

## SECTION - 6220

### ALUMINIUM WORKS

#### 1. SCOPE

The work covered under this section of the specifications consists of providing all material, labour, equipment, performing all operations required for providing and installation of aluminium doors, windows, ventilators & louvers and Partitions including all related items such as sealants, gasket, netting, rollers, hinges, latches, fastenings, anchor bolts, door locks, locking devices and glass complete in strict accordance with this section of specifications, the applicable drawings and as scheduled. Any additional information required in this connection and not stated in these specifications, shall be obtained from the Engineer's Representative.

#### 2. APPLICABLE STANDARDS

Latest editions of following ISO and British Standards are relevant to these Specifications wherever applicable.

##### 2.1 ISO (International Organisation for Standardisation)

1804	Doors	-	Terminology
6442	Door Leaves	-	Measurement of defects of general flatness.
6443	Door Leaves	-	Measurement of dimensions and defects of squareness.
6444	Door Leaves	-	Test of behaviour under humidity Variations (successive uniform climates)
6612	Windows & Doors	-	wind resistance tests.
6613	Windows & Door	-	Air permeability test.

##### 2.2 BSI (British Standard Institution)

1227	Hinges
4873	Aluminum alloy windows.

##### 2.3 AAMA (American Architectural Manufacturer Association)

AAMA 101	Aluminum Prime windows and Sliding Glass Doors
AAMA 603.8	Pigmented Organic Coating on Extruded Aluminum
AAMA 605.2	High Performance Organic Coatings on Architectural Extrusions and Panels
AAMA 606.1	Color Anodic Finishes for Architectural Aluminum
AAMA 607.1	Clear Anodic Finishes for Architectural Aluminum

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AAMA 701.2 Voluntary Specification for Pile Weather Stripping

2.4 AA - Aluminum Association

Aluminum Association Designation System for Aluminum Finishes

2.5 ANSI - American National Standards Institute

A134.1 Specification for Aluminum Prime windows.

2.6 ASTM - American Society for Testing and Materials

ASTM B 136 Stain Resistance of Anodic Coatings on Aluminum

ASTM B 137 Weight of Coatings on Anodically Coated Aluminum

ASTM B 209 Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 211 Aluminum and Aluminum-Alloy Bars, Rods and Wire

ASTM B 221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

ASTM B 244 Thickness of Anodic Coatings on Aluminum with Eddy-Current Instrument

ASTM D 2287 Non-Rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

ASTM D 3656 Insect Screening and Louver Cloth Woven From Vinyl-Coated Glass fiber Yarn

ASTM E 283 Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors

ASTM E 330 Structural Performance of Exterior Windows, Curtain Walls and Doors Under the Influence of Wind Loads.

ASTM E 331 Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Pressure Difference Loads

ASTM E 547 Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Difference Loads

ASTM F 468 Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

2.7 DIN - Deutsches Institut fuer Normung

DIN 4108 Heat Insulation in Buildings

DIN 18055 Windows; Air Permeability of Joints, Water Tightness and Mechanical Strain

2.8 AWS - American Welding Society:

D1.1 - Structural Welding Code, Steel

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## D1.2 - Structural Welding Code, Aluminum

### 3. SUBMITTALS

- 3.1 Product Data: Submit Manufacturer's specifications, standard details, and installation recommendations for components of aluminum doors, windows, ventilators, louvers and framing required for project, including data that products have been tested and comply with performance requirements.
- 3.2 Shop Drawings: Submit shop drawings for fabrication and installation of aluminum doors , windows, ventilators, louvers and framing, including elevations, detail sections of typical composite members, anchorages, reinforcement, expansion provisions, and glazing
- 3.3 Certification: Submit statement certified by registered structural engineer that systems including glass will withstand specified wind-loads.
- 3.4 Samples: Submit samples of each type and color of aluminum finish, on 300 mm long sections of extrusions or formed shapes and on 150 mm square sheets.

### 4. TRANSPORTATION, HANDLING AND STORAGE

Deliver aluminum entrance material to the site in packages or containers; labeled for identification with the Manufacturer's name, brand and contents. Store aluminum entrance material in weather tight and dry storage facility. Protect from damage from handling, weather and construction operations before, during and after installation.

### 5. WARRANTY

Submit 2 copies of written guarantee signed by the Manufacturer, Installer and Contractor, agreeing to replace aluminum doors, windows, ventilators, louvers and framing units that fail in material or workmanship within 2 years of date of substantial handing over.

Such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturers and the Contractor may have by law or by other provisions of the Contract Documents.

### 6. QUALITY ASSURANCE

- 6.1 Standards: Comply with applicable provisions of Metal Curtain Wall, Window,Storefront and Entrance Guide Specifications Manual - AAMA.
- 6.2 Performance and Testing:
  - 6.2.1 Thermal Movement: Fabricate exterior components from Manufacturer's stock systems which have been designed to provide for expansion and contraction resulting from ambient temperature range of 48°C.

6.3 Wind Loading: Fabricate exterior components from Manufacturer's stock systems which have been tested in accordance with ASTM E 330 to withstand at least the following loadings:

6.3.1 Uniform Pressure: 97.6 kg/m<sup>2</sup> inward; 97.6 kg/m<sup>2</sup> outward.

6.3.2 Maximum Deflection: 1/175 of clear span any framing member.

6.4 Weather Resistance: Fabricate exterior components from Manufacturer's stock systems which have been tested to demonstrate permanent resistance to leakages as follows with test pressure differential of 10 percent of design loading (excluding operable door edges).

6.4.1 Air Infiltration: Tested in accordance with ASTM E 283 and shall have a minimum of 0.6 m<sup>3</sup>/min/m of crack.

6.4.2 Water penetration and leakage shall not be allowed when tested in accordance with ASTM E 331 at a water application rate 10 percent more than the design rate.

## 7. GENERAL

7.1 Door, Windows, ventilators, louvers, partitions and other items to be provided shall be aluminium, of profile pattern and design shown on drawings and shop drawings manufactured by reputable manufacturer approved by the Engineer. The Contractor shall provide manufacture literature completely describing the product instructions for installation and maintenance.

7.2 All sections used for doors, windows, ventilators, louvers and fly screens shall be of best quality aluminium products such as equal and unequal angles, channels, tubes, corrugated strips, mouldings etc., in accordance with International standards conforming to ASTM B 308 & B 221.

7.3 All doors, windows, ventilators and louvers shall be of type and size indicated on drawings and shall conform to the requirements shown and specified herein.

7.4 Contractor shall arrange tests and analysis if directed by the Engineer of scaled models of each door, window, ventilator and louvers type at the maker's works or any laboratory specified by the Engineer for the material supplied by him to be tested in the presence of the Engineer's Inspector, to whom test certificates, proof sheets, etc. shall be furnished. The models shall be submitted to the Engineer for approval prior to testing. Nevertheless, neither the fact that the materials have been tested in the presence of the inspector nor that the Engineer may have been furnished with test certificates in lieu of sending an inspector to the works shall affect the liberty of the Engineer to reject, after delivery of materials found not in accordance with these specifications.

7.5 The Contractor shall submit shop drawings conforming to design concept which shall show full construction details, quantities and locations, fastenings, stiffening members and attachments to adjacent construction and materials. Shop drawings and calculations shall be submitted at the

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proper time to allow for checking, revisions, and agreement and to permit manufacturer's product delivery and start of site work to suit the building programme. The Contractor shall submit representative samples of finished doors, windows, anchoring mechanism, embedded parts, fastenings, glass panes, accessories and other materials for the Engineer's approval.

After approval of shop drawings and tests etc., the Contractor shall submit at his own cost one mock-up sample of each type of aluminium works complete with glazing, all components assembly method and required fittings and accessories prior to the actual fabrication of the bulk. The samples shall be returned to the Contractor for incorporation in the works after installation of at least 80% of the works.

Fabricate and assemble all work in the shop of the approved manufacturer to reduce field fabrication to a minimum unless otherwise directed by the Engineer.

- 7.6 The glass shall conform to specification laid down under chapter 'Glazing' and shall be free from all blemishes, bubbles, distortions and other flaws of any kind and shall be properly cut to size as shown on drawings, so as to fit the grooves in window members.
- 7.7 The structural shape of the Aluminium members shall be of uniform quality, colour and temper, clean, round, commercially straight and free from injurious defects.
- 7.8 All doors, windows, ventilators and louvers shall be fabricated as a complete unit, fully airtight and watertight, including rubber gasket for glazing, hinges, stays, rollers, latch, locking arrangement, handles, etc anodised in specified colour, inclusive of glass sheet, necessary holes for fixing, door locks, door closures and window locking requirements, all as approved by the engineer.
- 7.9 Contractor shall, provide certificate signed by the manufacturer stating that each lot has been sampled, tested and inspected and has met the requirements in accordance with these specifications and the same shall be furnished to the Engineer.
- 7.10 The shop drawings shall clearly show that there shall be no penetration of rainwater from the exterior to the interior in case of severe wind and rainstorm. This has to be specially ensured in sill section.

## 8. MATERIALS AND ACCESSORIES

### 8.1 Aluminum Members:

- 8.1.1 Extrusions of Bars, Rods and Tubes: 6063-T6 Alloy conforming to ASTM B 221.
  - 8.1.2 Sheets and Plates: 5005-H14 alloy conforming to ASTM B 209.
  - 8.1.3 Doors, windows, ventilators, louvers and frames shall be manufacturer standard systems of extrusions not less than 1.6 mm thick.
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8.1.4 Use manufacturer's standard thermal-break sections for all aluminum doors, windows, ventilators and louvers unless otherwise shown on Drawings.

8.2 Fasteners: Aluminum, or non-magnetic stainless steel, or other materials warranted by Manufacturer to be non-corrosive and compatible with aluminum components.

8.2.1 Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal.

8.2.1 Provide Phillips flat-head machine screws for exposed fasteners.

8.3 Glazing Gasket: Manufacturer's standard vinyl glazing gasket.

8.4 Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, non-magnetic stainless steel or hot-dip galvanized complying with ASTM A 386.

8.5 Concrete/Masonry Inserts: Cast iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.

8.6 Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC - Paint 12, compounded for 20 mil thickness per coat.

8.7 Glass: Glass and glazing materials shall be as specified in Section 6250 - GLAZING and as indicated on Drawings with all doors, windows, ventilators and louvers factory glazed. Provide 24 mm thick double clear tempered glass for swing type doors and 12 mm thick clear tempered glass for sliding and folding doors, as indicated on drawings.

8.8 Hardware: Provide aluminum doors, windows, ventilators and louvers with Manufacturer's standard, factory-installed hardware. Finish of hardware shall be satin stainless steel, as approved by the Engineer.

## 9. FINISH

Anodized Finish: Conform to AA C22A42; 22 micron thick; with shop-applied protective coating of clear acrylic lacquer or any coating in accordance with AAMA 602.2, 0.5 mil dry film thickness, over anodized finish. Color shall be as approved by the Engineer.

## 10. DESIGN REQUIREMENT

The Contractor shall design the installation to meet the following requirements.

### 10.1 Tolerances

The Contractor shall be responsible for agreeing to all dimensions with the Engineer before proceeding with the manufacture and for making provision to allow for building tolerances required by the Engineer. Contractor shall also take site measurements of the structure completed before manufacturing.

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## 10.2 Thermal & Seismic Movements

The window and glazing assemblies are to be constructed and installed in the openings with sufficient tolerance and, where necessary, to provide for joints incorporated in couplings, to provide for expansion and contraction as will be caused by the local seismic and climatic conditions and temperature changes, winter to summer - day to night without buckling, distortion of joints, or other harmful effects.

## 11. FABRICATION

- 11.1 Door Types: Types include double leaf swing doors and sliding doors, as shown on drawings. Provide manufacturer's standard electric door operator for motor-operated sliding doors.
  - 11.2 Sizes and Profiles: Required sizes for door , windows, ventilators, louvers and frame units including profile requirements shall be as shown on Drawings. Variable dimensions shall be indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
  - 11.3 Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation.
  - 11.4 Sequence: Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, surface treatment, and application of finishes. Remove arises from cut edges and ease edges and corners.
  - 11.5 Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.
  - 11.6 Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator which will prevent corrosion.
  - 11.7 Provide continuous steel reinforcing stiffening members within jambs and heads of all doorframes, except omit at jambs that are secured to adjacent fixed walls.
  - 11.8 Cut vertical reinforcing 50 mm less than mullion height and cut horizontal reinforcing 75 mm less than door head framing member.
  - 11.9 Securely fasten in a manner so that fasteners will not be visible in finished work. Fasten aluminum sections to steel reinforcing 150 mm from each end and intermediately at a maximum spacing of 600 mm on centers.
  - 11.10 Doorframes shall be free of vibration and distortion when doors are used.
  - 11.11 Maintain accurate relation of planes and angles, with hairline fit of contacting members.
  - 11.12 Fasteners: Conceal fasteners wherever possible.
  - 11.13 Weather stripping: For exterior doors, windows, ventilators, louvers and
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frames provide compression weather stripping against fixed strip; at other edges, provide sliding weather stripping retained in adjustable strips mortised in other edge.

## 12. WORKMANSHIP

The Contractor shall be responsible for the protection and installation of all items furnished. All items shall be installed plumb and square and shall be solidly anchored in a good workman like manner in accordance with the manufacturer's instruction and as specified herein. The Contractor shall be responsible for the protection of installed items from damage by other trades. All items shall be left in operating, neat and clean condition, free from dirt, finger marks, etc. The Contractor shall be responsible for final cleaning before the final acceptance.

The glass panes shall firmly be secured in the rebates with the rubber gasket. Ensure that the beads and grooves are clean, dry and unobstructed at the time of glazing. The complete unit shall be airtight and watertight on completion. No doors, windows and ventilator shall be considered complete until and unless the fingerprints and other stains and marks have been removed from the surface of glass and aluminum.

## 13. ERECTION

- 13.1 Comply with Manufacturer's instructions and recommendations for installation of aluminum doors and frames.
  - 13.2 Set units plumb, level, and true to line, without warp or rack of framing members, doors, windows, ventilators, louvers and frames or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials with bituminous coating.
  - 13.3 Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provided weather-tight construction.
  - 13.4 Expansion and Contraction: Allow for expansion and contraction due to temperature and building movement, and for practical building tolerances in connections to basic structure and in connections to work by others. At no place should window wall grid or framing impart any expansion or contraction forces on panels or glass.
  - 13.5 Hardware Preparation and Installation: Cut, reinforce, drill and tap aluminum work for application of finish hardware. Provide cover boxes in frames back of cutouts for hardware also install finish hardware in accordance with hardware Manufacturer's instructions and template requirements also use concealed fasteners wherever possible.
  - 13.6 Caulking: Seal joints between metal members and between metal and adjacent surfaces.
  - 13.7 Refer to Section 6250 - GLAZING for installation of glass and glazing requirements.
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13.8 Rawal plugs and anchoring bolts shall be embedded into the concrete or block masonry for holding the doors windows, ventilators and louvers in their correct positions.

13.9 Should any scale or scratch appears on the surface of doors, windows and ventilators the contractor shall at his own expense and at the Engineer's direction have all exposed surfaces cleaned to bare bright specified colour.

#### 14. SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc., shall be included by the Contractor in the unit rate of items.

Damage to existing works from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

#### 15. ADJUST PROTECTION AND CLEANING

15.1 Temporary protection shall be achieved by applying water-soluble protective coating capable of withstanding the action of lime mortar.

15.2 Apply coating in the manufacturer's plant to the exposed surfaces of all components.

15.3 Before application of coating, remove all fabrication compounds, moisture and dirt accumulations.

15.4 Adjust operating hardware to function properly, without binding, and to provide tight fit at contact points and weather stripping.

15.5 Clean completed systems, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.

15.6 Remove protective coating when completion of adjoining works and construction activities no longer requires its retention.

15.7 Institute protective measures and other precautions required to assure that aluminum doors, windows, ventilators, lovers and frames will be without damage or deterioration, other than normal weathering, at time of acceptance.

#### 16. DEFECTIVE WORK

In the event of non-conformance to specifications and drawings the aluminium works shall be rejected by the Engineer and the Contractor shall remove and replace the rejected works by new work of same specifications.

#### 17. MEASUREMENT AND PAYMENT

##### 17.1 General

Except otherwise specified herein or else where in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of

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Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

17.1.1 Aluminium extrusions tubular frame and sash member as per drawings.

17.1.2 Polyurethane thermal break material.

17.1.3 Rawal plugs, brackets, rubber gasket, sealants, rollers, heavy duty hinges, stays, concealed type floor mounted double action door closures, hinges, heavy duty stays, vetting latches and any other embedded fixture required for fixing the doors windows and ventilator.

17.1.4 Providing and fixing fly screens, weather stripping, backer rods, locks, stays, latches, push/pull bars, handles and door closures where ever required in the aluminium works as approved by the engineer.

17.1.5 Cleaning of aluminium after installation.

17.1.6 Sealing all around both from inside and outside and also of the screw holes with silicone sealant to avoid water leakage.

17.1.7 Fly screen including wire/fly mesh etc. in windows and ventilators.

17.1.8 Powder coating of Aluminium works.

17.1.9 Providing and fixing glazing

17.1.10 All samples & tests

## 17.2 Aluminum Works

### 17.2.1 Measurement

Measurement of acceptably completed works of aluminum doors, windows, ventilators, louvers and partitions will be made on the basis of net actual area in square foot / meter provided and installed in position as shown on drawings or as directed by the Engineer.

### 17.2.2 Payment

Payment will be made for acceptable measured quantity of all finished anodized aluminum doors windows, ventilators, louvers and partitions on the basis of unit rate per square foot / meter quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item including all reinforcing / stiffening arrangements.

\*\*\* End of Section 6220 \*\*\*

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