Section-7:

Technical Specifications

Table of Contents

Section-7:
Technical Specifications

PREAMBLE

1.0 The Technical Specifications contained herein shall be read in conjunction with the other Bidding Documents.

1.1 **Site Information General**

1.1.1 The site is situated at Neelbad Road, Bhauri Village, Bhopal . The natural ground condition of the site has good bearing capacity with hard rocky strata.

1.1.2 The area in which the works are located is in plain terrain, the approximate longitude and latitude of the region (Bhopal) being 77° 16" East and 23° 17" North.

1.1.3 **Climatic Conditions**

1.1.3.1 The temperature in this region is as under:

i) During summer months, the average maximum temperature is 42°C.

ii) During winter months, the average minimum temperature is 18°C.

1.1.3.2 The average annual rainfall in the area is of the order of 800mm.

1.1.4 **Seismic Zone**

The works are located in Seismic Zone-II as defined in IS: 1893(Part I) - 2002

2 GENERAL REQUIREMENTS

The Technical Specifications in accordance with which the entire work described hereinafter shall be constructed and completed by the Contractor shall comprise of the following:

Part-I
Additional conditions, additional specifications and important notes

"A" ADDITIONAL CONDITIONS

1. The work shall be carried out in accordance with the drawings to be issued by the Institute Architect.
2. The contractor shall maintain safe custody of materials brought to the site.
3. Some restrictions may be imposed by the security staff etc. on the working and / or movement of labour, materials etc. and the contractor shall be bound to follow all such restrictions/ instructions and nothing extra shall be payable on this account.
4. Labour will not be permitted to stay in the building under construction.
5. The contractor shall comply with proper and legal orders and directions of the local or public authority or municipality and abide by their rules and regulations and pay all fees and charges which he may be liable and nothing extra shall be payable on this account. The work shall be carried out without infringing on any of the local Municipal Bye-Laws.
6. Any damage done by the contractor to any existing work during the course of execution of work tendered for shall be made good by him at his own cost.
7. The rate for every item of work to be done under this contract shall be for all heights, depths, lengths and widths of the earthworks and nothing extra will be paid on this account.

8. The contractor shall take all precautions to avoid all accidents by exhibiting necessary caution boards such as day and night boards, speed limit boards and flags, red lights and providing barriers etc. He shall be responsible for all damages and accidents caused due to negligence on his part. No hindrance shall be caused to traffic during the execution of work. Nothing extra shall be paid on this account.
9. The contractor will work in close liaison, during the works, with other contractors of water supply, sanitary, drainage arrangements, electrical installation and any other works and adjust his work plan accordingly.
10. Other agencies doing work of electrification, external services, other building works, horticulture works etc for this project will also simultaneously execute the works and the contractor shall afford necessary facilities for the same. The contractor shall leave such necessary holes, opening etc for laying/buying in the work pipes, cables, conduits, clamps, boxes and hooks for fan clamps etc as may be required for the electric and sanitary works etc. and nothing extra over the agreement rates shall be paid for the same.
11. The contractor shall keep the site clear thoroughly of rubbish, useless scaffolding and materials etc. from time to time as well as before the actual date of completion of the work as per directions of the Dean (Planning & Development).
12. The contractor shall make his own arrangement for obtaining electric / water connections, if required and make necessary payment directly to the department concerned.
13. The contractor shall maintain in perfect condition all works executed till the completion of entire work allotted to him.
14. Materials brought at site of work shall not be used in the work before getting satisfactory test results. For details relevant provisions in C.P.W.D. Specifications for Works 2009 Vol. I to II shall be referred to.
15. The contractor shall maintain in perfect condition all works executed till the completion of entire work allotted to him.

Dean (Planning & Development)
Institute Works Department
SPA Bhopal

"B" ADDITIONAL SPECIFICATIONS

1. GENERAL

The entire work shall in general conform to the C.P.W.D. Specifications for works 2009 Vol. Ito Vol. II with correction slips issued up to date and description in the Schedule of quantities, additional conditions, particulars, specifications latest relevant Bureau of Indian Standard codes and the drawings.

All the above quoted documents shall be considered complementary to each other. However, in case of conflict among the various provisions, the following order of precedence shall be followed.

i) Provision in nomenclature of item in schedule of quantities, including drawings if any mentioned there in

ii) Additional Conditions.

iii) Particulars specifications

iv) CPWD Specifications.

v) Latest relevant B.I.S. codes.

vi) Drawings of the work not specifically mentioned in the nomenclature of the item and

vii) The decision of the Institute Architect given in writing based on sound engineering practice and local usage shall be final and binding on the contractor.

The work shall be executed and measured as per Metric Dimensions given in the schedule of quantities etc. (F.P.S. units wherever indicated are for guidance only).

1.1.1. Should there be any difference between the specifications mentioned above and the specifications given in the schedule of quantities, the later shall prevail.

1.1.2. If the specifications for any item are not available in the CPWD Specifications cited above, relevant BIS Specifications should be followed.

1.1.3. In case BIS Specifications are also not available, the decision of Institute Architect given in writing based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.

1.2. The work will be carried out in accordance with the architectural drawings and structural drawings to be issued by the Institute Architect. The structural and architectural drawings shall have to be properly correlated before executing the work.

1.2.1. Incase of any difference noticed between Architectural and Structural drawings, the contractor shall obtain final decision in writing of the Institute Architect.

1.2.2. In case of any discrepancy in the item given in the schedule of quantities appended with the tender and architectural drawings relating to the relevant item, former shall prevail unless otherwise given in writing by the Institute Architect

1.3. For items where so desired, samples shall be prepared before starting the particular items of work for prior approval of the Institute Architect and nothing extra shall be payable on this account.

1.4. Materials brought at site of work shall not be used in the work before getting satisfactory Mandatory test results. For details, relevant provisions in the CPWD specification shall be referred to.

1.4.1. Wherever it is desired to procure factory-made materials, such factory-made materials shall be procured from reputed and approved manufacturers or through their authorized dealers. The contractor shall obtain the approval from the Institute Architect of such firms prior to procurement of such factory-made materials. The Institute Architect may, at any stage, inspect such factories/ manufacturing units. The contractor shall have no claim if the factory made materials brought to the site are rejected by the Institute Architect in part or in full due to bad workmanship/ quality etc. even after the inspection of the manufacturing units.

1.4.2. The manufactured materials brought at site of work shall, in general, conform to the relevant specifications. The source for supply of the manufactured materials shall be approved by the Institute Architect. The contractor shall have no claim if the manufactured materials brought to the site are rejected by the Institute Architect in par tor in full due to bad workmanship/ quality etc.

1.4.3. The preference amongst the various alternative materials available shall be as follows: -

(a) The materials shall be as per the Brand specified to be used in the work.

(b) If the Brand specified material is not available then the material shall be ISI marked.
(c) If ISI marked item is not available then it should be from ISO certified Company.
(d) If the ISI marked or ISO certified items are not available then the best available items in the market to be procured.

1.4.4. Equivalents for the various materials and the materials of approved make shall be got approved from the Dean (Planning & Development) of work in writing before using them on the work.

PARTICULAR SPECIFICATIONS
&
SPECIAL CONDITIONS

1. GENERAL

1.1 Wherever any reference to any Indian Standard Specifications of BIS occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued there-to or revisions thereof, if any, up to the date of receipt of tenders.

1.2 The contractor shall work according to the programme of work as approved by the Dean (Planning & Development), for which purpose, the contractor shall submit a programme of the work within 15 days from the stipulated date of start of the work based on computer software such as MS Project etc. and shall update the same every fortnight.

The contractor shall submit monthly progress report of the work in a computerized form. The progress report shall contain the following, apart from whatever else may be required as specified :

(i) Project information, giving the broad features of the contract of the work under the contract, and the broad structural or other details.

(ii) Introduction, giving a brief scope of the work under the contract, and the broad structural or other details.

(iii) Construction schedule of the various components of the work through a bar chart for the next three quarters (or as may be specified), showing the milestones, targeted tasks and upto date progress.

(iv) Progress chart of the various components of the work that are planned and achieved, for the month as well as cumulative upto the month, with reasons for deviations, if any, in a tubular format.

(v) Plant and machinery statement, indicating those deployed in the work, and their working status.

(vi) Man-power statement, indicating individually the names of all the staff deployed in the work, along with their designations.

(vii) Financial statement, indicating the broad details of all the running account payments received upto date, such as gross value of work done, advances taken, recoveries effected, amounts withheld, net payments, details of cheque payments received, etc.

(viii) A statement showing the extra and substituted items submitted by the contractor, and the payments received against them, items pending for sanction/decision by the Department, broad details of the Bank Guarantees, indicating clearly their validity periods, broad details of the insurance policies taken by the contractor, if any, the advances received and adjusted.

(ix) Progress photographs, in colour, of the various items/components of the work done upto date, to indicate visually the actual progress of the work.

(x) Quality assurance and quality control tests conducted during the month, with the results thereof.

(xi) Videography at various stages of construction right from the day of start of work to date of completion/occupation, covering all major events, inspections, visits by dignitaries etc.

1.3 The contractor shall take instructions from the Dean (Planning & Development) for stacking of materials at site. No excavated earth or building materials shall be stacked on areas where the buildings, roads, services or compound walls are to be constructed.

1.4 If as per Municipal or prevailing rules of the secured campuses owned by paramilitary forces etc, the huts for labour are not to be erected at the site of work by the contractors, the contractors shall provide such accommodation at such locations as are acceptable to local bodies with all provisions concerning labour safety & sanitation as contained in the relevant clause of the contract, for which nothing shall be payable.

1.5 Unless otherwise provided in the Bill of Quantity, the rates tendered by the contractor shall be all inclusive and shall apply to all heights, lifts, leads and depths of the building and nothing shall be payable to him on this account.

1.6 The working drawings of conditions of contract shall mean to include both architectural and structural drawings respectively. The structural and architectural drawings shall be properly correlated before executing the work. In case of any difference noticed between architectural and structural drawings, final decision, in writing of the Institute Architect shall be obtained by the contractor before proceeding further.

1.7 Some restrictions may be imposed by the security staff etc. on the working and for movement of labour, materials etc. The contractor shall be bound to follow all such restriction / instructions including issue of identity cards to all persons authorized by him to do work / visit the work site and nothing shall be payable on this account.

1.8 The contractor shall make his own arrangements for obtaining electric connections, if required, and make necessary payments directly to the department concerned.

1.9 The contractor shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other contractor (s) or by the Institute Architect and shall as far as possible arrange his work and shall place and dispose off the materials being used or removed, so as not to interfere with the operations of other contractors, or he shall arrange his work with that of the others in an acceptable and coordinated manner and shall perform it in proper sequence to the complete satisfaction of Dean(Planning & Development). The contractor shall be responsible for any damage due to hindrance caused by him.

1.10 Cast iron pipes and fittings without ear shall be used. However, pipes and fittings with ears may be accepted without any extra payment. In such cases, clamps are not required and no extra payment shall be made for fixing the pipes in a different manner.

1.11 Any cement slurry added over base surface for bond or for continuation of concreting, for protecting reinforcement bars, its cost shall be deemed to have been included in the

respective items, unless specified otherwise and nothing extra shall be payable nor extra cement shall be considered in the cement consumption on this account.

1.12 Stacking of materials and excavated earth including its disposal shall be done as per the directions of the Dean (Planning & Development). Double handling of materials or excavated earth if required at any stage shall have to be done by the contractor at his own cost.

1.13 No claim for idle establishment & labour, machinery & equipments, tools & plants and the like, for any reason whatsoever, shall be admissible during the execution of work as well as after its completion.

1.14 Only Stainless Steel screws shall be used unless otherwise specified.

1.15 Work shall be carried out in professional manner with finished product serving the intended purpose with specified strength, durability and aesthetics.

1.16 Work activities shall be executed in well thought out sequences such that consequent activities not adversely affecting previously done work. Nothing extra shall be payable to protect the works already done.

1.17 The contractor shall prepare all the needed shop drawings well in advance and get them approved before placing the order and execution of the item.

ALUMINIUM WORK

1. Aluminium 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.
2. The aluminium extruded sections shall conform to IS 733 : 2008 and IS 1285 for chemical composition and mechanical properties. The stainless steel screws shall be of grade AISI 304.
3. 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.
4. Aluminium sheets for use as kick panels shall be 1.25 mm thick aluminium alloy sheet as per IS 1948 and sheet shall be as per IS 737 : 2008.
5. Aluminium alloy sheet for use in general paneling work shall be of types and thickness as specified and conforming to the requirement of IS 737 : 2008.
6. Aluminium sheets shall be of approved make and manufacturer. Aluminium panel may be prefabricated units manufactured on modular or non-modular dimension.
7. The float glass that conform to the IS 14900 : 2000.
8. Flat transparent sheet glass shall be as per IS 2835.
9. Prelaminated Particle Boards shall be as per IS 12823 :1990.

1 ALUMINIUM

1.1 Aluminum Sections

Aluminum sections used for partition, 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. 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.

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

1.2 Anodizing

Standard aluminum extrusion sections are available in various shape and sizes 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.

1.3 Powder Coating

1.4 Performance Requirements for the Finish

Surface appearance: The finish on significant surfaces shall show no scratches when illuminated and is examined at an oblique angle, no blisters, craters; pinholes or scratches shall be visible from a distance of about 1 m. There shall not be any visible variation in the colour of finished surfaces of different sections and between the colours of different surfaces of same section.

Adhesion: When a coated test piece is tested using a spacing of 2 mm between each of the six parallel cuts (the cut is made through the full depth of powder coating so that metal surface is visible) and a piece of adhesive tape, approximately 25 mm x 150 mm

approved by the Engineer-in-Charge is applied firmly to the cut area and then removed rapidly by pulling at right angles to the test area, no pieces of the finish other than debris from the cutting operation shall be removed from the surface of the finish.

1.5 Protection of Powder Coated I Anodizing Finish: It is mandatory that all aluminum members shall be wrapped with self adhesive non-staining PVC tape, approved by Engineer-in-Charge.

1.6 Measurement: All the aluminum sections including snap beading fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment. (Weight shall be taken after anodizing). The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts.

1.7 Rate: The rate shall include the cost of all the materials, labour involved in all the operations as described in nomenclature of item and particular specification-

2 PANELING MATERIAL

2.1 Pre-laminated Particle Board

A particles board laminated on both surfaces by synthetic resin impregnated base papers under heat and pressure. Pre-laminated particle boards shall be of two grades, Grade I and II corresponding to IS 3087 & 12823. Each of the grades specified shall be of four types, Types-l, II, III, and IV classified by the surface abrasion characteristics specified in Table 1. The grade and types of pre-laminated particle board shall be represented by symbols as follows:-

Grade	Type	Designation
Grade I	Type I Type II Type III Type IV	PLB-11 PLB-12 PLB-13 PLB-14
Grade II	Type I Type II Type III Type IV	PLB-21 PLB-22 PLB-23 PLB-24

TABLE 1.1 Physical and Mechanical Properties

S.N.	Properties	Flat Pressed Three Layer, Multilayer and Graded	
		Grade-l	Grade-II
i	Density variation (Max.) Percent	± 10	± 10
ii	Water absorption (Max)		

	(a)2 hours (b) 24 hours	7.0 15.0	15.0 30.0
iii	Thickness swelling (Max.), percent, 2 hours	5.0	8.0
iv	Modulus of rupture (Min) N/mm (a) Up to 20 mm thickness (b) Above 20 mm thickness	 15.0 12.5	 11.0 11.0
v	Tensile strength perpendicular to surface (Min.) N/m (a) Up to 20 mm thickness (b) Above 20 mm thickness	 0.45 0.40	 0.30 0.30
vi	Tensile strength perpendicular to surface (Min.) N/mm (a) After cyclic test* (b) After accelerated water resistance test**	 0.20 0.15	 ~~~~~~~~~~~~~~~~~~~~~~
vii	Screw withdrawal strength (Min.), N (a) Face (b) Edge	 1250 850	 1250 750
viii	Abrasion resistance (Min.) in number of revolutions (a) Type I (b) Type II (c) Type III	 450 250 80	 450 250 80

Note:- * Cyclic Test: Specimen are immersed in water at 27±2° C for a period of 72 hours, followed by drying in air at 27 ± 2° C for 24 hours and then heating in dry air at 70° C for 72 hours. Three such cycles are to be followed and then specimens are tested for tensile strength perpendicular to the surface.

** Accelerated Water Resistance Test: Specimens are immersed in water at 27±2° C and water is brought to boiling and kept at boiling temperature for two hours. Specimens are then cooled in water to 27±2° C and tested for tensile strength perpendicular to the surface.

(a) Particle Board: Synthetic resin bonded flat pressed three layers; multilayer and graded particleboard defined in IS 3087 having superfine surface shall be used for production of prelaminated particle board. For ECO Marks the particle board shall also conform to the requirements of ECO Mark sp ecified in IS 3087.

(b) Impregnated Base Paper: Printed or plain coloured absorbent base paper having a weight of 62 to140 g/m2 impregnated in a suitable synthetic resin and dried to a volatile content of 4 to 8 per cent shall be used for pre-lamination on both surfaces of particle board. 2

(c) Impregnated Overlay: An absorbent tissue, paper having a weight of 18 to 40 g/m impregnated in a suitable synthetic resin and dried to a volatile content of 4 to 8 per cent shall be used for the manufacture of pre-laminated particle board.

(d) Manufacture: Particle boards having superfine and closed surface with high face strength and steep density gradient across the thickness is used for making prelaminated particle boards. Impregnated base papers rich in a synthetic resin are placed on either side of the particle board and the assembly is taken inside a short cycle single opening lamination press or a multi day light press. Under heat and pressure the resin flows and forms a permanent bond with particle board. The top surface of impregnated paper comes in contact with special surface chromium plates or steel caul plates and takes the impression of surface finish of these cauls. Hot boards are extracted out of the short cycle press and cooled in air, whereas cooling of boards is done inside the dress in multiday light type. Care should be taken to keep cycle times low in the press to avoid heat penetration to the centre of the boar edge. The impregnated overlay paper may be used by placing it over the impregnated base paper (IBP) on one surface while using a normal IBP on the other surface and pressure. The impregnated overlay becomes transparent after pressing. Such boards are used for high surface abrasion application.

In case of finished foil particle boards, the finished foil is pasted on both surfaces of particle board after spreading suitable synthetic glue on board's surface and passing the assembly in a roller press or a flat press under the influence of pressure and/or heat depending on the type of binder used.

(e) Finish: The finish of the paper overlaid board depends on the surface of caul plates used. Common surface finishes in use are glossy, matt textured (soft, Swede, wood pore and leather), etc, the surface finish of the foil finished boards depends on the original finish of the foil used.

(f) Dimensions and Tolerances: Dimensions and tolerances shall conform to IS 12049.

(g) Testing: One sample for every 100 sqm. or part thereof shall be taken and testing done as per IS 12823. For quantity less than 100 sqm, the test certificate from manufacturer shall be relied upon. The Engineer-in-charge may ask for testing even if the quantity is less than 100 sqm.

2.2 Aluminum Sheet

(a) Aluminum Sheets for use as panels shall be 1.25 mm thick aluminum alloy sheet conforming to IS737. Aluminum alloy sheet for use in general paneling work shall be of types and thickness as specified and conforming to the requirement of IS 737. Aluminum sheets shall be of approved make and manufacturer. Aluminum panel may be prefabricated units manufactured on modular or non-modular dimension.

(b) Fixing: The required size of panel, keeping sufficient margin to be inserted inside the section, shall be cut to correct size and fixed firmly in the frame with CP brass or aluminum or stainless steel screws of star headed, counter sunk and matching size groove. Joints sealed with epoxy resin or silicon sealant to make the unit water proof.

2.3 Float Glass

(a) The float glass shall conform to the IS 14900. The glass shall be clear float glass and should be approved by the Engineer in Charge. It shall be clear, float transparent and free from cracks subject to allowable defects.

(b) Thickness: The thickness of float glass shall depend on the size of panel. The tolerance in thickness shall be as under:-

TABLE 2

Nominal Thickness	Tolerance (in mm)
4.0	±0.3
5.0	±0.3
6.0	±0.3
8.0	±0.6

(c) Allowable Defects: The allowable defects shall be as per Table.3 below:

S.N.	DEFECTS	CENTRE	OUTER	REMARKS
1	Gaseous inclusion. Max size,mm	3.0	6.0	Separated by at least 30.0 cm
2	Opaque gaseous inclusion. Max size. mm	3.0	6.0	Separated by at least 30.0 cm
3	Knots, dirt and stones, Max size. mm	1.0	1.0	Separated by at least 30.0 cm
4	Scratches, Rubs and Crush	Faint	Light	Separated by at least 30.0 cm
5	Bow, percent. Max	0.50	0.50	See 16.2.c
6	Reams, Strings and lines	Light	Light	See 16.2.d
7	Waviness	Nil	Nil	See 16.2.e
8	Sulphur stains	Nil	Nil	
9	Corner breakage and chip	Not more than nominal thickness of float glass		

(d) Allowable Cluster of Defects: The allowable cluster of defects mentioned under SI No. 1, 2 & 3 of Table 16.3 shall be as per IS 14900.

2.4 Tests

(a) Thickness: The thickness of float glass shall be measured with micrometers or a caliper which is graduated to 0.01 mm or with a measuring instrument having an equivalent capacity.

(b) Scratches, Rubs and Crush : Place the sample of float position approximately 50 cm from the viewer's position and look through it using either day light without direct sunlight or a background light suitable for observing each type of defect.

Intensity of Scratches, Rubs, Crush	Intensity Distance Limit
Faint	Shall not be detectable beyond 50 cm
Light	Detectable between 50-100 cm and not beyond 100 cm.

(c) Bow: Depending on the side on which bow is present, stand the sample vertically on a wooden plank. Stretch a thread edge to edge. Measure the longest perpendicular. Distance from the thread to the surface of float glass facing the thread and express it as percentage of the length of float glass from edge along the thread.

(d) Reams, Strings and Lines: Focus a fight projector with a 500 W lamp and an objective lens with an Approximate 5 cm aperture and about 30 cm focal length on a flat white projection screen placed about 760 cm from the light source in a dark room. Place the float glass in a vertical position parallel to the Screen between the light and the screen. Move the glass slowly towards the screen with a vertical Oscillating motion. The shadowgraph read out is the distance at which the distortion just blends with the general shadow of the glass on the screen.

TABLE.4

Intensity of Reams, Strings and Lines	Intensity Distance Limit
Light	7.5 cm
Medium	5.0 cm
Heavy	2.5 cm

(e) Perspective Distortion: When tested as per test procedure described below it shall not give distorted vision of straight stripe pattern.

Test Procedure for Perspective Distortion

Perspective distortion shall be examined by looking through the specimen glass which may be placed at about 4.5 m distance in such a direction that the incident angle to it is 50 degree (4 mm or above) and by observing a screen set up perpendicularly to the line of vision about 4.5 m further ahead of the specimen over the total width of about middle part of the specimen from the horizontal direction. The specimen glass shall be kept with the drawn direction at manufacture vertical and, on the surface of the screen, the strip pattern of white and black parallel straight lines of 25 mm width and inclined 45 degrees from the vertical shall be provided and its surface shall be luster less.

3 EPDM-GASKETS

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 in Table below:

S.N.	Description	Standard Follow	Specification
1	Tensile strength Kg.f/cm	ASTM-D412	70 Min.
2	Elongation at break %	ASTM-D412	250 Min.
3	Modulus 100% Kgf/cm2	ASTM-D412	22 Min.
4	Compression set % at 0° CC 22 Hrs.	ASTM-D 395	50 Max.
5	Ozone resistance	ASTM-D 1149	No visible cracks

4 SEALANT

(a) 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.

(b) Method of Application

Surface Preparation: Clean all joints and glazing pockets by removing all foreign matter and contaminants such as grease, oil, dust, water, frost, surface dirt, old sealants or glazing compounds and protective coatings.

(c) Masking

Areas adjacent to Joints shall be masked to ensure neat sealant lines. Masking tape shall not be allowed to touch clean surfaces to which the silicone sealant is to adhere. Tooling shall be completed in one continuous stroke immediately after sealant application and before a skin forms and masking shall be removed immediately after tooling.

(d) Application

Install backer rod of appropriate size and apply silicone sealant in a continuous operation using a positive pressure adequate to properly fill and seal the joint. The silicone sealant shall be tooled with Light pressure to spread the sealant against backing material and the joint surfaces before a skin forms; A tool with convex profile shall be used to keep the sealant within the joint. Soap or water shall not be used as a tooling aid. Remove masking tape as soon as silicone joint is tooled.

(e) Tolerance: A tolerance of + 3 mm shall be allowed in the width of silicone joints. The depth of the joints at throat shall not be less than 6 mm.

5 REFLECTIVE GLASS

5.1 Definitions

(i) Shading Coefficient: The shading coefficient is the ratio of total solar transmittance to the transmittance through 3.2 mm (1/8") clear glass. Windows with low shading coefficient values improve Comfort for building, lower the total cooling load of the building and help smooth out of the difference in cooling loads between perimeter & core zones.

(ii) Luminous Efficacy Constant (Ke) indicates a windows relative performance in rejecting solar heat-while transmitting day light. It is the ratio of the visible transmittance to the shading coefficient; clear glass which lets in roughly equal amounts of visible light and solar near-infrared energy has a Ke close to 1.0. The solar radiation contains about 50% invisible near-infrared & ultra violet light. Therefore, a perfectly selective glazing, which would all allow visible light pass through while blocking all of the invisible near-infrared & ultraviolet light, would have Ke of about 2.0.

(iii) Resistance to Heat Conduction (R-valve): It is a measure of resistance to heat flow that occurs because of temperature difference between the two sides of the windows. The inverse of R-value is termed as U-value.

5.2 Reflective Glass

This is an ordinary float glass with a metallic coat to reduce solar heat. Clear glass transmits most of the sunlight that shines upon it, and most of the solar heat as well; the metallic coated glass i.e. reflective glass has better shading coefficients because they reflect rather than absorb infrared energy. However, most of reflective glazing blocks day light more than solar heat.

(a) Types of Coatings:

(i) Pyroltic (Hard) coated: It is a coating applied during glass manufacture. The coating is fused into the glass at 1200°C.

(ii) Vacuum (Soft) Coated Glass: It involves the deposition of metal particles on the glass surface by a chain reaction in a vacuum vessel. It is often called a soft coat; because the coating is more susceptible to damage than hard coat glass. Where toughening of product is required, the product must be toughened first & then vacuum coated. Vacuum coated products have better shading coefficient values than pyroltic products.

(b) Performance of Reflective Glass: The performance of reflective glass 6 mm of nominal thickness is given below:

S.N.	Parameter	Threshold Ratio In %age
1	Visible Light :- -Transmittance (%) -Reflectance (%)	 15-46 12-24
2	Total Solar Energy:- -Transmittance (%)	 16-24

	-Reflectance (%)	8-12
3	Ultra Violet Rays; - -Transmittance (%)	2-10
4	U-Value -Summer -Winter	 0.58 0.45
5	Shading Coefficient	0.25-0.35

(c) Testing: The reflective glass shall be tested for the followings:

(i) Physical/Field Test: In a true reflective glass, when a pointed pencil is placed, then tip of pencil (physical) & image should coincide.
(ii) Lab. Test: In the lab, the reflective glass shall be tested for the parameter specified in para 5.2.b above.

(d) Fixing of glass shall be done as specified.

5.6 DOOR, WINDOW, VENTILATOR AND PARTITION FRAMES

5.6.1 Framework

First of all the shop drawings for each type of doors/windows/ventilators etc. (Showing full size sections of glazed doors, windows, ventilators etc) shall be prepared.The shop drawings shall also show the details of fittings, Joints and 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. Before start of the work, all the shop drawings shall be got approved from the Engineer-in-Charge.

Before fabrication 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.

5.6.2 Fixing of Frames

The holes in concrete/masonry/wood/any other members for fixing anchor bolts/fasteners/screws shall be drilled with suitable 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 25cm 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 headings and EPDM gasket shall be fixed as per the detail shown in the approved 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 save from electrochemical corrosion is, 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.

5.6.3 Measurements

All the aluminum sections including snap headings fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment (weight shall be taken after anodizing). The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts.

5.6.4 Rate

The rate shall include the cost of all the materials, labour involved in all the operations as described in nomenclature of item and particular specification.

6 DOOR, WINDOWS AND VENTILATOR SHUTTERS

Material, fabrication and dimensions of aluminum doors, windows and ventilators manufactured from extruded aluminum alloy sections of standard sizes and designs complete with fittings, ready for being fixed into the building shall be as per IS 1948.

6.1 Terminology

The components of doors, windows and ventilators shall be refer as per CPWD Specification Vol-2

Terminology for Aluminum Doors, Windows and Ventilators shall be refer as CPWD Specification Vol-2

6.2 Standard Sizes, Tolerances and Designations

Doors and side lights shall only be coupled with 12 module (117.5cm) high windows.

6.3 Tolerances

The sizes for doors, windows and ventilators frames shall not vary by more than ±1.5 mm.

6.4 Glass Panels

Glass panels shall weigh at least 7.5 kg/m and shall be free from flaws, specks or bubbles. All panels shall have properly squared corners and straight edges. The sizes of glass panels for use in doors, windows and ventilators shall be Refer as per CPWD SPECIFICATION VOL-2

6.5 Screws

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

6.6 Fabrication

Frames: Frames shall be square and flat, the corners of the frame being fabricated to a true right angle. Both the fixed and opening frames shall be constructed of sections which have been cut to length, mitered and welded at the corners. Where hollow sections are used with welded joints, argon-arc welding or flash butt welding shall be employed (gas welding or brazing not to be done). Subdividing bars of units shall be tenoned and riveted into the frame-

6.7 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 (FIG-3).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 Genera! 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. (FIG-4). 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 illustrated. (FIG-5).

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 points 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 (FIG-6). The height of the handles in each type of side-hung shutters shall be fixed in approximate position as indicated.

The peg stay shall be either of cast aluminum conforming to IS 617 or folded from IS Designation N84 aluminum alloy sheet conforming to IS: 737 specifications for wrought aluminum and aluminum alloys, Sheet and strip. It shall be 300 mm long, complete with peg and locking brackets (Fig. I). The stay shall have holes for keeping the shutter open in three different positions. The peg and locking bracket shall be riveted or welded to the fixed frame.

Alternatively, and if specifically required by the purchaser, side-hung shutters may be fitted with an internal removable fly screen of 0.375 mm wire and equivalent to IS Sieve 100 in a 0.900 mm aluminum alloy sheet conforming to IS Designation NS3-1/2H of IS 737 applied to the outer frame of the shutter by case or extruded aluminum alloy turn-buckie at the jambs and by aluminum or plated bronze shoes at the sill to allow of the screen being readily removed, and with a rotor operator at the sill to permit the operation of the shutter through an angle of 90°. On fly-screened shutters the peg stay is omitted and the normal handle

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-

The pegs stay shall be 300 mm long as in side-hung shutter, The locking bracket shall be fixed to the fixed frame.

6.8 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 85°. 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.

Aluminum or cadmium plated brass cord pulley-wheel in an aluminum bracket shall be fitted at the sill of the ventilator with aluminum or galvanized or cadmium plated steel screw or, alternatively, welded together with an aluminum cord eye riveted or welded to the bottom inner frame bar of the ventilator in a position corresponding to that of pulley.

6.9 Doors

The outer fixed frame shall be of section A1-FX8. The shutter frame shall be of either hollow sections

A1-HFX5 and A1-HFX6.

The kick panels shall be of 1.25 mm aluminum alloy sheet conforming to IS Designation NS3-1/2H of IS 737 specification for Wrought Aluminum and Aluminum Alloys, Sheet and strip and shall be screwed to the frame and the glazing bar.

Hinges -Cast of extruded aluminum alloy hinges for doors shall be of the same type as in the windows but of larger size. The hinges shall normally be of the 50 mm projecting type . Non-projecting type of hinges may also be used.

The handle for doors may be of the design indicated in.
A suitable lock for the door operable either from inside or outside shall be provided.

Note: From the point of view of security, the lock which is operable from only one side is better and in the case of such locks, a bolt shall be provided to make them inoperable from the other side.

Typical Door Handle

In double shutter doors the first closing shutter shall have a concealed aluminum alloy bolt at top and bottom. It shall be so constructed as not to work loose or drop by its own weight. Single and double shutter doors may be provided with a three-way bolting device Where this is provided in the case of double shutter door, concealed aluminum bolts may not be provided.

6.10 Composite Units

The doors shall be coupled to windows or side-lights by extruded aluminum sections made from aluminum alloy conforming to IS Designation HE9-WP of IS 733. The coupling member should conform to the dimensions indicated in Fig. refer CPWD Specification VOL-2

6.11 Weather Bar

Where a coupling member is fitted over an external opening shutter, the coupling member should Incorporate an integrally extruded weather bar.

6.12 Position of Bolts, Fixing Screws and Lugs

Outer frames shall be provided with fixing holes centrally in the web of the sections in the position Moreover, any steel lugs coming in contact with aluminum should be either galvanized or given one coat of bituminous paint.

The fixing screws and lugs shall be as given in Table.7

S.N.	Place of fixing	Size of screw or lug
i	To wooden frames rebated on the outside	30 mm x No. 10 galvanized wood-screws.
ii	) To plugs in concrete, stone or brick work rebated on the outside	-Do-
iii	To plugs in concrete, stone or brick work not rebated on the outside (that is plain or square jambs)	45 mm X No. galvanized wood-screws
iv	Direct to brick work or masonry (that is plain or square jambs)	Slotted steel adjustable lugs (natural finish) or square jambs) not less than 100 x 16 x 3 mm countersunk galvanized machine screws and nuts 19,0 X 6.3 mm
v	To steel work	Standard clips and 8 mm galvanized bolts with hexagonal nuts

6.13 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.

6.14 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 panesare required to be used or where the door or the window is located in heavily exposed situation, holesfor glazing clips have to be drilled prior to fabrication and cannot be done at any later stage. Use ofglazing clips, where necessary, shall be specified while placing the order.

6.15 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.

6.16 Marking

All doors, windows and ventilators shall be suitably marked on the frames with a mark identifying the manufacturer and the type. The units may also be marked with the BIS Certification Mark.

7 FITTINGS

7.1 Stainless Steel Friction Stay

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

7.2 Lockable Handles

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

7.3 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 stonecutting machine to exact size & shape. The spindle of suitable length to accommodate the floor finishshall be used. The contractor shall give the guarantee duly supported by the company for proper functioning of floor spring at least for 10 years.

7.4 Tubular Handle

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

7.5 Measurement

Refer Para 6.3.

7.6 Rate
Refer Para 6.4.

8 LOUVERS

Aluminum extruded sections (anodized or power coated) are used for providing Louvers in aluminum door, window & partition for ventilation.

8.1 Fabrication
Refer Para 6.1.

8.2 Measurements
Refer Para 6.3.

8.3 Rate
Refer para 6.4.

9 HERMETICALLY SEALED UNIT

Insulating glass shall be a double glazed unit comprising two sheet Insulating glass shall be a double glazed unit comprising two sheets of float glass panes separated by a spacer, hermetically sealed using primary and secondary sealants. The design of insulating glass system shall consist of:

(a) Hollow Spacer Bar

The hollow aluminum spacer bar shall be of required size and shape and shall be colour anodized. The spacer bar shall have two lines of perforations in the inner surface.

(b) Desiccant

The desiccant shall be Neftomol 3 A Chemetall or equivalent. The desiccant filled in the aluminum spacer bar shall be synthesized crystalline compounds of Aluminum Hydroxide, Caustic Soda and Sodium Silicate which absorbs water molecules. The desiccant shall be of 3 A sizes (A means Angstrom). The quantity of desiccant used shall not be less than 35 gm/m length of spacer bar. Filled spacer bar frame shall not be stored for more than 6 hours before assembly and sealing of the unit to ensure proper functioning of the desiccant. The contractor shall submit documentary proof of using the above material in the work.

(c) Primary Sealant

The primary sealant shall be single component approved by the Engineer in Charge, thermo plastic solvent free sealing compound based on polysosutylene. The sealant surface shall be free from cavities, depression and other defects. The contractor shall submit documentary proof of using the above material in this work.

(d) Secondary Sealant

The secondary sealant in double glazed unit shall be silicone sealant approved by the Engineer in Charge. The contractor shall submit documentary proof of using the above material in this work to the entire satisfaction of Engineer-in-Charge. Before application of silicone/ polysulphide, the surface must be cleaned and free from oil, grease, dust and other loose matter. The surfaces shall be cleaned with alcohol or other

suitable solvents. Detergent or soap shall not be used to clean the surfaces. The polysulphide shall be mixed and applied mechanically using automatic mixing machine in the manner approved by Engineer-in-Charge.

Measurement

The height and width of double glazed/single glazed unit (the area of glass unit outside the snap beading shall only be measured) as fixed in place shall be measured correct to one centimeter and area calculated in sqm. correct to second place of decimal shall be taken for payment.

Rate

The rate shall include the cost of all the materials, labors involved in all the operations as described in nomenclature of item and particular specification.

11 BRASS LOCK

This should generally conform to IS-2209. The size of the lock shall be denoted by the length of the body towards the face and it shall be 100 mm. the measured length shall not vary more than 3 mm from the specified length. Ordinary lever mechanism with not less than 2 levers shall be provided. False lever shall not be used. Lever shall be fitted with one spring of phosphor-bronze or steel wire and shall withstand the test as provided in IS-2209. Locking-bolt spring and strike plate shall conform to IS 2209. Two keys shall be provided with each lock.

LIST OF BUREAU OF INDIAN STANDARD (BIS) CODES

S.NO.	IS CODE	SUBJECT
1	IS 733	Wrought Aluminum and Aluminum Alloys, Bars, Rods and Sections (For General Engineering Purposes) Specification
2	IS 737	Wrought Aluminum and Aluminum alloy sheet and strip for general engineering purposes -Specification
3	IS 1285	Wrought Aluminum and Aluminum Alloy, Extruded Round Tube and Hollow sections (For General Engineering Purposes) - Specification
4	IS 1868	Anodic coating on Aluminum and its Alloys-Specification
5	IS 1948	Specification for Aluminum Doors, Windows and Ventilators
6	IS 3908	Specification for Aluminum. equal leg angles
7	IS 3909	Specification for Aluminum unequal leg angles
8	IS 3965	Dimensions for wrought Aluminum and Aluminum Alloys bars, rods and sections.
9	IS 5523	Method of testing anodic coating on aluminum and its alloys.
10	IS 6012	Measurement of coating thickness by Eddy Current Method
11	IS 6315	Floor springs (Hydraulically regulated) for heavy doors-Specifications
12	IS 6477	Dimensions of extruded hollow section and tolerances
13	IS 12823	Wood products- Pre-laminated particle board -Specifications
14	IS 14900	Transparent Float glass- Specifications.

List of approved makes

1	Aluminium Composite Panel	Alpolic, Aluco Bond, Reynobond, Euro bond, Al-strong
2	Aluminium Extrusions	Hindalco, Indalco, Jindal
3	Aluminum Sections	Jindal, Hindalco, Indalco
4	Annealed Float Glass	Saint Gobain, Modi Guard equivalent
5	Float Glass	Modi Float, Saint Gobain or equivalent
6	Hydraulic Door Closer	Hardwyn, Godrej or equivalent.
7	Pre-laminated Particle Board	Novapan, Eco, Kitlam or equivalent.
8	Vertical Blinds	Mac, Decore, Classic - Vista, Wind Sam or equivalent

Dean (Planning & Development)
Institute Works Department
SPA Bhopal
or his authorized representative with Seal