist way, Lift machine room, showing foundation details in the pit, machine room, electric control panel, Lift & equipment etc.

   (ii) Inspection manual for equipment & accessories covered in the scope of supply (8 copies).

   (iii) Technical literature of operation, control and maintenance etc. (8 copies) alongwith CDS.

   (iv) Schedule of scope of maintenance service during defect liability period and AMC.

The technical parameters furnished by the tenderer would be examined in detail during design submission stage. All improvements considered necessary to meet the tender Technical Specifications would have to be incorporated without any additional cost to EPI/SVNIT with objective of providing high performance and safety Lifts.

21.0 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

Comprehensive maintenance during Defects Liability Period inclusive of periodic servicing, prompt attention to client (SVNIT) complaint, prompt rectification of all malfunctions and equipment failures, replacement of defective equipment / parts, replacement of light fittings, lubrication including lubricants, maintaining correct alignment and leveling of cars and ensuring smooth running, starts and stops etc. all complete to EPI/SVNIT’s satisfaction shall be done.
22.0. ANNUAL MAINTENANCE (AMC) FOR FIVE YEARS AFTER ONE YEAR OF DEFECTS LIABILITY PERIOD

Comprehensive maintenance during AMC for 5(five) years (after one year of defect liability period) inclusive of periodic servicing, prompt attention to client (SVNIT) complaint, prompt rectification of all malfunctions and equipment failures, replacement of defective equipment / parts, replacement of light fittings, lubrication including lubricants, maintaining correct alignment and leveling of cars and ensuring smooth running, starts and stops etc. all complete to SVNIT’s satisfaction shall be done. For every 1(one) hour of delay in attending for a fault after allowing for 4(four) hours from the time a complaint has been lodged, will attract penalty at the rate of Rs.150/- per hour.
LIST OF RECOMMENDED MAKES

1. LIFTS

OTIS/ KONE/ SCHINDLER/ THYSSENKRUPP
/JOHNSON
### TECHNICAL DATA SHEET FOR LIFTS

#### (A) PASSENGER LIFT:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load-Kgs./Persons</td>
<td>544Kg/ (8 Persons)</td>
</tr>
<tr>
<td>Speed-Mps</td>
<td>1.0</td>
</tr>
<tr>
<td>Travel – Mts.</td>
<td>G+7 floors, 22.4 mtr.</td>
</tr>
<tr>
<td>Stops &amp; Openings</td>
<td>8/8 (All openings on same side)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>415 Volts 3-Phase 50 Hertz. Alternating Current</td>
</tr>
<tr>
<td>Control</td>
<td>A.C. Variable Voltage Variable Frequency</td>
</tr>
<tr>
<td>Operation</td>
<td>Simplex full Collective (With / Without Attendant)</td>
</tr>
<tr>
<td>Machine</td>
<td>Geared Traction machine of Design placed directly above hoistway in machine room.</td>
</tr>
<tr>
<td>Car Size</td>
<td>1300 mm Wide x 1350 mm Deep</td>
</tr>
<tr>
<td>Hoistway size</td>
<td>2170 mm Wide x 1900 mm Deep</td>
</tr>
<tr>
<td>Car Enclosure</td>
<td></td>
</tr>
<tr>
<td>Car Panels</td>
<td>All Stainless steel with hairline finish</td>
</tr>
<tr>
<td>Handrails on 3 sides</td>
<td>Scratch proof stainless steel finish</td>
</tr>
<tr>
<td>False Ceiling</td>
<td>As per manufacturer standard</td>
</tr>
<tr>
<td>Flooring</td>
<td>Granite tiles</td>
</tr>
<tr>
<td>Car Entrance</td>
<td>Protected by Centre opening sliding steel door in stainless steel hairline finish</td>
</tr>
<tr>
<td>Size</td>
<td>800 mm Wide x 2000 mm High</td>
</tr>
<tr>
<td>Hoistway Entrances</td>
<td>Protected by Centre opening sliding steel doors in stainless steel hairline finish</td>
</tr>
<tr>
<td>Size</td>
<td>800 mm Wide x 2000 mm High</td>
</tr>
<tr>
<td>Door Operation</td>
<td>Automatic</td>
</tr>
</tbody>
</table>
| Details                        | 1. Combined luminous hall button and digital hall position indicator.  
                                  | 2. Integral full height car operating panel with luminous buttons, digital car position indicator combined with direction arrows, overload warning indicator and service cabinet.  
                                  | 3. Battery Operated Alarm Bell and Emergency Light.  
                                  | 4. Fireman’s Switch at main lobby.  
                                  | 5. Refer technical specifications of lifts for other feature/details to be provided.                                                   |
| Face Plate Finish              | Stainless steel in hairline finish                                                                                                     |
| Cabin sill and landing sill    | As per the manufacturer.                                                                                                               |