Gujarat Biotechnology University

CONSTRUCTION OF STORAGE UNIT & FAÇADE ON TERRACE WITH OTHER AMENITIES.

Tender Specification

Item No -1

Demolishing Including RCC manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within any lead & any lift as per direction of Engineer-in-charge.

Workmanship:-

1.1. The demolition shall consist of demolition of one or more parts of the building as specified or shown in the drawings. Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown in the drawings.

1.2. The demolition shall always be planned beforehand shall be done in reverse order to the one in which the structure was constructed. This scheme shall be got approved form the Engineer-in-charge before starting the work. This however will not absolve the contractor from the responsibility of proper and safe demolition.

1.3. Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.

1.4. Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.

1.5. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roof, masonry etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.

1.6. All materials obtained from demolition shall be the property of Government unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge.

1.7. Any serviceable materials, obtained during dismantling or demolition shall be separated out and stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed' by the Engineer-m-charge.

1.8. On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.

Mode of measurements and payment

2.1. Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed. The demolition of lime concrete shall be measured under this item. Specification for deduction for voids, openings etc. shall be on same basis as that employed for construction of work,

2.2. All work shall be measured in decimal system as fixed in its place subject to the following limits; unless otherwise stated hereinafter: (a) Dimensions shall be measured to the nearest 0.01 mt. (b) Area shall be worked out to the nearest 0.01 sq.mt.(c) Cubical contents shall be worked out to the nearest 0.01 Cu.m.

2.3. The rate shall include cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable materials properly and disposing the unserviceable materials

with all lead and lift. The rate also includes for temporary shoring for the safety of the portion not required to be pulled down or of adjoining property arid providing temporary enclosures or portions where considered necessary.

2.4. The rate shall be for a unit of one cubic meter.

Item No -2

Demolishing Including Brick manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within any lead & any lift as per direction of Engineer-in-charge.

Workmanship

1.1. The demolition shall consist of demolition of one or more parts of the building as specified or shown in the drawings. Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown in the drawings.

1.2. The demolition shall always be planned before hand shall be done in reverse order to the one in which the structure was constructed. This scheme shall be got approved form the Engineer-in-charge before starting the work. This however will not absolve the contractor from the responsibility of proper and safe demolition.

1.3. Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.

1.4. Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.

1.5. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roof, masonry etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.

1.6. All materials obtained from demolition shall be the property of Government unless otherwise specified and shall bee kept in safe custody until handed over to the Engineer-in-charge.

1.7. Any serviceable materials, obtained during dismantling or demolition shall be separated out and stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed' by the Engineer-m-charge.

1.8. On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.

Mode of measurements and payment

2.1. Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed. The demolition of lime concrete shall be measured under this item. Specification for deduction for voids, openings etc. shall be on same basis as that employed for construction of work,

2.2. All work shall be measured in decimal system as fixed in its place subject to the following limits; unless otherwise stated hereinafter : (a) Dimensions shall be measured to the

nearest 0.01 mt. (b) Area shall be worked out to the nearest 0.01 sq. mt.(c) Cubical contents shall be worked out to the nearest 0.01 Cu.m.

2.3. The rate shall include cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable materials properly and disposing the unserviceable materials with all lead and lift. The rate also includes for temporary shoring for the safety of the portion not required to be pulled down or of adjoining property arid providing temporary enclosures or portions where considered necessary.

2.4. The rate shall be for a unit of one cubic meter.

Item No -3

Dismantling tiled of stone floors laid in mortar including IPS, Brick bats stacking of serviceable materials and disposal of unserviceable materials with all lead and lift. (Unusable material to be dumped with the permission of local authority any levies/charges to be paid by agencies and no extra payments will be made and disposed at non objectionable place to be found by the Contractor)

Workmanship

1.1. The demolition shall consist of demolition of one or more parts of the building as specified or shown in the drawings. Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown in the drawings.

1.2. The demolition shall always be planned before hand shall be done in reverse order to the one in which the structure was constructed. This scheme shall be got approved form the Engineer-in-charge before starting the work. This however will not absolve the contractor from the responsibility of proper and safe demolition.

1.3. Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.

1.4. Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.

1.5. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roof, masonry etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.

1.6. All materials obtained from demolition shall be the property of Government unless otherwise specified and shall bee kept in safe custody until handed over to the Engineer-in-charge.

1.7. Any serviceable materials, obtained during dismantling or demolition shall be separated out and stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed' by the Engineer-m-charge.

1.8. On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.

Mode of measurements and payment

2.1. Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed. The demolition of lime concrete shall be measured under this item. Specification for deduction for voids, openings etc. shall be on same basis as that employed for construction of work,

2.2. All work shall be measured in decimal system as fixed in its place subject to the following limits; unless otherwise stated hereinafter : (a) Dimensions shall be measured to the nearest 0.01 mt. (b) Area shall be worked out to the nearest 0.01 sq. mt.(c) Cubical contents shall be worked out to the nearest 0.01 Cu.m.

2.3. The rate shall include cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable materials properly and disposing the unserviceable materials with all lead and lift. The rate also includes for temporary shoring for the safety of the portion not required to be pulled down or of adjoining property arid providing temporary enclosures or portions where considered necessary.

2.5. The rate shall be for a unit of one cubic meter.

Item No -4

Removing and scraping of old deteriorated plaster of any thickness from wall / R.C.C member including stacking of serviceable material and disposal of unserviceable from site of work with all lead and lift

This item covers the complete removal and scraping of old, loose, or deteriorated plaster of any thickness from masonry walls, ceilings, and reinforced concrete (R.C.C.) members. The intent is to expose the base surface for subsequent repair or replastering work, ensuring a clean and properly prepared substrate. The work includes stacking of serviceable materials and disposal of unserviceable debris outside the work site with all leads and lifts.

Workmanship

Dismantling Process:

- The removal of plaster shall be done using suitable hand tools like chisels, hammers, scrapers, or mechanical tools, ensuring no damage to the base surface (brickwork or concrete).
- The operation shall be carried out carefully and systematically to prevent cracks, breakage, or structural damage to the underlying surface.
- Where mechanical means are used, proper vibration control and dust suppression shall be ensured.

Surface Cleaning:

- After removal of plaster, the exposed surface shall be:
- Thoroughly cleaned of dust, nails, spikes, wooden plugs, or any other material.
- Rinsed or air-blown to ensure a dust-free and clean surface.

All loose mortar, paint flakes, or residual bonding agents shall be completely removed.

Structural Safety and Protection:

- Suitable **scaffolding, ladders, safety nets, and protective gear** must be provided for safe execution of work, especially at height.
- Temporary **enclosures or partitions** shall be erected where required to protect adjacent finishes and limit dust spread.
- Necessary **safety measures** shall be in place for workers and adjoining property.

Stacking of Serviceable Material:

- Any serviceable material such as good-quality plaster chunks, bricks dislodged during removal, or other recoverable items shall be **carefully salvaged and stacked neatly** as directed by the Engineer-in-Charge.

Disposal of Debris:

- All **unserviceable material and debris** shall be collected and **disposed of beyond the construction premises** at a location approved by the local authority and Engineer-in-Charge.
- The contractor shall arrange for all **transportation, loading/unloading, local body permissions, taxes or dumping charges**, if applicable.
- Disposal shall be carried out in an **environmentally friendly manner** and not cause any nuisance to nearby residents or workers.

Cleaning and Site Clearance:

- On completion of work, the area shall be:
    - **Swept clean** of all loose particles and rubbish.
    - Ready for the next line of work (such as plastering, patching, or surface treatment).
    - All tools, equipment, and temporary arrangements shall be removed from the site.

Measurement:

- The measurement shall be done in **square meters (Sqm)** of plaster removed, measured over the finished exposed surface.
- The rate shall include:

Item No -5

Providing and laying in position controlled Cement Concrete M 25 Grade for Reinforced Cement Concrete work using cement content as per approved design mix including pumping, Pouring, curing of Concrete to site of laying, Rate are also including the cost of cantering, shuttering, staging, scaffolding for considering up to 3.5 meter floor height,

concrete cover blocks, finishing materials, labour and cost of admixtures in recommended proportion as per IS 9103 to accelerate / retard setting of concrete, improve workability plasticizer/ retarder and pumping by mechanical means without impairing strength and durability as per direction of Engineer In charge etc complete but excluding the cost of reinforcement. A) Foundation.

Specification same as Item no 13

Relevant Specification of should be followed as above. This concreting should be done in Foundation etc. all kind of RCC structures work levels and shapes. No extra payment will be made towards Shoring, strutting, dewatering if require for the all kind of RCC structures work and except the Concrete Grade & Level. Concrete Grade should be M-250 for the all kind of RCC structures work for Plinth level at various levels as per BOQ Provision. The minimum cement content for the various mixes shall be 450 Kg/cum or as per Mix Design whichever is higher and the details regarding proportioning and works control shall be in accordance with IS: 456:2000 The proportion given for a particular grade shall not, however, be placed in higher grade on the ground that the test strength are higher than minimum specified.

The relevant specification shall be followed as per item no 10 except that the work to be carried out in superstructure instead of Foundation and plinth. The rate shall include the cost of scaffolding apart from the. Work above Plinth level at various levels as per BOQ Provision.

Mode of Measurements and Payment:
The consolidated cubical contents of concrete work as specified in item shall be measured. The volume occupied by reinforcement shall not be deducted from RCC work. The rate shall be for a unit of one m3. The rate includes placing the concrete at heights as given in Bill of Quantities,. The rate does not include the cost of reinforcement but incl. cost of form work. No extra payment will be made towards Shoring, strutting, dewatering if require. Work above Plinth level at various levels as per BOQ Provision.

Item No -6
Providing and laying TMT Bar FE 500/500D reinforcement for R.C.C. work and straightening, cutting, bending, binding & placing in position completed up to any floor any level as per I.S. Standard. Complete.as directed by EIC.

Material:
CPWD Technical Specification clause no 5.1.3 and 5.1.4 and 5.1.5 should be followed.

Steel for Reinforcement:
Steel reinforcement for concrete shall be round/ribbed bars shall be TMT Bar FE 500D (min. Elongation 14.5% as per relevant latest IS standards for manufacturing of reinforcement)unless otherwise specified and equivalent conforming to IS: 1786 for mechanical properties with improved corrosion resistance and bond strength shall be used.Only new steel shall be delivered to the site and shall be free of mill scale, loose rust, grease oil, paint or any other deleterious materials which reduce or destroys bond.

Nominal mass/weight:

The tolerance on mass/ weight for round and square bars shall be the percentage given in IS code of the mass/ weight calculated on the basis that the masses of the bar/wire of nominal diameter and of density 7.85 kg/ cm3 or 0.00785 kg/mm3

Physical Properties:

High strength deformed bars & wires shall conform to IS 1786. The physical properties for all sizes of steel bars are mentioned below for FE -500

Sr.No	Property	Fe500D
1	0.2 Per cent Proof stress/ yield stress, Min, N/mm2	500.0
2	Elongation, per cent, Min. on gauge length 5.65 A, where A is the cross- sectional area of the test piece.	16.0
3	Tensile strength, Min	10 Per cent more than the actual 0.2 per cent proof stress/ yield stress but not less than 565.0 N/mm2
4	Total elongation at maximum force, percent, Min on gaugelength 5.65 A, where A is the cross-sectional area of the test piece.	5
5	Bend- Re bend Test	This shall be done as per IS 1786

Chemical composition of reinforcement bars shall be as per Table follows: -

Sr. No	Particular	Result
1	Carbon	0.25% max
2	Sulphur (S)	0.040% max
3	Phosphorus (P)	0.040% max
4	S+P	0.075 %max

Thermo Mechanically treated reinforcement bars:

There is no BIS code for TMT bars. The available code BIS 1786 pertains to HSD Bars. Therefore, there should be no stipulation that TMT bars should conform to relevant BIS code.

The TMT bars are being produced under valid license from either of the firms namely Temporal, Thermax Evcon Turbo & Turbo Quench. These firms have acquired patents and are giving licenses to various producers to produce TMT Bars.

The TMT bars shall conform to IS 1786 pertaining to Fe 415 D or Fe 500 D or Fe grade of steel as specified.

Binding Wire:

Binding Wire shall conform to M-21. The reinforcement shall be securely bound wherever bars intersect or wherever required with 16 to18 gauge (1.63mm to 1.22 mm diameter) annealed steel wire conforming to IS: 280-1972. Binding wire shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

Welding electrodes:

Electrodes used for welding of steel bars shall be ordinary mild steel grade 2 electrodes conforming to IS: 814 and shall be the best quality and approved by the Engineer. -In-Charge. The work shall be carried out strictly as per IS: 2751 and IS: 9417.

Welding of reinforcement bars covered in this specification shall be done in accordance with the requirements of IS 2751

Sampling & Testing:

Sampling:

Sampling shall be done in accordance with relevant IS codes. For every 40 MT (Metric Ton) of steel at least one test shall be done. reinforcing bars shall conform to the physical properties of IS: 1786. In addition, when tested for corrosion resistance as per the standard ASTM method such as salt spray test (B.117.90), Potential Dynamic Polarization measurement test (G.5.78), Atmospheric Corrosion test (G.50.76) and Sulphur-di-oxide chamber test (G.87.84) shall exhibit corrosion resistance index of minimum 1.5. (deformed) bars should either be butt or lap welded as per recommended practice of IS:9417. For best results basic coated electrodes containing copper and/or nickel shall be used.

Testing:

Test certificates from manufacturer, mill certificates and certificates of origin shall be submitted for each consignment. Additional tests required shall be done as recommended by the client/consultant at the contractor's own cost. An accredited laboratory shall carry out testing.

Selection and preparation of Test sample:

All the tests pieces shall be selected by the Engineering-Charge or his authorized representative either- From cutting of bars Or

If he so desires, from any bar after it has been cut to the required or specified size and the test piece taken from and any part of it.

In neither case, the test pieces shall be detached from the bar or coil except in the presence of the Engineer-in-Charge or his authorized representative. The test pieces obtained in accordance with as above shall be full sections of the bars as rolled and subsequently cold worked and shall be subjected to physical tests without any further modifications. No deduction in size by machining or otherwise shall be permissible. No test piece shall be enacted or otherwise subject to heat treatment. Any straightening which a test piece may require shall be done cold. All tests as shown in IS code shall be carried out.

Causes of Rejection:

Any reinforcement so sampled and tested which fails to comply with the specifications shall be rejected by the client/consultant and the whole batch shall be removed from the site immediately. The contractor shall have no claim for bars mutilated in obtaining test samples.

Every bar shall be inspected before assembling on the work and defective, brittle or burnt bar shall be rejected. Cracked ends of bars shall be discarded. The contractor at his own expense shall immediately remove rejected steel from the work site.

Workmanship:

Stacking and Storage:

Steel for reinforcement shall be stored in such a way as to prevent distorting and corrosion. Cares hall be taken to protect the reinforcement from exposure to saline atmosphere during storage, fabrication and use. It may be achieved by treating the surface of reinforcement with cement wash or by suitable methods. Bars of different classifications, sizes and lengths shall be stored separately to facilitate issue in such sizes and lengths to cause minimum wastage in cutting from standard length Steel conforming to above for reinforcement shall be clear and free from loose mill scales, dust loose rust, coats of paints, oil or other coating which may destroy or reduce bond. It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Prior to assembly of reinforcement on no account any oily substance shall be used for removing the rust. Bar bending schedule shall be made by the contractor before starting the work. The payment shall be done based on quantity worked out in bar bending schedule. The bar bending schedule shall be prepared as per SP 34.

Assembly of Reinforcement:

Bars shall be bent correctly and accurately to the size and shape as shown in the detailed drawing or as directed by Engineer-in-Charge. Preferably bars of full length shall be used. Necessary cutting and straightening is also included. Overlapping of bars, where necessary shall be done as directed by the Engineer-in-Charge. The overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25mm or 11/4 times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceedingly twice the dia. of such bars with two strands annealed steel wire of 0.90 mm to 1.6 mm twisted tight. The overlaps/ splices shall be staggered as per directions of the Engineer-in-Charge. But in no case the overlapping shall be provided in more than 50% of cross-sectional area at one section.

Bonds and Hooks Forming End Anchorages:

Reinforcement shall be bent and fixed in accordance with procedure specified in IS 2502, code of practice of bending and fixing of bars for concrete reinforcement. The details of bends and hooks are shown below for guidance.

U-Type Hook

In case of mild steel plain bars standard U type hook shall be provided by bending ends of rod into semicircular hooks having clear diameter equal to four times the diameter of the bar.

Note: In case of work in seismic zone, the size of hooks at the end of the rod shall be Eighth times the diameter of bar or as given in the structural drawings.

Bends

Bend forming anchorage to a M.S. plain bar shall be bent with and internal radius equal to two times the diameter of the bar with a minimum length beyond the bend equal to four times the diameter of the bar.

Anchoring Bars in Tension:

Deformed bars may be used without end anchorages provided, development length equipment is satisfied. Hooks should normally be provided for plain bars in tension. Development length of bars will be determined as per IS: 456.

Anchoring Bars in Compression:

The anchorage length of straight bar in compression shall be equal to the 'Development length' of bars in compression as specified in IS: 456. The projected length of hooks, bend and straight lengths beyond bend, if provided for a bar in compression, shall be considered for development length.

Binders, stirrups, link etc.:

In case of binders, stirrups, links etc. the straight portion beyond the curve at the end shall be not less than Eighth times and nominal size of bar.

Welding of Bars:

Wherever facility for electric arc welding or gas pressure welding is available, welding of bars shallbe done in lieu of overlap. The location and type of welding shall be got approved by the Engineer-in-Charge. Welding shall be as per IS 2751 and 9417.When permitted or specified on the drawings, joints of reinforcement bars shall be welded with appropriate welding rod as per the instructions given by Structural Engineer. The type of welding, size of fillet etc shall be as approved by Structural Engineer. Welded joints shall preferably be located at points when steel will not be subject to more than 75 % of the maximum permissible stresses and welds so staggered that any one section not more than 20 % of the rods are welded. Suitable means shall be provided for holding bars securely in position during welding. It shall be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous

Mechanical splices:

Whenever indicated on the drawings or desired by the Architect and Engineer-in-charge, bars shall be joined by couplings which shall have a cross section sufficient to transmit the full stresses of bars. The ends of the bars that are joined by coupling shall be upset for sufficient length so that the effective cross sectional the base of threads is not less than normal cross section of the bar. Threads shall be standard threads. Steel coupling shall conform to IS: 226. Mechanical connections for splicing reinforcement bars in congested locations shall be used only with the approval of consultant/Engineer.-In-Charge. Patented couplers as manufactured by Usha Martin Industries Ltd. (CCL bar grips) and BBR India Ltd. (BBR SWIF) shall be used wherever mentioned in the drawings or as per instruction of Structural Engineer. The couplers shall be attached to the reinforcement bars by forging, hydraulic pressing or screw couplers in special circumstances may be permitted. All operations relating to reinforcement coupling shall be done using supplier's patented machine / equipment and in the presence of the supplier's representative. The contractor shall submit relevant trade literature, mil certificates, certificate of origin and letters of approval for each proposed application. A sample of each type of mechanical coupler shall be submitted for testing and approval prior to the use of any coupler in the works.

Placing in Position:

Fabricated reinforcement bars shall be placed in accurately position as shown in the drawings

or as directed by the Engineer-in-charge. The bars crossing one another shall be tied together at every inter section with two strands of annealed steel wire 0.9 to 1.6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete. Tack welding in crossing bars shall also be permitted in lieu of binding with steel wire if approved by Engineer-in-Charge.

The bars shall be kept in correct position by the following methods:

In case of beam and slab construction pre-cast cover blocks in cement mortar 1:2 (1 cement : 2coarse sand) about 4x4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcements. In case of cantilevered and doubly reinforced beams of slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 meter or at shorter spacing to avoid sagging. In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them: or with clock of cement mortar 1:2 (1 cement: 2coarse sand) of required size suitable tied to the reinforcement to ensure that they are in correct position during concreting. In case of other R.C.C. structure such as arches, domes, shells, storage tanks etc. a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in- Charge.

Tolerance on Placing of Reinforcement:

Unless otherwise specified by the Engineer-in-Charge, reinforcement shall be placed within the following tolerances:

Tolerance in spacing

For effective depth, 200 mm or less +10 mm

For effective depth, more than 200 mm + 15 mm

Bending at Construction Joints:

Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position care should be taken to ensure that at no time the radius of the bend are less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

Cover: The minimum nominal cover to meet durability requirements shall be as under: -

Exposure Condition as per IS 456-2000	Nominal Concrete cover in mm not less than
Mild	20
Moderate	30
Severe	45
Very severe	50
Extreme	75

Nominal cover to meet specified period of fire resistance shall not be less than as givenin Table 16A of IS 456.

Chairs:
Adequate no. of chairs shall be provided to prevent sagging of reinforcement during concreting.

MODE OF MEASUREMENTS & PAYMENT:
Reinforcement shall be measured in length excluding overlaps for different diameters as actually used in the work. Where welding or coupling is resorted to in place lap joints, such joints shall not be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in tones/Kgf on the same basis of as per M-18 and relevant IS Code. Reinforcement shall be measured in lengths of bar as actually placed in position on standard weight basis, no allowance being made in the weight for rolling margin. Wastage and binding wire shall not be measured. Authorized overlaps, chairs, splices, spacers and hooks shall not be measured. Rate quoted shall include the cost of welding if specified. Payment shall be made as per reinforcement drawings and with theoretical weights only. Cutting, bending, placing, binding and fixing in position as shown on the drawings and as directed It shall also include all devices for keeping reinforcement in approved position, cost of joining as per approved method and all wastage and spacer bars. The rate shall be for a unit of One Kg.

Item No -7

Providing & fixing of reinforcement bars (reinforcement bars shall be paid extra under relevant item of work) after drilling the hole of required diameter & depth , cleaning of the same ,providing /filling the hole with Injection Mortar (HY 150 or approved equivalent),inserting reinforcement bar etc. complete as per Manufacturers & architects instruction. The work shall be carried out by the technical workmen's/agency approved by the manufacturer and under technical supervision of Manufacturer of Injection grout including all materials, tool tackles, labour etc. Complete. (C) 12 mm. dia. bar -Holes 16mm dia Depth 120mm

Drilling holes into existing concrete structure for anchoring of new rebar's with 12 mm dia shear connectors at 0.5 mtr c/c and fixing with pure epoxy resin based cartridge form chemical anchor material Master flow 935 of BASF or approved equivalent product as per NF P 18-831 and NF P 18- 836. Drilling hole diameter: 16 mm, Drilling hole depth: 120 mm including cleaning, cutting, fabricating, chemicals, tools, plants, machineries, labour, electricity, etc. Complete as directed by Engineer-in-charge.

Material: -
a) Master flow 935 (BASF make) or approved equivalent product as per NF P 18-831 and NF P 18-836 Master Flow 935 is a t w o-component, thixotropic, pure epoxy resin based chemical anchoring mortar. The product is specially designed for applications where heavy loads under critical conditions are to be fixed in concrete. Both components of Master flow 935, packed in a single cartridge with separate compartments, are correctly mixed in the mixing nozzle during application.

Advantages: High adhesive power, Fast curing time – saves time and money, Easy to extrude, Styrene free formulation – low odour, High mechanical strengths, Can be used in

diamond drilled holes, Applicable in slightly damp conditions, Can be used at high temperatures, Very low shrinkage, even on big diameters, For interior and exterior use, Specially suitable for technical applications, For fixing in solid material like concrete or brickwork

Methodology: -

Provision of Shear Connector

a) Wherever the reinforcement is reduced by corrosion for more than 20% of its original diameter, extra main steel is to be provided by welding a suitable dia. bar to existing steel or lapping it suitably (lap = 50 times the bar dia.). While doing this it may be necessary to take anchorage in sound concrete in case length beyond damaged portion is not adequate to provide lap and welding is not feasible. In such cases drill a slightly oversize (4 mm more in dia.) hole adjacent to existing main reinforcement, to a depth of 80-150 mm depending upon dia. of rebar and anchor new reinforcement using anchor resin grout of approved manufacturer.
b) New reinforcement can be clamped on soffit of damaged concrete slabs and anchored into supporting beams or at the end of the slab by making L shape bend.
c) For strengthening of columns and beam by jacketing methodology, new reinforcement shall be provided as per drawing and structural consultant recommendation by rebar grouting for Main steel. Stirrups and shear connector as per Item no. 5 & 6 above.

Mode of Measurement & Payment:

Measurement shall be taken in Numbers of shear connector fixed in Nos. and shall be paid as per rates approved.

Item No -8

Providing & fixing of reinforcement bars (reinforcement bars shall be paid extra under relevant item of work) after drilling the hole of required diameter & depth , cleanning of the same ,providing /filling the hole with Injection Mortar (HY 150 or approved equivalent),inserting reinforcement bar etc. complete as per Manufacturers & architects instruction. The work shall be carried out by the technical workmen's/agency approved by the manufacturer and under technical supervision of Manufacturer of Injection grout including all materials, tool tackles, labour etc. Complete. (D) 16 mm. dia.bar -Holes 20mm dia Depth 160mm

Drilling holes into existing concrete structure for anchoring of new rebar's with 16 mm dia shear connectors at 0.5 mtr c/c and fixing with pure epoxy resin based cartridge form chemical anchor material Master flow 935 of BASF or approved equivalent product as per NF P 18-831 and NF P 18- 836. Drilling hole diameter: 20 mm, Drilling hole depth: 160 mm including cleaning, cutting, fabricating, chemicals, tools, plants, machineries, labour, electricity, etc. Complete as directed by Engineer-in-charge.

Material: -

a) Master flow 935 (BASF make) or approved equivalent product as per NF P 18-831 and NF P 18-836 Master Flow 935 is a t w o-component, thixotropic, pure epoxy resin based chemical anchoring mortar. The product is specially designed for applications

where heavy loads under critical conditions are to be fixed in concrete. Both components of Master flow 935, packed in a single cartridge with separate compartments, are correctly mixed in the mixing nozzle during application.

Advantages: High adhesive power, Fast curing time – saves time and money, Easy to extrude, Styrene free formulation – low odour, High mechanical strengths, Can be used in diamond drilled holes, Applicable in slightly damp conditions, Can be used at high temperatures, Very low shrinkage, even on big diameters, For interior and exterior use, Specially suitable for technical applications, For fixing in solid material like concrete or brickwork

Methodology: -

Provision of Shear Connector

a) Wherever the reinforcement is reduced by corrosion for more than 20% of its original diameter, extra main steel is to be provided by welding a suitable dia. bar to existing steel or lapping it suitably (lap = 50 times the bar dia.). While doing this it may be necessary to take anchorage in sound concrete in case length beyond damaged portion is not adequate to provide lap and welding is not feasible. In such cases drill a slightly oversize (4 mm more in dia.) hole adjacent to existing main reinforcement, to a depth of 80-150 mm depending upon dia. of rebar and anchor new reinforcement using anchor resin grout of approved manufacturer.
b) New reinforcement can be clamped on soffit of damaged concrete slabs and anchored into supporting beams or at the end of the slab by making L shape bend.
c) For strengthening of columns and beam by jacketing methodology, new reinforcement shall be provided as per drawing and structural consultant recommendation by rebar grouting for Main steel. Stirrups and shear connector as per Item no. 5 & 6 above.

Mode of Measurement & Payment:

Measurement shall be taken in Numbers of shear connector fixed in Nos. and shall be paid as per rates approved.

Item No -9

Providing and laying water proofing treatment in roof Patches etc., by applying cement slurry mixed with water proofing cement compound consisting of applying:

(a) First layer of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/ sqm. This layer will be allowed to air cure for 4 hours.

(b) Second layer of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing for 48 hours.

The rate includes preparation of surface, treatment and sealing of all joints, corners, junctions of pipes and masonry with polymer mixed slurry.

Preparing Surface and Fixing Pipes and Fittings

Before the water proofing treatment work, proper key in the concrete surface should be provided.

The depressed/sunken portion should be hacked by a hacking tool, after the concrete slab is cast and when this concrete is still green.

The vertical surfaces of the depressed /sunken portion should be hacked with a hacking tool just after the shuttering is removed.

In case of old work, the water proofing treatment on such surfaces shall be permitted after making proper spatter dash key.

Fixing the 'P' trap in position and all other pipes work including the water escape pipe shall be fixed properly and the holes should be plugged carefully before taking up the water proofing work.

Providing and Laying of Slurry for First Layer

The consistency of the slurry should be such as to cover the desired area by using 0.488 kg of blended cement per sqm of area.

On deciding the correct quantity of water required per sqm. area the required quantity of slurry should be prepared which can be applied over the desired surface within half an hour of mixing with 0.488 kg. of grey cement + 0.253 kg. water proofing compound as per manufacturer specifications + x litres of water per sqm. area and the required quantity of slurry thus prepared should only be used for first application.

The first layer shall be applied with painting brushes over the specified and dampened area carefully including the corners, holes on the surfaces and joints of pipes in concrete etc. and the application should continue at least upto 150 mm height of fixtures of pipes from the surface. The surface on application shall be air cured for 4 hours.

Providing and Laying of Slurry for Second Layer

The quantity of slurry required for second application to be covered within an hour of mixing shall be prepared with 0.242 kg. cement + 0.126 kg. water proofing compound + y litres of water per sqm. area and the required quantity of slurry thus prepared should only be used for second application.

The applied surface shall be allowed to air cure for 4 hours and thereafter water curing shall be done for full 48 hours.

In case no further work as described above is to be taken up immediately on completion of water proofing treatment due to any reason it is recommended to protect the treated portion with cement plaster 1:4 as a protective layer for which separate payment shall be made to the contractor.

Measurement

Length and breadth shall be measured along the finished surface correct to a cm and area shall be worked out to nearest 0.01 sqm.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described above. The cost of plastering shall be measured and paid for separately.

Item No. 10

Providing and laying Glossy/matt/GVT 600 X 600 Full body/ Double charge vitrified floor tiles in different sizes having 3/4/5mm groove (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS : 15622, of approved make, in all colours and shades, laid on upto 60 mm thick Tile Adhesive cement mortar 1:4 (1 cement : 4 coarse sand) or Tile on Tile Chemical Grout as specified by Architect, including grouting the joints with white cement and matching pigments etc. complete. Colour and shade as approved by architect. All joints filled with epoxy grout.Rate includes of all tool, tackle, machinery, labor & floor protection system to protected floor by either floor protection sheet or Plaster of Paris work until hand over of building, all lead & lift & as per directed by EIC.

Pressed Ceramic Tiles

The tiles shall be of approved make and shall generally conform to IS 15622. They shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as per IS 13630.

Classification and Characteristics of pressed ceramic tiles shall be as per IS 13712.

The tiles shall be square or rectangular of nominal size. Table 1,3,5, and 7 of IS 15622 give the modular preferred sizes and table 2,4,6 and 8 give the most common non modular sizes. Thickness shall be specified by the manufacturer. It includes the profiles on the visible face and on the rear side. Manufacturer/supplier and party shall choose the work size of tiles in order to allow a nominal joint width upto 2mm for unrectified floor tiles and upto 1mm for rectified floor tiles. The joint in case of spacer lug tile shall be as per spacer. The tiles shall conform to table10 of IS 15622 with water absorption 3 to 6% (Group BII).

The top surface of the tiles shall be glazed. Glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable, shall be permissible on only upto 50 per cent of the surface area of the edges.

Coloured Tiles

Only the glaze shall be coloured as specified. The sizes and specifications shall be the same as for the white glazed tiles.

Decorative Tiles

The type and size of the decorative tiles shall be as follows :

(i) Decorated white back ground tiles

The size of these tiles shall be as per IS 15622.

(ii) Decorated and having coloured back-ground

The sizes of the tiles shall be as per IS 15622.

Preparation of Surface and Laying

Base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as specified. The average thickness of the bedding shall be 20 mm or as specified while the thickness under any portion of the tiles shall not be less than 10 mm.

Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set and to enable the mason to place wooden plank across and squat on it.

Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 3.3 kg of cement per square metre over an area upto one square metre. Tiles shall be soaked in water washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope. In bath, toilet W.C. kitchen and balcony/verandah flooring, suitable tile drop or as shown in drawing will be given in addition to required slope to avoid spread of water. Further tile drop will also be provided near floor trap.

Where full size tiles cannot be fixed these shall be cut (sawn) to the required size, and their edge rubbed smooth to ensure straight and true joints.

Tiles which are fixed in the floor adjoining the wall shall enter not less than 10 mm under the plaster, skirting or dado.

After tiles have been laid surplus cement slurry shall be cleaned off.

Pointing and Finishing

The joints shall be cleaned off the grey cement slurry with wire/coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. Where spacer lug tiles are provided, the half the depth of joint shall be filled with polysulphide or as specified on top with under filling with cement grout without the lugs remaining exposed. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped with a wooden mallet.

Measurements

Length and breadth shall be measured correct to a cm before laying skirting, dado or wall plaster and the area calculated in square metre correct to two places of decimal. Where coves are used at the junctions, the length and breadth shall be measured between the lower edges of the coves.

No deduction shall be made nor extra paid for voids not exceeding 0.20 square metre. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square metre.

Areas, where glazed tiles or different types of decorative tiles are used will be measured separately.

Rate

The rate for flooring shall include the cost of all materials and labour involved in all the operations described above. Nothing extra shall be paid for the use of cut (sawn) tiles in the work.

Item No. -11

Providing, fabricating, assembling, hoisting/ erecting and fixing in position at any heights/ any levels/ all floors/ all shapes & sizes with all leads & lifts using MS Rolled Steel Sections, Hollow sections, Tubular Sections, MS Plates, Chequered Plates, MS Pipes, Perforated Sheet, Flats, Bright Bars, Angles, MS Sheet, Girder, Beam. threaded J bolts, insert plate, support plate etc as per drawing. all confirming to latest relevant IS codes for the work of steel structures like staircases, railings, handrail, jali, gates, grills, bracings, platforms, brackets, monkey ladder, cattle trap, grill door, pipe rack, rungs, false ceiling frame work, framing for facade, Roof canopy, fencing posts, M.S. Screen & fencing jali frame work etc. including straightening, cutting, bending, bolting and welding the members all as per structural drawings and as per detailed specifications (for materials & workmanship) including necessary scaffolding/ staging etc. complete in the situations described hereinafter and comprising of : i) Profile Cutting of components to required length/ width and shape/profile; ii) Smooth grinding/ machining of edges/ faces/ all welding joints; iii) Necessary welding (electric arc welding) for required weld lengths and sizes. Fabrication shall be in a perfect architectural workmanship manner and as provided in section V & VI of IS 800 & IS 7215. Welding shall be carried out by qualified welders/ fabricators. The procedure, selection, test and inspection shall confirm to provisions in IS 816, IS 818, IS 822, & IS 823. Erection/ hoisting shall commence only after passing of fabricated parts by Architect/ Engineer. Rate shall be inclusive of cutting, wastage, welding, bending (shop at site), bolting wherever necessary, grinding, finishing edges, filling & finishing the welded spots & gaps with "Bombay Masala" & "Steel Putty" etc. complete. It should also include the cost of necessary scaffolding/ staging, zinc coated nut-bolt as required for safety, anchore fastner of approved make (Hilti Fisher or equivalent) structural stability of all works at site and for fixing with RCC element. Including, Providing and applying minimum two coats of enamel paint (2 coats of zinc chromate yellow primer and 2 coats of enamel paint) of approved make on all type of MS sections, new steel and other metal surfaces & including preparing the surface to give an even shade & finish at any heights, any levels etc. complete as per satisfaction of engineer-in-charge. (Only standard measurements will be paid for as actual cut length used at site)

Laying Out

A figure of the steel structure to be fabricated shall be drawn on a level platform to full scale. This may be done in full or in parts, as shown on drawings or as directed by the Engineer-in-Charge. Steel tape shall be used for measurements.

Fabrication

Fabrication shall generally be done as specified in IS 800. In major works or where so specified, shop drawings giving complete information for the fabrication of the component parts of the structure including the location, type, size, length and details or rivets, bolts or welds, shall be prepared in advance of the actual fabrication and approved by the Engineer-in-charge. The drawings shall indicate the shop and field rivets, bolts and welds. The steel members shall be distinctly marked or stencilled with paint with the identification marks as given in the shop drawings.

Great accuracy shall be observed in the fabrication of various members, so that these can be assembled without being unduly packed, strained or forced into position and when built up, shall be true and free from twist, kinks, buckles or open joints.

Wooden or metal sheet templates shall be made to correspond to each member, and position of rivet holes shall be marked accurately on them and holes drilled. The templates shall then be laid on the steel members, and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting as per required dimensions. The base of steel columns and the positions of anchor bolts shall be carefully set out at the required location.

The steel section shall be straight or to be straightened or flattened by pressure unless required to be of curvilinear form and shall free from twists. These shall be cut square either by shearing or sawing to correct length and measured by steel tape. No tow pieces shall be welded or joined to make up for the required length of member.

Making Holes : Holes through more than one thickness of materials for members, such as compound stanchion and girder flanges shall, where possible, be drilled after the members are assembled and tightly clamped or bolted together. Punching may be permitted before assembly, provided the holes are punched 3mm less in diameter than the required size and reamed after assembly to the full diameter. The thickness of material punched shall be not greater than 16 mm.

Rivet Holes

The diameter for rivets and black bolts holes shall be taken as the nominal diameter of a rivet/ black bolts plus 1.5 mm for rivets/ bolts of nominal diameter less than or equal to 25 mm" and 2.0 mm for rivets of nominal diameter exceeding 25 mm, unless specified otherwise. Holes for turned and fitted bolts shall be drilled or reamed large by 0.2 to 8 mm depending upon the dia. of bolts.

Holes shall have their axis perpendicular to the surface bored through. The drilling or reaming shall be free from burrs, and the holes shall be clean and accurate. Holes for rivets and bolts shall not be formed by gas cutting process. Holes for counter sunk bolts shall be made in such a manner that their heads sit flush with the surface after fixing.

Assembly : Before making holes in individual members, for fabrication and steel work intended to be riveted or bolted together shall be assembled and clamped properly and tightly so as to ensure close abutting, or lapping of the surfaces of the different members. All stiffeners shall be fixed (or placed) tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or dressed true and straight, and fitted close together.

Web plates of girders, which have no cover flange plates, shall have their ends flush with the tops of angles unless otherwise required. The web plate when spliced, shall have clearance of not more than 5mm. The erection clearance of cleated ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm at each end but where for practical reasons, greater clearance is necessary, seating designed suitably shall be provided.

Column splices and butt joints of struts and compression members *requiring c* ontact for stress transmission shall be accurately, machined and close butted over the whole section. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc. after riveting together shall be accurately machined so that the parts connected, butt against each other over the entire surfaces of contact. Connecting angles or channels shall be fabricated and placed in position with great accuracy so that they are not unduly reduced in thickness by machining.

The ends of all bearing stiffeners shall be machined or grounded to fit tightly both at top and bottom.

Riveting : Rivets shall be used, where slip under load has to be avoided.

Preliminaries before Rivetings:- Members to be riveted shall have all parts firmly placed and held together before and during riveting, and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

Process of Riveting

The riveting shall be carried out by using machines of the steady pressure type. However, where such facilities are not available hand riveting may be permitted by the Engineer-in -charge. The rivets shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than10mm may be driven cold. Rivets shall be finished neat with heads full and of equal size. The heads shall be central on shanks and shall grip the assembled members firmly.

All loose, burnt, or badly formed rivets with eccentric or deficient heads shall be cut out and replaced. In cutting out rivets, care shall be taken so as not to injure the assembled members. Caulking and recapping shall not be permitted.

For testing rivets, a hammer weighing approx. 0.25 kg shall be used and both heads of the rivet

(Specially the machine head) shall be tapped. When so tested, the rivets shall not give a hollow sound and a jar where so specified, other tests shall be carried out to ensure the soundness of rivets.

All rivets heads shall be painted with approved steel primer paint within a week of their fixing.

Bolting : The nominal length of the bolt shall be the distance from the underside of the head to the further end of the shank. The nominal diameter of the bolt shall be the diameter at the shank above the screwed threads. Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil, before use. All bolts heads and nuts shall be hexagonal unless specified otherwise. The screwed threads shall conform to IS 1363 and the threaded surface shall not be tapered. The bolts shall be of such length as to project at least two clear threads beyond the nuts when fixed in position, and these shall fit in the holes without any shake. The nuts shall fit in the threaded ends of bolts properly.

Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least two thread. In all cases where the full bearing area of the bolt is to be developed, the bolt shall be provided with a washer of sufficient thickness under the nuts to avoid any threaded portion of the bolt being within the thickness of the parts bolted together.

Where there is a risk of the nuts being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of lock nut, spring washers as directed by the Engineer-in-charge.

Welding : Welding shall generally be done by electric arc process as per IS 816 and IS 823. The electric arc method is usually adopted and is economical. Where electricity for public is not available generators shall be arranged by the contractor at his own cost unless otherwise specified. Gas welding shall only by resorted to using oxyacetylene flame with specific approval of the Engineerin- charge. Gas welding shall not be permitted for structural steel work Gas welding required heating of the members to be welded along with the welding rod and is likely to create temperature stresses in the welded members. Precautions shall therefore be taken to avoid distortion of the members due to these temperature stresses.

The work shall be done as shown in the shop drawings which should clearly indicate various details of the joint to be welded, type of welds, shop and site welds as well as the types of electrodes to be used. Symbol for welding on plans and shops drawings shall be according to IS 813.

As far as possible every efforts shall be made to limit the welding that must be done after the structure is erected so as to avoid the improper welding that is likely to be done due to heights and difficult positions on scaffolding etc. apart from the aspect of economy. The maximum dia of electrodes for welding work shall be as per IS 814. Joint surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter, which adversely affect the quality of weld and workmanship.

Precautions : All operation connected with welding and cutting equipment shall conform to the safety requirements given in IS 818 for safety requirements and Health provision in Electric and gas welding and cutting operations.

Operation, Workmanship and process of Welding is described in Appendix B,

Inspection and testing of welds shall be as per IS 822.

Assembly : Before welding is commenced, the members to be welded shall first be brought together and firmly clamped or tack welded to be held in position. This temporary connection has to be strong enough to hold the parts accurately in place without any disturbance. Tack welds located in places where final welds will be made later shall conform to the final weld in quality and shall be cleaned off slag before final weld is made.

Erection : The specification shall be as described in 10.3.3 except that while erecting a welded structure adequate means shall be employed for temporary fastening the members together and bracing the frame work until the joints are welded. Such means shall consists of applying of erection bolts, tack welding or other positive devices imparting sufficient strength and stiffness to resist all temporary loads and lateral forces including wind. Owing to the small number of bolts ordinarily employed for joints which are to be welded, the temporary support of heavy girders carrying columns shall be specially attended. Different members which shall be fillet welded, shall be brought into as close contact as possible. The gap due to faulty workmanship or incorrect fit if any shall not exceed. 1.5 mm if gap exceeds 1.5 mm or more occurs locally the size of fillet weld shall be increased at such position by an amount equal to the width of the gap.

Painting : Before the member of the steel structures are placed in position or taken out of the workshop these shall be painted as specified in para 10.2.2.

Measurements

The mode of measurements shall be the same as specified in 10.2.4 except that weight of welding material shall not be added in the weight of members for payment and nothing extra shall be paid for making and filling holes for temporary fastening of members during erection before welding.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described above.

Item No.- 12

PUF Insulated Roofing Sheet:

Providing and fixing PUF Insulated continuous sandwich panels for roofs of total thickness not less than 30 mm made out from continue line method.Panel shall have 0.5 mm thick pre coated GI sheet on both side of Polyurethane foam with external face being corrugated in shape for GI and PU foam both material.The crest height of the panel shall be of 35mm minimum with 250mm c/c pitch. The Precoated sheet shall be of minimum 240 mpa steel grade confirming

to IS 14246:1995 and shall have zinc coating of 120 gsm as per IS:277 , 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron.The PPGI Sheet shall have protective guard film of minimum 25 microns to avoid scratches while trasportation.The roof panels are laid over a frame work of trusses, columns and purlins fixed using 90mm self drilling bolt with rubber washer including all types of flashings. PU Foam must be self-extinguishing, fire retardant type having minimum density of 40 Kg/Cu.mt.(+, - 2 Kgs) including 0.25mm craft paper edging,self tapping screws of required length and nos.etc complete including fixing Ridge and Flashing on required location on edges and with wall joint and other locations with all ancillary accessories as per structural design and direction of Engineer in-charge.

Material Composition and Panel Structure

- Type: Polyurethane Foam (PUF) Insulated Sandwich Roofing Panels.
- Total Thickness: Minimum 30 mm.
- Core Insulation: Rigid Polyurethane Foam (PUF), fire-retardant, self-extinguishing type.
    - Density: 40 kg/m³ ± 2 kg/m³.
- Sheet Composition: 0.5 mm thick Precoated Galvanized Iron (GI) sheet on both sides.
- External Face Profile: Corrugated GI sheet for enhanced structural rigidity.
    - Crest Height: Minimum 35 mm.
    - Pitch: 250 mm center-to-center.
- Edge Protection: 0.25 mm craft paper edging for protection and durability.

Coatings and Protection

- Steel Grade: GI sheets must meet 240 MPa steel grade, conforming to IS 14246:1995.
- Zinc Coating: Both sides should have a 120 gsm zinc coating as per IS 277.
- Primer: 5-7 microns of epoxy primer on both sides.
- Top Coat: 15-18 microns of polyester coating on the external face for UV and corrosion resistance.
- Protective Guard Film: Minimum 25 microns applied on the PPGI sheet to prevent scratches during transportation.

Installation Requirements

- Framework: Panels to be installed over a pre-constructed framework of trusses, columns, and purlins as per design.
- Fastening:
    - Bolts: Use 90 mm long self-drilling bolts with rubber washers to secure the panels.
    - Screws: Self-tapping screws of suitable length and frequency as per structural requirements.
- Flashing and Ridge Caps:
    - Install flashing at panel edges, joints with walls, and ridge caps as per design to ensure waterproofing and weather protection.

    - Flashing should conform to the panel's profile and extend to cover vulnerable joints, with adequate overlap.

Technical Performance Standards

- Thermal Insulation: PUF core provides excellent insulation properties, maintaining indoor thermal comfort.
- Fire Retardancy: PUF core should be self-extinguishing, complying with relevant fire safety standards.
- Durability and Load-Bearing:
    - Impact Resistance: Corrugated GI external sheet profile provides additional impact resistance and load-bearing capacity.
- Wind and Weather Resistance:
    - The combination of zinc coating and polyester top coat ensures weather and corrosion resistance.
- Structural Integrity: Corrugation with a 35 mm crest height and 250 mm pitch ensures stability against wind loads.

Additional Accessories and Workmanship

- Ancillary Components:
    - All ancillary fittings, including ridge caps, flashings, screws, bolts, washers, and edge moldings, should be of compatible materials to avoid galvanic corrosion.
    - PU foam should fill all potential gaps for effective thermal sealing.
- Workmanship:
    - Installation should follow best practices to ensure tight, gap-free sealing along joints.
    - Panels should be handled and fixed in compliance with manufacturer guidelines.
- Cleaning and Protection:
    - Remove the protective guard film only after installation is complete.
    - Clean the roofing surface upon completion to ensure an undamaged finish.

Testing and Compliance

- Material Standards:
    - GI Sheets: Conforming to IS 277 and IS 14246:1995.
    - Zinc Coating: 120 gsm as per IS 277.
- Performance Standards:
    - PUF Density: 40 kg/m^3 ± 2 kg as per quality control norms.
    - Fire Retardancy: Self-extinguishing foam to be tested and compliant with fire safety standards.
    - Load-Bearing Tests: Structural stability and wind load resistance as per site-specific requirements.

Execution and Approval

- All materials, installation methods, and accessories should be approved by the **Engineer in Charge** before commencement.
- Any deviation from the specified standards requires written approval from the supervising engineer or consultant.

Mode of Measurement:

- **Area Measurement**: Square Meter (m^2).
- The total area covered by the roofing sheets, including overlaps and joints, will be measured for billing.

Item No.- 13

PUF Insulated Wall Sheet:

Providing and fixing PUF Insulated continueous sandwich panels for walls of total thickness not less than 40 mm and width 1.0 m made out from continue line method on automatic plant.Panel shall have 0.5 mm thick pre coated GI sheet on both side of Polyurethane Foam confirming to IS 12436:1988.The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992 , 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron.The PPGI Sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during trasportation.The panels shall be vertically joined together by tongue and groove joints. The PU Foam shall be self-extinguishing, fire retardant type having minimum density of 40 Kg/Cu.mt.(+, - 2 Kgs) including 0.25 mm thick craft paper edging on both edges. The panels shall be fixed to the steel frame structure with minimum 5mm thick self tapping GI screws of required length and nos. with minimum spacing of 300 mm c/c.

Materials:

- **Panel Composition:**
  The panels shall be composed of Polyurethane Foam (PUF) insulation with galvanized iron (GI) sheets on both sides, forming a sandwich panel structure.
- **Outer GI Sheets:**
  - **Thickness:** 0.5 mm on both sides of the PUF core.
  - **Steel Grade:** Minimum 240 MPa, conforming to IS 14246:1995.
  - **Coating:** Zinc coating of minimum 120 gsm in accordance with IS 277:1992.
  - **Epoxy Primer:** 5-7 microns on both sides of the sheet.
  - **Polyester Top Coat:** 15-18 microns.
  - **Protective Film:** A plastic guard film of minimum 25 microns to protect against scratches during transportation.
- **Polyurethane Foam (PUF) Core:**
  - **Type:** Self-extinguishing, fire retardant as per safety requirements.
  - **Density:** 40 Kg/Cu.m. (±2 Kg), conforming to IS 12436:1988.
  - **Edge Protection:** 0.25 mm thick craft paper edging on both sides of the panel.

Panel Jointing System:

- Tongue and Groove Joints:
  Panels shall be connected vertically using tongue and groove joints for a secure and flush installation, preventing gaps and enhancing thermal performance.

Installation Requirements:

- Fixing to Steel Frame:
  Panels shall be fixed to the steel frame structure with self-tapping galvanized iron (GI) screws.
  - Screw Specifications: Minimum 5 mm thick screws, galvanized for corrosion resistance.
  - Screw Spacing: Installed at intervals of 300 mm center-to-center.

Standards and Compliance:

- All materials and workmanship shall conform to relevant IS standards:
  - PUF Core: IS 12436:1988.
  - GI Sheet Steel Grade: IS 14246:1995.
  - Zinc Coating: IS 277:1992.

Quality Assurance:

- Inspection:
  Each panel must be inspected for uniform thickness, proper coating, and secure protective film.
- Testing:
  PUF panels should meet fire retardancy standards and density requirements. Test certificates for GI sheet zinc coating, epoxy primer, and polyester coating shall be provided upon request.

Measurement and Payment:

- Measurement:
  The area of installed panels shall be measured in square meters, based on actual wall coverage.
- Payment:
  Payment will be made per square meter of installed panel as per the approved rate in the BOQ, inclusive of materials, labor, transport, and installation.

Item No.- 14

G.I. Gutter :

Providing and fixing precoated galvanised steel sheet roofing accessories of total coated thickness 0.50mm (base metal of minimum 0.45mm thickness with total coating thickness of 0.05mm) with Zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7

microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns using self drilling/ self tapping screws complete : Gutter (300 mm over all girth)

Gutters

Gutter shall be fabricated from plain G.S. Sheets of thickness as specified in the item.

Eaves gutters shall be of the shape and section specified in the description of the item. The overall width of the sheet referred to therein shall mean the peripheral width of the gutter including the rounded edges. The longitudinal edges shall be turned back to the extent of 12 mm and beaten to form a rounded edge. The ends of the sheets at junctions of pieces shall be hooked into each other and beaten flush to avoid leakage.

Slope

Gutter shall be laid with a minimum slope of 1 in 120.

Laying and Fixing

Gutter shall be supported on and fixed to M.S. flat iron brackets bent to shape and fixed to the requisite slope. The maximum spacing of brackets shall be 1.20 metres.

Where these brackets are to be fixed to the sides of rafters, they shall be of 40 × 3 mm section bend to shape and fixed rigidly to the sides of rafters with 3 Nos. 10 mm dia bolts, nuts and washers. The brackets shall overlap the rafter not less than 30 cm and the connecting bolts shall be at 12 cm centres.

Where the brackets are to be fixed to the purlins, the brackets shall consist of 50 × 3 mm M.S. flat iron bent to shape with one end turned at right angle and fixed to the purlin face with 2 Nos. of 10 mm dia bolts nuts and washers. The bracket will be stiffened by provision of 50 × 3 mm. M.S. flat whose over hung portion bent to right angle shape with its longer leg connected to the bracket with 2 Nos. 6 mm dia M.S. bolts, nuts and washers and its shorter leg fixed to face of purlin with 1 No. 10 mm dia, bolt, nut and washer. The over hang of the vertical portion of the bracket from the face of the purlin shall not exceed 22.5 cm with this arrangement. The spacing of the brackets shall not exceed 1.20 metres.

The gutter shall be fixed to the brackets with 2 Nos. G.I. bolts and nuts 6 mm dia, each fitted with a pair of G.I. and bitumen washers. The connecting bolts shall be above the water line of the gutters.

For connection to down take pipes, a proper drop end or funnel shaped connecting piece shall be made out of G.S. sheet of the same thickness as the gutter and riverted to the gutter, the other end tailing into the socket of the rain-water pipe. Wherever necessary stop ends, angles etc., should be provided.

Finish

The gutters when fixed shall be true to line and slope and shall be leakproof.

Measurements

Measurements shall be taken for the finished work along the centre line of the top width of the gutter connection to a cm. The hooked lap portion in the junctions and gutter lengths shall not be measured. The number of brackets which are fixed to purlins with stiffener flats should be measured.

Rate

The rate shall include the cost of all labour and materials specified above, including all specials such as angles, junctions, drop ends or funnel shaped connecting pieces, stop ends etc., flat iron brackets and bolts and nuts required for fixing the latter to the roof members. Brackets of 50 × 3 mm flats fixed to purlins with stiffener flats will be paid extra.

Item No.- 15

Providing and fixing of Ridge flashing for roof panel shall be made out of 0.5 mm thick pre coated GI sheet . The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992 , 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGI Sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during transportation. The ridge shall be fixed to the steel members by pop rivet or self drilling/self stitching fastners @ maximum 450 mm c/c along length of capping/flashing etc complete as per architectural drawings and the directions of Engineer-in-charge.

Ridges and Hips

Ridges and hips of C.G.S. roof shall be covered with ridge and hip sections of plain G.S. sheet with a minimum lap of 20 cm on either side over the C.G.S. sheets. The end laps of the ridges and hips and between ridges and hips shall also be not less than 20 cm. The ridges and hips shall be of 60 cm overall width plain G.S. sheet, 0.6 mm or 0.8 mm thick as given in the description of the item and shall be properly bent in shape.

Fixing

Ridges shall be fixed to the purlins below with the same 8 mm dia G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fix the sheets to the purlins.

Similarly, hips shall be fixed to the roof members below such as purlins, hip and valley rafters with the same 8 mm dia G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fix the sheets to those roof members. At least one of the fixing bolts shall pass through the end laps of ridges and hips, on either side. If this is not possible extra hook bolts shall be provided.

The end laps of ridges and hips shall be joined together with C.G.S sheet by galvanised iron seam bolts 25 x 6 mm size each with a bitumen and G.I. washer or white lead as directed by the Engineer-in-Charge. There shall be at least two such bolts in each end lap.

Surface of C.G.I. sheets of ridge and hip sections and the roofing sheets which overlap each other shall be painted with a coat of approved primer and two coats of approved paint suitable for painting G.S. Sheets before they are fixed in place.

Finish

The edges of the ridges and hips shall be straight from end to end and their surfaces should be plane and parallel to the general plane of the roof. The ridges and hips shall fit in squarely on the sheets.

Measurement

The measurements shall be taken for the finished work in length along the centre line of ridge or hip, as the case may be, correct to a cm. The laps in ridges and hips and between ridges and hips shall not be measured.

Rate

The rate shall include the cost of all labour and materials specified above, including painting, cost of seam bolts and any extra G.I. hook bolts, nuts and washers, required.

Item No.- 16

Design, manufacture and installation of 12 mm dpi system, a complete assembly of extruded Multi / Micro cellular profile UV extruded/protected polycarbonate panels incorporated into a complete system. The Polycarbonate panel system consists co- extruded UV protected Multi / Micro cellular structure polycarbonate panel with width of 1040 mm to ensure best performance for wind uplift, vibration, oil canning and visual appearance. Panels shall be manufactured with vertical standing seam with standing seam height of 10 - 15mm at both sides of the panel. Panels shall be fixed on Purlins with the Z - Type Stainless Steel Fastener/retention clips and connectors. Each fastener shall be min 1 mm thick of SS 304 Grade and secured to supporting frame/structure with min 3 numbers of self-drilling screws so that the Pull Out Load of Fastener exceeds 7000 N (7 KN) when tested as per ISO 6892: 1998 and IS 1608: 2005. Snap-on connectors to interlock the panels shall have 2-4 teeth grip-lock locking mechanism to ensure maximum uplift capability. Panel shall be fixed with additional End cap/Aluminum U / F Profile / Glazing Bar (mill finish) for ends as required. Panel shall be fixed over structural steel / MS purlin (paid separately) by trained & factory authorised installer under direct supervision to complete entire project installation according to the detail technical specifications as per approved architectural drawings.

Material

- **Panel Material:** Co-extruded UV-protected polycarbonate, multi or micro cellular structured for enhanced insulation and structural stability.
- **Panel Thickness:** 12mm.
- **Panel Width:** 1040mm, to optimize performance for wind uplift, vibration resistance, oil canning prevention, and visual consistency.
- **Standing Seam Profile:** The panels must include a vertical standing seam along both edges, with a seam height of 10–15mm. The standing seam design should ensure water-tightness and durability under environmental loads.

Fixing and Retention System

- **Fasteners and Retention Clips:** Use Z-type stainless steel fasteners/retention clips and connectors manufactured from SS 304 grade stainless steel, with a minimum thickness of 1mm.
- **Screw Details:** Each fastener to be secured with a minimum of 3 self-drilling screws (SS 304) to anchor firmly to the supporting frame or purlins.
- **Fastener Pull Out Load:** Each fastener must have a pull-out load capacity exceeding 7000 N (7 kN), as tested in compliance with ISO 6892:1998 and IS 1608:2005 standards.
- **Snap-On Connectors:** Panels should interlock using snap-on connectors with a 2-4 tooth grip-lock mechanism to maximize uplift resistance and panel stability.

End Caps and Profiles

- **Edge Protection:** Panels shall be installed with end caps or U/F profiles or glazing bars (mill finish aluminum) at the edges for secure enclosure and protection.
- **Profile Type:** Aluminum U/F profile, glazing bar, or equivalent, as specified in architectural drawings.

Supporting Frame and Structure

- **Purlins and Structure:** Panels will be installed over a supporting structural steel or mild steel (MS) purlin framework (separately itemized in the tender).
- **Installation by Authorized Personnel:** All installations must be completed by trained and factory-authorized installers under the direct supervision of an engineer to ensure adherence to technical standards and installation requirements.

Standards and Compliance

- **ISO and IS Standards:** The entire system, including panels and fasteners, must comply with ISO 6892:1998 and IS 1608:2005 standards.
- **Wind Uplift and Load Testing:** The system shall be tested and certified to withstand wind uplift, vibration, and external environmental loads as specified by the project requirements.

Installation Process

- **Panel Installation:** Each panel shall be anchored to the purlins using Z-type retention clips and connectors, interlocked with snap-on connectors for secure attachment.
- **End Cap Installation:** End caps or aluminum profiles must be installed at panel ends to ensure full protection against environmental exposure.

- **Quality Compliance:** The contractor must ensure that all work meets or exceeds the specified requirements, and documentation of compliance with all standards must be provided upon completion.

Mode of Measurement and Payment:

Payment will be made per square meter of the installed polycarbonate panel system as

outlined in the BOQ, inclusive of all components, installation labor, and quality inspections.

Item No.- 17

ACP SHEET:-

Designing, fabricating, testing, installing and fixing in position Curtain Wall with Aluminium Composite Panel Cladding, with open grooves for linear as well as curvilinear portions of the building , for all heights and all levels etc. including:

(a) Structural analysis & design and preparation of shop drawings for pressure equalisation or rain screen principle as required, proper drainage of water to make it watertight including checking of all the structural and functional design.

(b) Providing, fabricating and supplying and fixing panels of aluminium composite panel cladding in pan shape in metalic colour of approved shades made out of 4mm thick aluminium composite panel material consisting of 3mm thick FR grade mineral core sandwiched between two Aluminium sheets (each 0.5mm thick). The aluminium composite panel cladding sheet shall be coil coated, with Kynar 500 based PVDF / Lumiflon based fluoropolymer resin coating of approved colour and shade on face # 1 and polymer (Service) coating on face # 2 as specified using stainless steel screws, nuts, bolts, washers, cleats, weather silicone sealant, backer rods etc.

(c) The fastening brackets of Aluminium alloy 6005 T5 / MS with Hot Dip Galvanised with serrations and serrated washers to arrest the wind load movement, fasteners, SS 316 Pins and anchor bolts of approved make in SS 316, Nylon separators to prevent bi-metallic contacts all complete required to perform as per specification and drawing The item includes cost of all material & labour component, the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working curtain wall with aluminium composite panel cladding, cleaning and protection of the curtain wall with aluminium composite panel cladding till the handing over of the building for occupation. Base frame work for ACP cladding is payable under the relevant aluminium item.s The Contractor shall provide curtain wall with aluminium composite panel cladding, having all the performance characteristics all complete , as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer-in-Charge. However, for the purpose of payment, only the actual area on the external face of the curtain wall with Aluminum Composite Panel Cladding (including width of groove) shall be measured in sqm. up to two decimal places.

General

1. All composite aluminium panels shall have a thickness of 4.00mm.
2. The composite cladding panels shall be of cassette type, framed with an extrude aluminium profile.
3. All fasteners shall be concealed within the panel joints. All fixing and joint details shall be designed to provide for the expected thermal expansion and contraction. The fixing of these panels shall accommodate the expected structural movements in the building.
4. With a gloss of 30% according to Gardner Scale, the installed composite panel surface shall not have irregularities such as oil canning, waves, buckles, and other irregularities when viewed at any position not less than 15 degrees to the true plane of the panel.
5. All fasteners, anchors, brackets and similar attachments used for the fixing and erection of these panels shall be of aluminium, non-magnetic stainless steel, or hot dip galvanized steel.

Materials

Aluminium Composite Panel (ACP) cladding in pan shape in metallic colour of approved shade, made of Aluminium Composite Material (ACM), made out of 4 mm thick aluminium composite panel consisting of 3 mm thick fire retardant (FR) grade mineral filled thermoplastic inorganic core of grade B1 sandwiched between two thin coil coated aluminium sheets (Top i.e. face # 1& rear i.e. face # 2) of alloy, Grade 3003 and H-16 temper and minimum thickness of 0.5 mm each as specified in the nomenclature of item. The ACPs are used for the external cladding surface like column, wall, jambs, sills, projected area, ceiling, decorative cladding on any surface to any profile and shape (pan shape) at horizontally / vertically / sloped / curved / circular etc.(linear as well as curvilinear shape).

The ACP fire retardant core of B1 grade contain 70% of Non-Combustible Inorganic compound & 30% of virgin LDPE. The main ingredient of the non-combustible compound are Aluminum Oxide (AlO) and Magnesium Oxide (MgO), when this ACP are put on fire at self-ignition temperature of 460º C, it can be catched on fire after 5 minutes and when the fire leave the panels, the fire on the wall extinguish after 10 seconds.

The ACP top face (exposed surface) coil should have Kynar 500 PVDF (Polyvinylidene fluoride)/ Lumiflon based fluropolymer resin (high surface energy) coating of approved colour and shade of 30 microns to ensure corrosion resistance and weather proof and thus shall confirm to relevant ASTM or DIN or EN or BS code. The back face (rear side) of the cladding penal surface facing to the wall shall have polyester based wash (service) coating of 7 microns preferably grey in colour to protect against possible corrosion problems. The finished surface (Top face) shall be protected with a self-adhesive peel off film with two layers of white & black tested to with stand local weather conditions without losing the original peel off characteristic or causing stains or other damages.

The weight of the Aluminium Composite Panel (ACP) should not be less than 7.50 Kg/Sqm. The ACP shall confirm to ASTM E84-08 or EN13501-1 or DIN4102 resulting in fire resistant properties.

The complete system shall be designed to with stand the design wind pressure as per relevant IS code or international code (Test pressure shall be 1.5 times of the design wind pressure).

Necessary pull out test of anchor fastener shall be carried out on the masonry wall /RCC structure to check the load carrying capacity of the bolt designed under suction pressure for designing the supporting and anchoring system.

Movement

System shall be designed to accommodate movement due to any force including the movement resulting from the exterior skin temperature ranging from 15°C to 85°C and also to accommodate the horizontal building movement of 10 mm per panel & vertical movement of 20 mm between floors on the aluminium framing system with support brackets, glass, and gaskets and fastening devices. System shall be designed to accommodate the size and shape of the Laminated sandwiched composite panel as per the approved drawings including

approved modifications as may be required during execution as well as all other incidental forces and stresses likely to be experienced under service conditions, i.e. Lateral force, Dead weight and Thermal expansion due to building movement both vertical and horizontal etc. Grooves shall be designed in such a way to accommodate weather silicon sealant/ None staining sealant of approved make.

Testing

The mechanical properties of 4mm thick ACP or ACM with core and aluminium coil/sheet shall Confirm to the requirement as given in table 8.5 below.

Table 8.5

Specification for Aluminium Composite Material (ACM)

S. No.	Description	Specification for 4mm	
A	**Physical Tests for ACM**	**Standard Test**	**Acceptable Value/Results**
1	Over all thickness of ACM	Measurement	4mm (Tolerance + 0.2mm)
2	Aluminium Skin thickness (each side)	Measurement	0.5mm (Tolerance +/- 0.03mm)
3	Panel weight (ACM)	Measurement	7.5 Kg/m² (+ 5%)
B	**Mechanical Properties of ACM**		
1	Peel off strength (Drum Peel Test)	ASTM D903	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm²
3	Yield strength	ASTM E8	Min. 40 N/mm²
4	Elongation	ASTM E8	Min. 6%
5	Flexural strength	ASTM C393	Min. 130 N/mm²
6	Shear strength with punch shear test	ASSTM D732	Min. 18 N/mm²
C	**Properties of Aluminium skin**		
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm²
2	Modules of elasticity	ASTM E8	Min 70000 N/mm²
3	Elongation	ASTM E8	Min. 2%
4	0.2% proof stress	ASTM E8	Min. 110 N/mm²
5	Yield strength	ASTM E8	Min. 124 N/mm²
6	Sound Transmission loss	ASTM E413	Max. 26 dB

8.20.5 Performance Certificate

Requisite performance certificate from the manufacturer of ACM stating compliance with ACM technical specification as per Table 5 above shall be submitted by the contractor to the Engineer-in- Charge before fixing at site of work.

The contractor shall provide curtain wall with aluminum composite panel cladding, having all the performance characteristics all complete as per the Architectural drawings, as per items description, as specified, as per the approved shop drawings and as directed by the Engineer-in-charge.

Marking

The ACP sheet should have a following laser marking and should be at repeated interval at the rear face of ACP sheet.

1. Total thickness with coil and core materials.
2. Size of ACP sheet.
3. Fire Retardant (FR) grade.
4. Date of manufacturing.
5. Batch number.
6. Make of manufacturer.

Installation

The installation system of ACP as external cladding with tray type (rout and return) panels and sealing joint is one of the most common method and it is available for a wide range of new buildings and renovation projects. The ACP sheet under this system is first fixed on the substructure i.e. of steel members/RCC structures/brick walls with the help of base aluminium member frame work using necessary clamps, brackets, anchor fasteners, stainless screws, nuts and bolts, weather silicon sealant backer rods etc. as per approved design & drawing at all height and elevation which include all labours, materials, equipment's, handling, transportation, workmanship, design & preparation of working drawings, staging, scaffolding etc. all complete as per specification, drawings and instructions of the Engineer-in-Charge.

Frames:

Providing and fixing Aluminium extruded members (Box Tube) designed to with stand design wind pressure and movement as specified as continuous member for cladding the Aluminium Composite Panel. Aluminium member shall be fixed into masonry wall / RCC member / steel structures with brackets / clamps and it shall be of chromicised finish aluminium. All fastening straps, nuts & bolts, rivets, washers/other fastening materials shall be of nonmagnetic stainless steel and aluminium brackets shall be considered for ACP cladding with standard dimension and after the site survey if any undulation is observed intern that doesn't allow to fix the aluminium bracket only in these areas the additional support with locally fabricated hot dip galvanized bracket can be considered. The bidder shall include the provision for these brackets also with in the quoted rate for ACP cladding works. Aluminium shim shall be used for level adjustment of bracket but more than 20 mm is not acceptable. If more than 20 mm, bracket shall be designed according to site condition.

Aluminium brackets / clamps shall be fixed with chemical injection technique threaded anchor rods of approved make to the base structure in the case of masonry wall / RCC members and SS anchor bolts in the case of steel structure. Extruded member shall be designed to accommodate laminated sandwiched composite panel as per the approved shop drawings and extruded aluminium member shall be 6063 T6 or 63400 (H9) grade conforming to BS 1467 or IS 8147, finished with transparent electrolytic colour anodic coating AC15 grade conforming to IS 1868.

Composite Panel: Aluminium composite panel cladding of approved make as specified in BOQ to be fixed on the framing system described above. Lamination process of Aluminium panel shall only be glue technology and the source of complete composite panel shall only be accepted.

The Laminated sandwiched composite panel suitably stiffened internally on the back side for preventing deformation due to design wind pressure beyond permissible limits by using aluminium flat 25 mm wide, 4 mm thick gloved with double adhesive tape in order to maintain panel flatness and to avoid permanent deformation over a period. Stiffener shall be provided at 600 mm c/c behind ACP panel irrespective of structural check of the panel against stability and deflection. Aluminium flat of size 25 mm wide and 3 mm thick shall be provided to a length 100 mm bent to shape, wherever the inner skin is cut to bend the ACP at the corners and as per approved shop drawing. Methodology of fixing the stiffener/flat in the corner panel shall

be established in the drawing or to be glued to ACP on the backside of the panel in such a way the fixing mechanism of stiffener / flat shall not be visible on the elevation of the panel / outside.

Sealing:

After fixing the ACP on the sub structure, then a suitable sealing materials i.e. Non structural weather silicon sealant/Non staining sealant filled to the joints of panel with baker rod of approved make to ensure water tightness to the panel. Sealing shall be carried out with Non-structural (weather) sealant / Non staining sealant with PE baker rods, wherever the system is interfacing with glazing, cladding groove and any other groove.

Flashing:

Fixing flashing at terrace level as part of the system made to profile as shown in the approved shop drawings and the profile shall be made out of hot dip galvanized sheet 1.2 mm thick and galvanizing coating thickness shall be in accordance with IS 2629 & 4759. In general, the flashing shall be provided to the entire length of cladding horizontally at terrace level with necessary anchoring system with SS fastening devices of approved make. Also, the flashing shall be provided at parapet top below the coping to drain the water during any seepage through the sealant joints with overlap of 100 to 125 mm in plan with sealant at joints to make sure that no water leakage through coping / flashing joints.

Field Test:

Conduct field test at site on the installed system as per the criteria set out in the particular specification in the presence of Engineer in charge. Methodology for carrying out the test shall be submitted to Engineer-in Charge for approval prior to testing. Record the results and submit the report to the Engineer-in Charge for approval. If Field test fails, correct the defects revealed to
the satisfaction of the performance data as set out in the technical specification with the prior approval of Engineer-in Charge on defects rectification methodology.

General Guideline:

System design in total, including Aluminium extruded member, type & thickness of Aluminium composite panel, Aluminium sleeves at connections, inserts, Sealant, Supporting system/bracket including fastening and anchoring system & materials specified in the schedule and the system details as shown in the tender drawing are only tentative and is meant to set out a general outline of the proprietary system. Since the cladding system in terms of design, materials, all fixing details, methodology of execution are proprietary in nature, the onus of the design and performance requirements, shop drawing, execution etc. satisfying the design intent, particular specification and site conditions lies solely with the Contractor.

Precautions

1. Do unpacking and repacking of ACP sheet work in a clean place.
2. Remove dust and chips from ACP sheet and the packing paper.
3. Handle ACP sheet on a worktable. Do not handle it on the floor.
4. ACP sheets should always be handled by two people with external face upward to avoid Possible rubbing of the ACP surface during handling.

5. Prior to fabrication, clean off the worktable, temporary stand and both side of ACP sheet.
6. Ensure that cutting chips generated from saws, routers and drills are completely removed From the interface between ACP sheet and tools.
7. The arrow should be followed as marked on the rear (back) face coil/ sheet to avoid the Variation in colour.
8. Protective film of 75 microns should be removed within 45 days after the installation.
9. Do not use adhesive tapes made of PVC (Polyvinyl Chloride) on the surface of protective Film or any time during storage, fabrication or installation.
10. Aluminium composite material (ACM) manufacturer shall provide warranty of ten years for Any manufacturing defects.

Measurements

For the purpose of payment, only the actual area on the external face of the curtain wall with Aluminium Composite Panel cladding (including width of groove) shall be measured in square meters up to two places of decimal.

Rate

The rate includes the cost of all materials, labour, equipment's, design, shop drawing, fabricating, installation and fixing in position the curtain wall with Aluminium composite panels cladding for all height and all level etc. in all the operation described above and any other stipulations in the particular specification and agreement. Also, includes the cost of scaffolding, infrastructure facility and all other consumables to execute the work as specified above.

The cost of all mock-ups at site, testing charges, cost of all sample of the individual components For testing in an approved laboratories, field test on the assembled working curtain wall with aluminium composite panel's claddings, cleaning and protection of the curtain wall with aluminium composite panel claddings till the handing over of the building for occupation. Base aluminum members frame work for ACP cladding is payable under the relevant aluminum items.

Item No.- 18

Cement sheet :

Providing and fixing panelling & Flooring as per design drawing, cladded with first quality 12mm thk. cement sheet, using first quality hardware. made of 2 MM thick Aluminium tube frame The sections are placed @ 600 x 600 MM C/C both ways and additionally at openings or ends as required. Sections are joined by Aluminium angle cleats and the frame is fixed to wall, floor with suitable aluminium angles and fastened with steel screws.Frame size 50 x 50 MM with 12 MM thick cement sheet. panelling work should be carried out as per detail drawings and as per the instructions given by the architect. Rate of panelling shall be inclusive of out in order to execute the aforesaid item to the satisfaction of the architect / EIC. The rate shall be for complete item inclusive of all material, labor, wastages, necessary tools & tackles, adhesives, consumable hardware. (heritage gallery, lift lobby, reception & waiting area and other area.

2. Materials

2.1 Cement Sheet

- **Thickness**: 12mm
- **Quality**: First-quality, weather-resistant, and fire-resistant cement sheet.
- **Finish**: Smooth surface, ready for finishing or painting as required.
- **Standards**: Cement sheets must comply with relevant IS standards for durability and performance.

2.2 Aluminum Frame

- **Material**: Aluminum, conforming to **IS 733** for structural aluminum extrusions.
- **Thickness**: 2mm, ensuring durability and resistance to corrosion.
- **Dimensions**: 50x50mm square sections.
- **Spacing**: Sections placed at **600mm x 600mm center-to-center** in both directions. Additional sections are required around openings, edges, and ends to maintain structural integrity.

2.3 Fasteners and Hardware

- **Screws**: Corrosion-resistant steel screws meeting **IS 1367** standards.
- **Cleats and Angles**: Aluminum angle cleats and angles for frame assembly and wall/floor attachment, as per IS standards.

3. Installation Process

3.1 Frame Assembly and Installation

- **Grid Layout**: Assemble the aluminum frame in a grid pattern, maintaining 600x600mm spacing.
- **Reinforcement**: Add sections as required at all openings and edges for stability.
- **Anchoring**: Fix the aluminum frame to walls and floors using **suitable aluminum angles** and **steel screws** at intervals (300mm-400mm) to ensure stability, as per design specifications.

3.2 Cladding Installation

- **Fixing Cement Sheets**: Attach 12mm thick cement sheets to the aluminum frame with corrosion-resistant steel screws or mechanical fasteners spaced every **200mm**.
- **Expansion Joints**: Provide **3-5mm expansion gaps** between sheets to accommodate thermal movement. Seal the gaps with appropriate sealant for durability.
- **Finishing**: Ensure a smooth and flush finish on all surfaces, ready for paint or further treatment as required by the design.

3.3 Quality and Compliance

- Install paneling and flooring in compliance with all relevant building codes, IS standards, and architectural drawings.
- Ensure stability, alignment, and smooth finishes on all surfaces.

4. Testing and Quality Assurance

- Material Certification: Contractors must provide manufacturer certifications for all materials, including cement sheets, aluminum frames, and fasteners.
- Inspection: On-site inspections will be conducted to ensure alignment, secure attachment, and structural stability of the frames and cement sheets.
- Load Testing: Perform random load tests to verify frame stability in high-traffic areas like the lift lobby and reception.

5. General Terms

- Workmanship: The paneling work should be executed to the complete satisfaction of the Architect/Engineer-in-Charge.
- Inclusions in Rate: The rate should be inclusive of all materials, labor, waste disposal, tools, adhesives, consumables, and hardware necessary for completing the work.

Mode of Measurement:
The rate shall be measured a unit of square meter. No wastage shall be paid. The unit rate includes the cost of transportation, labour, material, and installation.

Item No.- 19
Providing and fixing openable window comprising anodized extruded aluminium frame with sliding or casement shutters, transparent bronze-coloured tinted float glass, and powder-coated aluminium fittings and fixtures. The glass shall be fixed into the frame using transparent silicone sealant to ensure a secure and weather-tight bond. The window shall include all necessary fittings, accessories, and hardware such as handles, locks, hinges, and any other required components for smooth operation. The installation shall be carried out as per the architectural details and as directed by the Engineer-in-charge.

General:
Dimensions:
Figured dimensions are in all cases to be accepted in preference to scaled sizes. Large scale details take precedence over small scale drawings. In case of discrepancy the Contractor shall ask for clarification before proceeding with the work.

Access for inspection:
The Contractor is to provide at all times during the progress of the works and the maintenance period proper means of access, with ladders, gangways etc. and the necessary attendance to move and adapt as directed for the inspection or measurement of the works by the Architects or their representatives.

Shed for materials:

The Contractor shall provide for all necessary sheds of adequate dimension for storage and protection of materials including tools and equipment which are likely to deteriorate by the action of Sun, Wind, Rain or other natural causes due to exposure in the open. The safe custody of the materials shall be the

sole responsibility of the Contractor. All such sheds shall be cleared away and the whole area left in good order in completion of the contract to the satisfaction of the Architects or Engineer-in-charge.

Cost of transporting:

The Contractor shall allow in his cost for all transporting, unloading, stacking and storing of supplies of goods and materials for this work on the Site and in the places approved from time to time by the Architect of Engineer-in-charge. The Contractor shall allow in his price for transport of all materials controlled or otherwise to the Site.

Materials, workmanship & samples:

Materials shall be of approved quality and the best of their kind available and shall generally conform to I.S. specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on Site well ahead of requirement for use in the work. The work involved calls for high standard of workmanship combined with speed and to the entire satisfaction of the Architects or Engineer-in-charge.

Foreman and tradesman:

All tradesmen shall be experienced men properly equipped with suitable tools for carrying out the work in a first class manner and where the Architects deem necessary, the Contractor shall provide any such tools, special or ordinary, which are considered necessary for carrying out of the work in a proper manner. All such tradesman shall work under an experienced and properly trained Foreman, who shall be capable of reading and understanding all drawings, pertaining to the work. On completion the Contractor shall clean all the surrounding area of work to the satisfaction of the Architects.

Protection:

The Contractor shall protect all doors, windows, curtain wall glazing, etc. work throughout the duration of work until completion.

Preparation of building for occupation and use on completion:

The whole of the work shall be thoroughly inspected by the Contractor and all deficiencies and defects put right. On completion of such inspection, the Contractor shall inform the Architects or Engineer – in - charge in writing that he has finished the work and it is ready for the Architect's inspection.

Rates to include:

The rates quoted shall be for all heights, levels and depths and for finished work.

Testing of work and materials:

The Contractors shall if required by the Architects or Engineer – in - charge, arrange to test materials and or portions of the works at his own cost in order to prove their soundness and

efficiency. If after any such test the work or portion of works is found in the opinion of the Architects to be defective / Un sound, the Contractor shall pull down and redo the same at his own cost. Defective materials shall immediately be removed from the Site.

Guarantee bond:

The Contractor shall have to give a guarantee bond, for Powder Coating / anodizing, on appropriate Stamp paper for a period of 10 years. In this period he shall attend to and rectify all complaints without causing any inconvenience to the Owners/Client. The form of Guarantee Bond shall be as prescribed below:

"I/We ..... (Contractor) hereby guarantee that work shall remain unaffected and shall not be

in any way damaged by atmospheric conditions, for a period of 10 years after the completion of

the work of Powder Coating / anodizing the aluminum doors as per the terms and conditions of the Contract and guarantees to redo the affected work without claiming any extra cost."

Approved make selected glass (clear / frosted) / wired glass /Reflective glass / Double glazed unit of specified thickness as mentioned in the drawings/ manufacturer's specification shall be used in doors. Wired glass / frosted glass/Clear glass louvers shall be provided wherever shown in the drawings after grinding the edges.

The rates shall also be inclusive of providing and applying neutral grade silicone sealant of approved make weather or structural with ordinary gun or compressed air operated gun as per the requirement and making the joints around aluminum doors, windows curtain wall glazing etc. watertight, on the external periphery of the building at the junction of two different materials as directed by the Architect and site engineer.

The Contractor shall have to give a guarantee bond, for water tightness of exterior door window, on appropriate Stamp paper for a period of 10 years. In this period he shall attend to and rectify all complaints without causing any inconvenience to the Owners/Client. The form of Guarantee Bond shall be as prescribed below:

b. "I/We ..... (Contractor) hereby guarantee that work shall remain unaffected and shall not

be in any way damaged by atmospheric conditions, for a period of 10 years after the completion of the work of applying sealant and making the joints around aluminum doors watertight, on the external periphery of the building at the junction of two different materials as per the terms and conditions of the Contract and guarantees to redo the affected work without claiming any extra cost."

Necessary provision for rain water disposal shall be done in the bottom guides/frames as directed and approved by Architect. Offer must be in accordance with tender drawings with dimensions of aluminum sections in frames and shutters as shown in drawing. It shall be accompanied by the detailed drawing if any deviation is proposed. The quantities are provisional and may vary to any extent. No claim will be entertained on this account for any reason.

Double action hydraulic floor springs of approved make with minimum one year guarantee.

a. The Contractor shall have to give a guarantee bond, for the Hydraulic floor springs, on appropriate Stamp paper for a period of 1 year. In this period he shall attend to and rectify all complaints without causing any inconvenience to the Owners/Client. The form of Guarantee Bond shall be as prescribed below:

b. "I/We ..... (Contractor) hereby guarantee that the floor springs shall remain unaffected and

shall not be in any way damaged by normal usage, pulls and pushes, for a period of 1 year after the completion of the work of supplying & fixing the Hydraulic Floor Springs to aluminum doors as per the terms and conditions of the Contract and guarantees to redo the affected work without claiming any extra cost."

Details/arrangements for after sales/maintenance services shall be furnished.

Work shall be carried out in co-operation and in coordination with all other agencies working at Site. The civil work, making cut in flooring, grouting as required for fixing of floor springs, hold fast or other works required for the erection and completion of doors/windows etc. shall be done by the Contractor without any extra cost. Any damage, if caused to the existing work done by other agencies, shall be reinstated by the Contractor to its original condition without any extra cost. During the course of work, the Contractor shall pay due care to avoid any stains on the powder coating/anodizing work and if required, the Contractors shall provide necessary protective arrangement as directed by the Architects for which no extra payments shall be made. After the installation is completed, if required by the Architects, the aluminum work shall be washed with mild solution of non-alkali soap and water .The Contractor shall be responsible for the windows/doors/curtain wall glazing/grills/louvers etc. being set straight, in plumb level and for their satisfactory operations after the fixing is completed.

Wherever required and as directed strengthening of members shall be done by providing steel/M.S. concealed members without extra cost. Hydraulic door closer of approved make with minimum one year guarantee as and where shown in the drawings and as directed.

a. The Contractor shall have to give a guarantee bond, for the Hydraulic door closer, on appropriate Stamp paper for a period of 1 year. In this period he shall attend to and rectify all complaints without causing any inconvenience to the Owners/Client. The form of Guarantee Bond shall be as prescribed below:

b. "I/We ..... (Contractor) hereby guarantee that the hydraulic door closers shall remain unaffected and shall not be in any way damaged by normal usage, pulls and pushes, for a period of 1 year after the completion of the work of supplying & fixing the Hydraulic Door Closers to aluminum doors as per the terms and conditions of the contract and guarantees to redo the affected work without claiming any extra cost.".

Material:

Aluminum Sections:

All Aluminum sections shall confirm to IS-733, IS737 & IS-1285 of appropriate / required shape & size. Alloy shall be 6036 T5 or T6 or equivalent. Sections shall be either conventional or Euro profile as approved by Architect. Aluminum sections used for fixed / openable windows, ventilators, partitions, frame work & doors etc. shall be suitable for use to meet architectural designs to relevant works and shall be subject to approval of the Engineer-in-Charge for technical, structural, functional and visual considerations. The aluminum extruded sections shall conform to IS 733 and IS 1285 for chemical composition and mechanical properties. The stainless steel screws shall be of grade AISI 304.The permissible dimensional tolerances of the extruded sections shall be as per IS 6477 and shall be such as not to impair the proper and smooth functioning/operation and appearance of door and windows. Aluminum glazed doors, windows etc. shall be of sizes, sections and details as shown in the drawings.

The details shown in the drawings may be varied slightly to suit the standards adopted by the manufacturers of the aluminum work, with the approval of Engineer-in-Charge. Before proceeding with any fabrication work, the contractor shall prepare and submit, complete fabrication and installation drawings for each type of glazing doors, windows, ventilators and partition etc. for the approval of the Engineer-in-Charge. If the sections are varied, the contractor shall obtain prior approval of Engineer-in- Charge and nothing extra shall be paid on this account.

Anodizing/powder coating:

Powder coating:

All the internal door windows surface shall have powder coating finish of 50-60 micron thickness of approved shade and external visible surface with minimum 35 micron PVDF finish. The non-visible aluminum surfaces shall have minimum achromatizing treatment.

Color anodizing:

Surfaces of all aluminum sections shall have 15 to 20 micron color anodizing of approved shade and manufacturer. Standard aluminum extrusion sections are manufactured in various sizes and shapes in wide range of solid and hollow profiles with different functional shapes for architectural, structural glazing, curtain walls, doors, window & ventilators and various other purposes. The anodizing of these products is required to be done before the fabrication work by anodizing/electro coating plants which ensures uniform coating in uniform colour and shades. The extrusions are anodized up to 30 micron in different colours. The anodized extrusions are tested regularly under strict quality control adhering to Indian Standard.

PANELING MATERIAL:

Pre-laminated Particle Board as per M-40 & as per relevant IS Glass should be as per Specification M-38 and as per IS relevant specification to be adopted. All gaskets used shall be 100% EPDM / siliconised rubbers gaskets of approved color & shape for long life guarantee. The EPDM Gaskets shall be of size and profile as shown in drawings and as called for, to render the glazing, doors, windows, ventilators etc. air and water tight. Samples of gaskets shall be submitted for approval and the EPDM gasket approved by Engineer-in-Charge shall only be used. The contractor shall submit documentary proof of using the above material in the work to the entire satisfaction of Engineer in-Charge. The EPDM gasket shall meet the requirements as given below:

Sl. No	*Description*	*Standard*	*Follow Specification*
1	Tensile strength Kg.f/cm2	ASTM-D 412	70 Min.
2	Elongation at break %	ASTM-D 412	250 Min
3	Modulus 100% Kgf/cm2	ASTM-D 412	22 Min.
4	Compression set % at 0o CC 22 Hrs	ASTM-D . 395	450 Max.
5	Ozone resistance	ASTM-D 1149	No visible cracks

SEALANT:

The sealants of approved grade and colour shall only be used. The silicone for perimeter joints (between Aluminum section and RCC/Stone masonry) shall be of make approved by the Engineer in Charge.

Operable louvers:

Providing and fixing fixed Aluminum louvers of Jindal or equivalent & operable louvers of wherever required as per design & drawings. The depth of aluminum section shall not be less than 40 mm. The corner joints of frame shall be made at 45 degree using die-cast aluminum corner cleats fixed with external buttons with a spring for rapid and secure joint assembly. Louver Opening Adjuster shall be operated in 30, 45 and 60 degree and shall be lockable from inside the building. Necessary operating device (as approved) for operation of louvers of windows, ventilators, sky lights, including necessary rods shall be provided as per supplier's specifications. Aluminum extruded sections (anodized or power coated) are used for providing Louvers in aluminum door, window & partition for ventilation. Providing and fixing 1 mm thick laminate on both side of non-decorative flush door wherever mentioned in the items. The rate shall be including in the door items. No separate payment should be made for this work.
Hardware: - All samples of hardware shall be subject to approval of EIC / Architect. Following type of hardware shall be used as mentioned in the Drawings. Hydraulic floor spring, Dead lock of Godrej (7 lever) Pin cylindrical concealed mortise lock (7") with mortise pin cylinder 22 mm diameter SS 316 satin (brush) finish push-pull handles of various dia.(simple or offset type) 150 mm length 22 mm diameter SS 316 satin finish D type mortice lever handles (without lock body) 200 mm satin nickel finish brass or SS 316 brush finish tower bolt. Heavy duty hinges 100 mm rod handles 75 mm S.S. 316 satin finish baby latch with indication of occupancy (flat/round) 75 - 100 mm white PVC door buffer 5" S.S 316 satin finish hinges

Workmanship:

Contractor shall submit shop drawings in hard and soft copies for all the doors and windows explaining complete system and technical details based on Architectural tender drawing for Architect's approval. Contractor shall also incorporate all comments and resubmit revised shop drawings for approval before execution. Prior approval from Architect shall be required before procurement of each section and hardware. The sizes of the opening mentioned in the Architectural drawings are indicative only. Actual finished opening sizes at site shall be measured and checked. Contractor shall get approval of engineer in charge for the variation in sizes before fabrication,

DOOR, WINDOW, VENTILATOR, GLAZING AND PARTITION ETC,

First of all the shop drawings for each type of doors/windows/ventilators etc. shall be prepared by using suitable sections based on architectural drawings, adequate to meet the requirement/ specifications and by taking into consideration varying profiles of aluminum sections being extruded by approved manufacturers. The shop drawings shall show full size sections of glazed doors, windows, ventilators etc. The shop drawings shall also show the details of fittings and joints. Before start of the work, all the shop drawings shall be got approved from the Engineer-in- Charge. Actual measurement of openings left at site for different type of door/window etc. shall be taken. The fabrication of the individual door/windows/ventilators etc. shall be done as per the actual sizes of the opening left at site. The frames shall be truly rectangular and flat with regular shape corners fabricated to true right angles. The frames shall be fabricated out

of section which have been cut to length, mitered and jointed

mechanically using appropriate machines. Mitered joints shall be corner crimped or fixed with self-tapping stainless steel screws using extruded aluminum cleats of required length and profile. All aluminum work shall provide for replacing damaged/broken glass panes without having to remove or damage any member of exterior finishing material.

Fixing of Frames:

The holes in concrete/masonry/wood/ Granite stone or any other members for fixing anchor bolts/Fasteners/screws shall be drilled with an appropriate electric drill. Windows / doors/ventilators etc. shall be placed in correct final position in the opening and fixed to Sal wood backing using stainless steel screws of star headed, counter sunk and matching size groove of required size at spacing not more than 250 mm c/c or dash fastener. All joints shall be sealed with approved silicone sealants. In the case of composite windows and doors, the different units are to be assembled first. The assembled composite units shall be checked for line, level and plumb before final fixing is done. Engineer-in-Charge in his sole discretion may allow the units to be assembled in their final location if the situation so warrants. Snap beadings and EPDM gasket shall be fixed as per the detail shown in the shop drawings. Where aluminum comes into contact with stone masonry, brick work, concrete, plaster or dissimilar metal, it shall be coated with an approved insulation lacquer, paint or plastic tape to ensure that electrochemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion. The contractor shall be responsible for the doors, windows etc. being set straight, plumb, level and for their satisfactory operation after fixing is complete. Frame shall be fixed by using anchor fasteners with average 6 to 10mm teak wood/water proof marine ply as per IS 710 as a continuous packing between wall and frame, width of such continuous packing should be approx 10 mm less than the width of the relevant aluminum section .Groove, 8mm deep, thus created shall be filled with approved color polyethylene baker rod of required size and colour. Glazed & metal silicon sealant (neutral cure) of approved colour and make at all sides / perimeter shall be filled with minimum 10 mm width and depth of 6 mm. Proper care shall be taken during filling of sealant by providing protecting tape on either side of filling gap.

DOOR, WINDOWS AND VENTILATOR SHUTTERS:

Screws threads of machine screws used in the fabrication of aluminum doors, windows and ventilators shall conform to IS 1362.

Side-hung Shutters:

For fixing aluminum alloy hinges, slots shall be cut in the fixed frame and the hinges inserted inside and may be riveted to the frame. The hinges shall normally be of the projecting type 67 mm wide the aluminum alloy for cast hinges shall conform to IS Designation A-5-M of IS 617. Specification for Aluminum and Aluminum Alloy Ingots and Castings for General Engineering Purpose and for extruded section of hinges to IS Designation HE10-WP or HE30-WP of IS 733. The pins for hinges shall be of stainless steel of non-magnetic type or aluminum alloy HR30. Irrespective of hinges being anodized or not, the aluminum alloy pins shall be anodized to a minimum film thickness of 0.025 mm shall be sealed with oil, wax or lanolin. Non- projecting types of hinges may also be used where ever required. Frictions hinges may be provided for side- hung shutter windows, in which case peg stay may not be required. The working principle

of the friction hinges is shown in approved drawings. The handle for side-hung shutters shall be of cast aluminum conforming to IS Designation A-5-M of IS 617 and mounted on a handle plate

welded or riveted to the opening frame in such a way that it could be fixed before the shutter is glazed.

The handle should have anodized finish with minimum anodic film Thickness of 0.015 mm. The handle shall have a two point's nose which shall engage with an aluminum striking plate on the fixed frame in a slightly open position as well as in a fast position. The height of the handles in each type of side-hung shutters shall be fixed in approximate position as per approve Drawings indicated in Fig. 21.16.

Top-Hung Ventilators:

The aluminum hinges for top-hung ventilators shall be either cast or fabricated out of extruded sections and shall be riveted to the fixed rail after cutting a slot in it. The aluminum alloy for cast hinges shall conform to IS Designation A-5-M of IS 617 and the extruded section of hinge to IS Designation HE10-WP or HE30_WP of IS 733The pegs stay shall be 300 mm long as in side-hung shutter (Fig. 21.17). The locking bracket shall be fixed to the fixed frame.

Centre-Hung Ventilators:

Centre hung ventilators shall be hung on two pairs of cup pivots of aluminum alloy to IS Designation NS-4 of IS 737 and IS Designation A-5-M of IS 617 or on brass or bronze cup pivots which should be either chromium or cadmium plated and riveted to the inner and outer frames of the ventilators to permit the ventilator to swing through an angle of approximately 85º. The opening portion of the ventilator shall be so balanced that it remains open at any desired angle under normal weather condition. Cast aluminum conforming to IS Designation A-5-M of IS 617 or bronze which shall be either chromium plated or cadmium-plated spring catch shall be fitted in the centre of the top bar of the ventilators for the operation of the ventilator. This spring catch shall be secured to the frame and shall close into aluminum catch plate riveted or welded to the outside of the outer ventilator frame bar

Finish:

Aluminum doors, windows and ventilators may be supplied in either matt, scratch-brush or polished finish. They may, additionally, also be anodized, if so required by the Engineer-in-charge. If colour anodizing is to be done then only approved light-fast shades should be used.

A thick layer of clear transparent lacquer based on methacrylates or cellulose butyrate, shall be applied on aluminum doors, windows and ventilators by the supplier to protect the surface from wet cement during installation. This lacquer coating shall be removed after installation is completed.

Glazing:

Glazing shall be provided on the outside of the frames If required; glazing clips may be provided as extra fittings. Four glazing clips may be provided per glass pane, except for door type 8HS21 where the glazing clips shall be six per glass pane. In case of doors, windows and ventilators

without horizontal glazing bars the glazing clips shall be spaced according to the slots in the vertical members, otherwise the spacing shall be 30 cm.Note: Glazing clips are not usually provided for normal size glass panes. Where large size glass panes are required to be used or where the door or the window is located in heavily exposed situation, holes for glazing clips have to be drilled prior to fabrication and cannot be done at any later stage. Use of glazing clips, where necessary, shall be specified while placing the order. For fixed glazing the glass shall be encased in PVC channel so as to avoid metal to glass contact.

Packing:

All doors, windows and ventilators shall be dispatched with the opening parts suitably secured to preserve alignment when fixing and glazing. Fixing lugs, coupling fittings and all hardware shall be dispatched separately. Composite windows shall be dispatched uncoupled.

FITTINGS:

Stainless Steel Friction Stay:

The stainless steel friction stays of make approved by the Engineer-in-Charge shall be used. The SS friction stays shall be of grade AISI-304 and of sizes specified in nomenclature of item.

Lockable Handles:

The lockable handle shall be of make approved by the Engineer-in-Charge and of required colour to match the colour of powder coated /anodized aluminium window sections

Hydraulic Floor Spring:

The hydraulic floor spring shall be heavy duty double action floor spring of make approved by the Engineer-in-Charge suitable for door leaf of weight minimum 100 kg. The top cover plate shall be of stainless steel, flushing with floor finish level. The contractor shall cut the floor properly with stone cutting machine to exact size & shape. The spindle of suitable length to accommodate the floor finish shall be used. The contractor shall give the guarantee duly supported by the company for proper functioning of floor spring at least for 10 years.

Tubular Handle:

The tubular handle bar shall be aluminum polyester powder coated minimum 50 micron to require colour/anodized AC 15. Outer dia of tube shall be 32 mm, tube thickness 3.0 mm and center to center length 2115 mm + 5 mm.

Tower Bolts:

Tower bolts may be of one of the following types:

Brass barrel tower bolt with cast brass barrel and rolled or drawn brass bolt. Brass barrel tower bolt with brass sheet barrel and rolled or drawn brass bolt. Anodized aluminum barrel tower bolt with barrel and bolt of extruded Sections of aluminum alloy (10/12mm dia. shoot).

Floor door stopper:

This shall be made of cast brass or anodized aluminum and shall have a rubber cushion. The type and pattern shall be as approved by the Client/Consultant.

Hooks and Eyes:

These shall be of hard drawn brass or steel and shall generally conform to IS: 207.

Mortise Lock:

Mortise lock with latch and pair of lever handles shall have steel or brass casing and brass bolts and shall be right or left handed as shown in the drawing or as directed by the Client/Consultant. It shall be of the approved quality and shall conform to IS; 2209. The shape and pattern shall be approved by the Client/Consultant. The size of the lock shall be determined by its length. The lock for single leaf door

shall have plain face and that for double leaf door shall have a rebated face. Lever handles with springs shall be mounted on plates and shall weigh not less than 0.5 kg per pair. These shall be of brass, finished bright chromium plated or oxidized.

Door latch:

These shall be mild steel, brass or as specified and shall be capable of smooth sliding action.

Door handles:

These shall be cast brass or MS or aluminum of specified size and of the shape and pattern as approved by Client/Consultant. These shall generally conform to IS;208. The size of the handle shall be determined by the inside grip of the handle. Door handles shall be of 100 mm size and window handles of 75 mm size unless otherwise specified. These shall be fixed with 25mm long screws. For Sliding Window Shutter shall be provided with two ball bearing rollers and 2 anti-ratting pieces/guides one each at top and bottom and weather strip all around. All joints shall be mechanically jointed. Window shutters shall be provided with special locking arrangement. 5 mm thick toughened glass or as shown in drawing shall be fixed in the shutter by means of rubber gasket. Work shall be carried out to the best workmanship manner & through fabricator. Cutting of the members & making of key holes, lock holes, holes in sliding window handles, concealed stopper in sections etc. shall be done by machines. Actual on site measurement of shutter shall be measured and verified before ordering and installation. Dimensions mentioned in the drawing shall not be used for ordering / fabrication. The civil work as required for fixing of floor springs, hold fast or other works required for the erection and completion of doors/windows etc. shall be done by the Contractor without any extra cost. The Contractor shall be responsible for the windows/doors etc. being set straight, in plumb level and for their satisfactory operations after the fixing is completed. The work is to be carried out as per the best workmanship manner as per the approved shop drawing and as per the approved sample Even after approval of shop drawings and execution if the Architect / engineer in charge is not satisfied with the stability / steadiness of any doors-windows system or part of the doors- windows system, contractor shall rectify or replace the doors-windows system or part of the doors-windows system up to the satisfaction of the Architect / engineer in charge without any additional claim against the rectification or replacement complete.

Mode of Measurements and Payment:

All visible anodized or powder coated aluminum Compacted Component item sections only shall be paid in Kilogram. Including all labour, Cost of powder coating/anodizing shall be inclusive in aluminum rate. Hardware accessories, paneling (particle board/Glazed), hardware as per item description. shall be measured separately in no or pair & paid in relevant tender item. In panels fill like glass, compact sheet, Particle board net shall be measured separately

for payment. Rate shall be inclusive of cost of material, wastage & labour involved in all the operations described in item description and protecting and cleaning up till taking over to client. Rates quoted shall be inclusive of all wastages of material, all other consumable hardware like screws (sheet metal for concealed / brass nickel plated or SS for open screws), anchor fasteners, 10 mm GI tie rod for door shutter making, heavy angle cleat 4 mm thick for conventional section / die cast spring loaded cleat for Euro sections, etc. as per the item description & shall not be measured separately &shall be inclusive in respective item. The rate shall be inclusive of excise duty, taxes, VAT, transport, insurance, storage and safe custody, etc. complete

Item No.- 20

Supplying & Fixing of Sinage board Representing Institute Name having font size at least 1500mm in height & 75mm embossed letter with LED, Top Black Boarder cover & Emboss colour 3000k backlit LED light made up of 4mm thick acraylic sheet of approved brand as per make in tender document shall be fixed on required size stand made up of alluminium heavy grade frame or M.S structure shall be used to back support the bord to Fix it on Back side MS With ACP Background, Hard Letter with illumeatd Bright light, Day & Night respectively like coloured Media to impart desired color DAY BLACK & NIGHT WHITE. AL return to attain desired color. Rate shall be inclusive of all material, tool, tackle and machinary with frame & electrical connection or fitting si that said letter should be glow at night time period shall be operted with necessay driver of LED light with RGB color shechme and light temp 3000k. Name to be prepared is "GUJARAT BIOTECHNOLOGY UNIVERSITY " as per Given Drawing

Signage Design and Material Specifications

Font and Letter Size:

Each letter should have a minimum height of 1500mm and be embossed to a depth of 75mm for clear readability.

Font style and size should adhere to the provided design specifications for uniformity.

Acrylic Sheet:

Letters to be crafted from 4mm thick high-grade acrylic sheets of an approved brand specified in the tender.

Acrylic should be UV-stabilized to prevent discoloration or degradation due to weather conditions.

Color and Finish:

The signage will utilize a day-night color effect, showing black during the day and white at night.

The lettering should be hard-wearing with 3000K backlit LED lighting, emitting a soft, warm glow that enhances visibility.

RAL color codes for day (black) and night (white) must be adhered to for consistency.

Lighting Specifications

LED Backlighting:

LED lights should be RGB-enabled with a 3000K color temperature, offering energy-efficient, long-lasting illumination.

Lights must be suitable for outdoor use, with an Ingress Protection (IP) rating of IP65 or higher for water and dust resistance.

LED drivers should be included and compatible with the RGB scheme to allow for color adjustments.

Brightness and Visibility:

Backlighting should be sufficient for clear readability from 200 meters at night, with controlled intensity to prevent glare.

Light diffusion should ensure even lighting across all letters without hotspots.

Power and Control:

Signage should operate on standard 220-240V AC power and include appropriate transformers and drivers.

Provision for remote or automatic dimming based on ambient light levels is preferred.

Structural Requirements

Frame Construction:

The supporting structure must be built using heavy-duty aluminum (grade 6061-T6) or MS steel to ensure stability.

Frame dimensions and section thicknesses should meet structural load requirements, ensuring no deformation due to wind or weight.

Weather-resistant coating (e.g., powder coating for aluminum or epoxy paint for MS) to prevent rust and corrosion.

ACP Backing Panel:

Use Aluminum Composite Panels (ACP) as the backing for the signage to provide a sleek, modern look.

ACP thickness should be at least 4mm, with a PVDF coating for UV protection.

Background color and finish should be as specified in the design, providing a high contrast for letter visibility.

Mounting and Anchoring:

Install a secure mounting system to withstand wind loads in accordance with IS:875 Part 3 (Wind Loads).

Use stainless steel fasteners and chemical anchors for stability.

Structural calculations and stability testing should be done to ensure compliance with safety standards.

Electrical and Installation Requirements

Wiring and Connections:

All electrical wiring should be of FRLS (Fire Retardant Low Smoke) grade and suitable for outdoor use.

Connectors, junction boxes, and other accessories should have an IP66 rating or higher.

Control Systems:

Include a driver compatible with RGB LEDs for color changes, along with necessary power supply units.

Provision for automatic switching or dimming of lights based on ambient lighting conditions.

Installation of a weatherproof control panel accessible for maintenance.

Testing and Commissioning:

Conduct pre-installation testing to ensure all LEDs and connections work as intended.

Post-installation tests for brightness, color accuracy, and power efficiency.

Provide full documentation of the control and driver systems, along with a maintenance manual.

Day-Night Color Transition (AL Return) Technology

Special Day-Night Material:

Use materials that offer a daytime black appearance and nighttime white illumination.

Acrylic sheets and LED configurations should support this dual effect without compromising visibility.

AL Return Edging:

Edges should be lined with **AL return edging** to achieve the color shift effect.

AL return materials should be of **high reflectivity** and suited to outdoor use, resistant to UV rays and other environmental factors.

Inclusions and Deliverables

Materials and Tools:

Tender cost to include all materials, tools, equipment, and labor required for the signage board.

Documentation and Certifications:

Provide certification of materials (especially LEDs and ACP) as per industry standards.

Electrical components should meet **IEC standards**.

Maintenance and Warranty:

Offer a **minimum of 3 years warranty** on LED lighting, acrylic material, and structural integrity.

Annual maintenance for cleaning and electrical checks included as part of the service contract.

Safety and Compliance Standards

All installations must comply with local building and electrical codes, including:

National Building Code (NBC) for structural stability.

IS:10322 (LED Luminaries Standards) for lighting quality.

IS:15961 (Aluminum Composite Panels) for ACP specifications.

IS:3043 (Earthing) for electrical safety.

Mode of Measurements

Item No.- 21

Designing, Providing, fixing, Dismentling & Removing MS scaffolding system (H-Frame/cup lock type) on the exterior side, for 18-Meter height made with 50 mm dia M.S. tube 1.5 m centre to centre, horizontal, vertical tubes & Cross Bracings joining with cup & lock system or H Frame with M.S. tubes, M.S. tube challies, M.S. clamps and M.S. staircase system in the scaffolding for working platform etc. and maintaining it in a serviceable condition for the required duration as approved and removing it there after .The scaffolding system shall be stiffened with bracings, runners, connection with the building etc wherever required for inspection of work at required locations with essential safety features for the workmen etc. complete as per directions and approval of Engineering-charge .The elevational area of the scaffolding shall be measured for payment purpose. The payment will be made once irrespective of duration of

scaffolding. (Bidder should submit scaffolding Design & Get approval from Structural engineer for the same)

Double Scaffolding: Where the joints in the masonry of heritage building are to be exposed by raking, manual or mechanical, double scaffolding system (cup & lock type/ H-Frame) shall be provided in the interior as well as exterior side of the building wherever it is feasible/ required to provide the scaffolding system. The scaffolding system shall be stiffened with bracings, runners, and connectors etc. to secure it to the building. Size of the members shall be dependent upon the height at which raking of the joints is to be done.

Raking of Joints

Proper working space/platform shall be provided to the workers by providing scaffolding (if required) so that raking of the joints could be done easily. The surface where raking of joints is to be done, shall be clearly marked with chalk or any other material, so that it can be easily distinguished.

Raking with hand tools like hammer and chisel shall be resorted to in case the location is not easily accessible for mechanical equipment's, sufficient power supply is not ensured or the area is too small to be economical for mechanical raking.

Raking of joints should progress from one end to other first raking the one horizontal joint at a time to the requisite depth as decided by the Engineer-in-Charge. Then next horizontal joint is taken up and so on. Once all horizontal joints are raked up vertical joints shall be raked from either ends. The raked joints are then cleaned by brushing and watering.

The debris/rubbish shall be collected in most professional manner and disposed of to the dumping ground up to 50metres lead or as per direction of the Engineer-in-Charge.

The whole process shall be considered complete if approved from the Engineer-in-Charge.

Mode of Measurements

1. Length and breadth shall be measured correct to a cm and its area shall be calculated in square metres up to two places of decimal.
2. For jambs, soffits, sills etc. for opening not exceeding 0.5 sqm each in area, ends of joists, beams, posts, girders, steps etc. not exceeding 0.5 sqm each in area and opening not exceeding 3 sqm each deductions and additions shall be made in the following way, in case of raking on external face only.

(a) No deduction shall be made for ends of joists, beams, posts etc. and openings not exceeding 0.5Sqm each, and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings.

(b) Deductions for openings exceeding 0.5 sqm but not exceeding 3 sqm each shall be made as follows and no additions shall be made for reveals, jambs, soffits, sills, etc. for these openings.

(c) When both the faces of the wall are raked deduction shall be made for one face only.

(d) When only one face is raked deduction shall be made from one side of frame for doors, windows, etc. on which the width of the reveal is less than that on the other side, but no deduction shall be made from the other side.
(e) Where width of reveals on both faces of wall is equal, deduction of 50% of area of opening on each face shall be made from the raked area.
(f) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each pointed face of wall.

3. In case of openings of area above 3 sqm each, deduction shall be made for the openings, but jambs, soffits and sills shall be measured.

Rates

The rate shall include the cost of all materials and labour/equipment's involved in all the operations described above except Scaffolding which if required and provided shall be paid for separately).