

**DIVISION 08000 – DOORS AND WINDOWS****08110 ALUMINIUM DOORS AND WINDOWS****08111 GENERAL****A- Scope of Work**

The work covered under this section comprises of the following:

- a) Fabricating, furnishing and installing in position aluminium doors and windows complete with handles, locks, nylon wheels, vinyl weather strips etc. and other finish hardware as shown on the drawings and specified hereunder.
- b) Furnishing and installing glass glazing of specified quality and colour to windows and doors.

**B- General Requirements****(01) Codes And Standards**

The ASTM and or BS standards and codes form a part of this section of specifications as though written in and/or attached here to and are intended to be used as a guide only to provide a minimum standard of kind quality and finish. The Engineer reserves the right to determine compliance and/or acceptability of the material and/or standards.

**(02) Design Requirements**

All doors and windows will be designed for a positive and negative wind loads based on section 2311 of UBC for a basic wind speed of 80 mph Exposure C, and will comply with AAMA 302.8 specification p .A 2.50. All sectional dimensions shown on drawings are only indicative. The Contractor shall be responsible to determine the adequacy of these with respect to actual structural and performance requirements. All extrusions shall be of adequate strength, not only to meet the structural performance, but also to minimize the risk of distortion in the finished surfaces.

**(03) Work Sizes**

All dimensions given on drawings are between structural openings and/or between finished surfaces and allowances shall be made for variation due to constructional tolerances. The Contractor shall be responsible to measure the final dimensions from the Site before fabrication of doors, windows and other assemblies/units.

**(04) Weather Tightness**

Weather tightness and operations shall suit the weather conditions prevailing in Islamabad. All doors and windows will be fabricated as completely air and water tight units including gaskets for glazing, weather stripping, latches, locks, bolts for fixing etc.

**(05) Air Tightness**

The fixed glazed windows shall be as far as possible 100% air tight under all weather conditions. Air infiltration for opening windows and doors when fully closed shall not

exceed  $3\text{m}^3/\text{hr}/\text{meter}$  length of opening joint at a test pressure of  $498\text{ N/M}^2$  as tested in accordance with B.S. 4315 part 1.

**(06) Acoustic Performance**

Windows when installed shall provide an average sound reduction of 28 dB over a frequency range of 100-3150Hz.

**C. Technical and Fabrication Requirements.**

**(01) Appearance**

- a) Provide units composed of aluminium shapes with visible portions of profile matching detail indicated on the drawings, and free from additional slots, grooves, fins or other non-functional details.
- b) Fabricate and assemble all work in the shop wherever possible and otherwise profit as required to reduce field fabrication to minimum.
- c) Fit member neatly and to hairline accuracy with profile extending into joints without additional trim. Match flush joints to form perfectly smooth plane; match offset joints to hairline butt fit to flat surface by one point of tangency of corner radius. Units using extra trim to conceal misalignment will not be acceptable.
- d) Make all connections by means of concealed fasteners; exposed fasteners will be permitted where essential to proper adjustment of door units. Use only countersunk flathead machine screws for exposed fasteners.
- e) Where additional strength of section is required to meet structural requirements, provide additional wall thickness or stiffeners inside the extrusion. Width of face (sight line) dimensions indicated on the drawings are maximum permissible exposed surface.
- f) Manufacturer's standard sections will be acceptable only when such extrusions are substantially in accordance with the profiles indicated on the drawings as accepted by the Engineer.
- g) Surface Smoothness: Submit samples and obtain approval for extent of the lines permissible in all "as extruded" materials.

**(02) Design**

Design anchors to allow for horizontal and vertical expansion. Screws, nuts, washers, bolts and reinforcements shall be aluminium, AISI Series 300 stainless steel or other material compatible with aluminium, and of adequate strength for the proposed use.

**(03) Structure**

- a) All extrusions, where used structurally, including column covers: Not less than 3.2 mm (0.125 in.) wall thickness, except where otherwise detailed.
- b) Non-structural covers: Not less than 2 mm (0.080 in.) wall thickness, except as otherwise indicated on drawings.
- c) Snap-on glazing or applied trim: Not less than 1.6 mm (0.60 in.) except as otherwise indicated on drawings.

- d) Internal stiffeners: As indicated on the drawings and as standard with the manufacturer for the required strength.

**D- Submittals**

**(01) General**

Refer to "Schedule of Required Submittals", section of Division 01000, and other sections referenced therein for special instructions relating to submittals.

**(02) Manufacturer's Coordination and Services**

- a) Product Certification: Certification of proper use and compatibility for aluminium sealing and lacquer.
- b) Certification of alloy for integral colour finishes.
- c) Certification by Aluminium Association designation for class of anodizing and finish.
- d) Maintenance instructions.

**(03) Warranty**

- a) All organic coating including PVF<sub>2</sub> "Kynar" shall be warranted by the manufacturer for a period of not less than 10 years or such longer periods the manufacturer normally provides.
- b) The fabricator shall certify compliance with all of manufacturer prerequisites for maximum warranty.

**(04) Samples**

- a) Submit Samples in accordance with section 01343 of Division 01000.
- b) Before any work is performed, the following samples shall be submitted:
  - Three sets of 300 mm x 300 mm (12 in. x 12 in.) sheets (pairs indicating range) of samples of each type of aluminium finish specified herein. The integral colour anodized samples must demonstrate the limits of colour range within which production materials will be processed.
  - Submit samples of all components, including all hardware trim, weather stripping and typical extrusions.
  - Representative samples of welded connections, mitred joint, and butt weld and typical brake form and bend for bar and sheet stock to show final finished appearance.
- c) Identify samples as to treatment, anodic film thickness, alloy, colour, and portion of the work to which the sample applied. Make samples on sections of similar shape as proposed materials and large enough to establish good comparison.
- d) For project reference, one set of record samples will be retained by the Engineer, and kept available at the job site and one returned to the Contractor.

**(05) Shop Drawings**

Submit shop drawings in accordance with section 01344 of Division 01000.

Coordinate shop drawings with material description to show location and extent of various finishes.

Identify finish by reference to Aluminium Association designations and to numbered samples established for the project. '

**(06) Maintenance Instructions**

Prepare and deliver to the Engineer a complete maintenance manual in accordance with the requirements of the "Project Record Documents" section 01720 of Division 01000.

Such documents are an integral part of the requirements of these Specifications and require close cooperation between the basic metal manufacturer, the fabricator and the finisher.

Reference information shall include:

- Complete description of alloy, temper, and finish of each type of material as delivered.
- Description of method by which finish was produced.
- Location in the building of each type.

Maintenance information shall include specific instructions for:

- Routine cleaning instructions with recommendations for materials and schedule applicable to locality and exposure.
- Recommendations for major cleaning as required to maintain anodized appearance and prevent development of oxidation.
- Instructions for re-finishing and restoration of original appearance.

Appropriate publications shall be included but these shall not be regarded as taking the place of required specific instructions.

**08112 PRODUCTS****A- Materials****(01) Aluminium**

- a) Sheet Aluminium
  - Natural Colour Anodized Sheet: No 55 Architectural Sheet or Anoclad Type 01.
  - Sheets to receive Integral Colour Finish: See "Aluminium Finishes".
- b) Extruded Aluminium
  - Natural Colour Anodized Extrusions: 6063- T5 alloy with a minimum wall thickness of 3.2 mm (1/8")

- Natural Colour for Snap-in Beads: 6063- T6 alloy.
- Structural Shapes, except where integral colour finish is indicated: 6063- T6 alloy. Extrusions for Integral Colour Finish: Special alloy, see "Aluminium Finishes".

c) Cast Aluminium

- Anodized Castings: 214 alloy.
- Structural Castings: 356- T6 alloy.

**(02) Support Devices**

- a) Fasteners used in assembling sections: Exactly matching adjacent surfaces where exposed or AISI 300 series stainless steel where concealed.
- b) Steel Anchors: Hot dip galvanized, or AISI 300 series stainless steel.
- c) Inserts: For required anchorage into concrete or masonry work furnish inserts of cast iron, malleable iron or 2.8 mm (12 gauge) steel hot-dip galvanized after fabrication.
- d) Expansion Anchor Devices: Fed. Spec. FF-S-325 Group II, Type 4, Class I, Int. Amendment 3; Molly "Parabolt" or equal.

**(03) Accessory Materials**

- a) Joint Filler: Expanded cellular neoprene, closed cell, tape, coated with non-staining adhesive on surface: ASTM D 1056 "Testing Sponge and Expanded Cellular Rubber Products", type SC-41 ; shape as required.
- b) Thermal Barrier: Solid neoprene, 60 durometer.
- c) Bituminous Paint: Koppers 50 or SSPC Paint 12 (0.03 in. per coat).
- d) Protective Coverings: After finishing procedures have been completed apply protective wrappings of paper or plastic film. Keep material dry until wrappings are removed.

**B- Aluminium Finishes**

Finish designations are indicated herein in accordance with the standards of the Aluminium Association.

**(01) Natural Colour Anodizing**

Aluminium Association AA-A41 and A-31.

- a) Exterior Aluminium: Architectural Class 1AA A-41 with a minimum coating weight of 5 mg/cm<sup>2</sup> (27 mg/sq. in.) and a minimum anodic film coating of 0.018 mm (0.7 mils).
- b) Interior Aluminium: Architectural Class II, AA-A31 , or as indicated, with a minimum coating of 0.01 mm (0.4 mils)
- c) Pre-treatment: Pre-treat aluminium specified as NCA in general as listed below. See drawings for finish in each specific location.

- Typical Finish unless otherwise specified: Clean and caustic etch AA C12-C21.
- Other Items: As called for on drawings by Aluminium Association designations on drawings and specified under sections or paragraphs dealing with specific item.
- d) Testing Standards:
  - Minimum Anodic Film Coating: (ASTM B 244)
  - Minimum Film Weight: (ASTM B 137)
  - Corrosion: no pitting at 500 hours (ASTM B 117).
  - Staining: ASTM B 136.
  - Mill Finish noted M10: As extruded but not to exceed 90 micro inch, 100 RMS surface roughness.
- e) Lacquer Coating: Clear lacquer coating, apply uniform 0.08 to 0.012 mm (0.3 to 0.5 mil); equivalent to electrostatic gun application, free of runs or brush marks.

**(02) Kynar Coating**

- a) Finish coating shall be a factory applied oven baked finish based on Kynar 500 "Kynar 500/DURANAR XLE" (Poly vinylidene Fluoride/PVFP<sub>2</sub>). Formulation shall contain a minimum of 70% poly vinylidene fluoride by weight. Licensed formulator shall identify the finish which he supplies as meeting the minimal requirements for formulation as set forth in Penwalt's licensing agreement.
- b) Application of the finish based on Kynar 5000 shall be performed under specifications issued by the licensed formulator and by an applicator specifically approved by one (or more) of the formulators. Said applicator shall provide written notification of approval by a formulator prior to application of the finish.
- c) Primer coat shall be corrosion resistant epoxy based primer with dry film thickness averaging from 0.0025 to 0.005 mm (.1 mil to .2 mils). The finished coat based on Kynar 5000 shall have a dry film thickness averaging 0.04 mm (1.5 mils).
- d) Testing Standards
  - Weatherometer: In accordance with ASTM E 24 withstand 500 hours exposure in the Sunshine Aro Weatherometer Model XW-R under 60/60 Dew Cycle conditions without evidence of chalking or withstand 2,000 hours exposure in Atlas Twin/Arc Weatherometer without evidence of chalking or film failure.
  - Humidity: In accordance with ASTM D 2247 withstand 3000 hours at 100 % relative humidity with no more than 5 % of surface showing blisters no larger than No.4 (ASTM D 714).
  - Salt Spray: In accordance with ASTM B 117 withstand 3000 hours at 5% salt fog at 35° C (95° F) with no more than a few blisters no larger than No.4

ASTM D 714 and no more than 1.6 mm (1/16 in.) creepage and loss of adhesion from line scribed to metal.

- Pencil Hardness: F-H.
  - Gloss:  $35 \pm 5\%$  on 60° gloss meter in accordance with ASTM D 523.
  - Adhesion: No removal of finish after 1.6 mm (1/16 in.) cross-hatching (ASTM D-3359) to bare metal, impacting to point of metal rupture and subjecting to application and quick removal of scotch cellophane tape.
  - Abrasion Resistance: 60 Litres/mil minimum ASTM D-968.
- e) Colour: As approved by the Engineer.

**C- Dissimilar Materials**

**(1) Dissimilar Metals**

Aluminium materials placed in contact with, or fastened to dissimilar metals should be separated from such metals by application of bituminous coating, non absorptive tape or gaskets or sealants.

**(2) Masonry, Concrete or Plaster**

Where aluminium materials are placed in contact with, or built into, masonry, concrete, or plaster, apply a heavy brush coat of alkali resistant bituminous paint, 1 mm (40 mils) dry film thickness.

**08113 EXECUTION**

**A- Construction Requirements**

The aluminium doors and windows shall be manufactured by an approved manufacturer in this trade.

The Contractor shall provide shop drawings based on Architectural drawings for the approval of the Engineer before orders are placed with the manufacturers.

The manufacturer shall use the latest and approved method of jointing employed in the manufacture of high class work viz. mechanical jointing, reinforced with concealed welding shall be used in the manufacture of doors and windows.

The workmanship of metal doors and windows shall conform to applicable provision of B.S. 990:1970.

**(01) Wind Pressure**

The Design wind speed to which the various elements of glazing and framing will be subjected to shall be calculated in accordance with B.S. CP-3 and the wind speeds of 80 mph are to be taken into account.

All assemblies must be of appropriate shape, thickness and sections, to enable them to resist the loads produced by repeated imposed wind pressures. The maximum deflection over clear span of any member shall be such that it does not induce cracking in glass panels and render the assembly unsafe. No member shall suffer any permanent deformation. No part of the work shall rattle in use.

**(02) Fixing**

The fixing of doors and windows to concrete openings shall be carried out in an approved method as indicated on the drawings or as directed by the Engineer. Provision of necessary groove or rebate and hold fasts in the concrete shall be made in the form work and no holing or drilling shall be allowed in the exposed concrete finishes. These shall be erected in position after the building structure is completed and by using proper hold fasts as shown on drawings or counter sunk bolts and screws as directed by the Engineer in accordance with site requirements.

**(03) Handling**

Care shall be taken in handling metal doors and windows, during transportation and at job site. These shall be stored under cover and shall be installed only by skilled mechanics, set plumb, level, in alignment and properly braced to prevent distortion.

**B- Protection**

- (1) The joint between window and door frames and the building shall be caulked with approved building mastic for total weather proofing.
- (2) After installation, doors and windows shall be protected from construction hazards that will interfere with their operation or damage their appearance or finish. They shall be cleaned on inside and outside of all mortar, plaster, paint of other foreign matter to present a neat appearance. Hardware and moving parts shall be lubricated.

**C- Glazing****(01) General**

The work of fixing glazing to doors, windows shall be carried out with the type and special quality of glass specified for each door and window and as indicated on the drawings or as directed by Engineer.

The sizes of glass indicated on the drawings are approximate only, and the actual sizes required shall be determined by measuring the frames to receive the glass. All glass shall be factory labelled on each pane and the label shall not be removed until finally approved by the Engineer. Glass will be fixed with best quality mastic compound of approved make suitable for the type of glass or as directed by Engineer. Special rubber lining and weather proof brush joints for sliding surfaces shall be provided where required.

**(02) Glazing Gaskets**

Structural Rubber Glazing Gaskets consisting of Dense Neoprene extrusions with injection molded corner units, fabricated into frames, with either integral or separate locking strips (Zippers); shall comply with ASTM C 542 black.

**(03) Standards and Performance**

Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading impact loading for operating sash and doors without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air-tight, deterioration of glazing materials and other defects in the work.



Protect glass from edge damage at all times during handling installation and operation of the building.

Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives directs otherwise.

Inspect each piece of glass immediately before installation, and eliminate any which have observable edge damage or face imperfections.

Cut and install tinted glass as recommended in "Technical Services Report No.104" by PPG Industries.

Install polysulfide sealants as recommended by Thiokol Chemical Corp., except as otherwise recommended by the sealant manufacturer.

#### **(04) Preparation for Glazing**

Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer

Do not attempt to cut, seam, nip or abrade glass which is tempered.

Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gaskets will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

#### **(05) Cure, Protection and Cleaning**

Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

Protect glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.

Wash and polish glass on both faces not more than 4 days prior to Employer's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

**08114 Measurement and Payment**

**A- Measurement**

Payment for doors and windows will be made by measuring clear opening area in block work or concrete in square feet.

**B- Rate and Payment**

Rates for all the items under this Section shall cover the cost of furnishing all the materials labour, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions of the Engineer. It is particularly mentioned that the rates for fixing doors and windows etc. shall include fixing of all finished hardware iron mongery fittings such as locks, peg, stays, handles, push plates, kicking plates, door closers, glazing, flexible compounds, rubber lining and appliances at site and performing all operations in accordance with the instructions of the Engineer and specifications.

The wastage for glazing due to breaking, cutting to sizes and replacement during maintenance period shall not be paid for separately and the rates shall be deemed to be inclusive of all these costs.

\*\*\* End of Section 08110 \*\*\*

**08120 FINISH HARDWARE****08121 GENERAL****A- Description**

This section covers fabricating, furnishing, and installing finish hardware.

**B- Applicable Codes and Standards**

The codes and standards applicable to only a portion of the work specified in this section are referenced in the relevant paragraphs. Codes and standards, which are generally applicable to the work of this section, are listed hereinafter:

<u>Sponsor</u>	<u>Number</u>	<u>Subject</u>
ANSI	A 156.1	Butts and Hinges
ANSI	A 156.2	Locks and Lock Trim
ANSI	A 156.3	Exit Devices
ANSI	A 156.4	Door Controls-Closers
ANSI	A 156.5	Auxiliary Locks & Associated Products
ANSI	A 156.6	Architectural Door Trim
ANSI	A 156.13	Mortise Locks and Latches
ANSI	311	Door Controls Overhead Holders
ANSI	501	Auxiliary Locks
ANSI	1201	Auxiliary hardware
ANSI	1301	Materials and Finishes
ANSI	80	Fire Doors and Windows

**C- Submittals**

The following submittals are required:

1. Installation Manuals  
Includes complete installation and adjusting instructions.
2. Samples  
Representative samples of complete finished units as may be requested.
3. Manufacturer's Data
4. Operations and Maintenance Manuals  
Include instructions for operating parts and maintenance of exposed finishes.

5. Certificates of Compliance

Certificates of qualified independent testing laboratories certifying that a prototype of each item of hardware has been tested in accordance with the applicable BHMA or ANSI testing procedures and meets the requirements of the specified standard and grade.

**D- Quality Assurance**

1. Manufacturer

Obtain each kind of hardware (latch and lock sets, hinges, closers, flush bolts, holders, etc.) from only one manufacturer.

2. Fire-Rated Openings

a) Provide hardware for fire-rated openings in compliance with NFPA Standard No.80. This requirement takes precedence over other requirements for such hardware. Provide only hardware which has been tested and listed by UL, or an approved equal fire rating agency, for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.

b) Where panic exit devices are required on fire-rated doors, (with supplementary marking on UL door label or approved equivalent indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label or approved equivalent on exit device indicating "Fire Exit Hardware".

**E. Product Handling**

Provide secure lock-up for hardware delivered to the project, but not yet installed. Control the handling and installation of hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation.

**F- Job Conditions**

1. Coordination

Coordinate hardware with other work. Tag each item or package separately with Identification related to the final hardware schedule, and Include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.

2. Templates

Furnish templates to fabricators of other work which is to be factory prepared to receive finish hardware.

**G. Tools and Spare Parts**

1. Tools

Three sets of all special tools required for use in adjustments, maintenance, assembly, and removal and replacement of builder's shall be furnished for

each different type of hardware furnished. The use of each special tool shall be indicated.

2. Unused Parts

Deliver to designated personnel all miscellaneous accessories accompanying hardware which are not incorporated in the work, such as leftover equipment, special wrenches for hardware, screws, extra strikes, emergency type keys and other similar parts.

**H- Shipping**

Packing each item separately, with identification related to the approved hardware schedule. Include basic installation instructions in the packages.

**I- Security Control Hardware**

1. Coordination with Other Work

Various items of hardware for security control, such as electrical hinges, electrically operated locksets, balanced magnetic switches, electric strikes, solenoid operated panic devices, electric power transfers and similar devices are included in another section of the works. Verify and confirm the extent and details of such other work, and coordinate and cooperate with the work of such other section.

**08122 PRODUCTS**

**A- Materials**

**(01) General Metals and Finishes**

For all items in each hardware set at each opening furnish base materials and exposed finishes as set forth below, Finish code numbers specified are from BHMA 1301; finishes shall comply therewith. Match the finish of every hardware unit at each door or opening to the greatest extent practicable, except as otherwise indicated. Limit differences in colour and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening, including items with factory painted finishes. In general, match all items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for colour and texture. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminium, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".

- a) Butts and Hinges at Exterior Doors: Type 304 stainless steel with satin finish, code 630.
- b) Hinges at Exterior Gates: Stainless steel with satin finish, code 630
- c) Butts and Hinges at Interior Doors: Steel, satin chromium plated, code 652.
- d) Knobs, Panic Bars and Accompanying Trim: Stainless steel with satin finish, code 630.
- e) Other Stainless Steel Items: Satin finish, code 630.
- f) Concealed Closers: Satin chrome plated, code 626, on exposed portions.

- g) Surface Closers and Covers: Satin chrome plated, code 626, unless otherwise specified.
- h) Padlocks: Hardened steel shackles, satin chrome, code 626.
- i) Rust Resistant Finish (-RP): For iron and steel base metal, required for exterior work (and also when designated with the suffix "-RP", provide 0.005 mm (0.2 mil) thick copper coating on base metal before applying brass, bronze, nickel or chromium plated finishes, or prime painting with weather-resistant epoxy primer.
- j) Aluminium Finish: Furnish all aluminium manufactured items with a BHMA 628 finish, clear anodised aluminium; or 671, a flat black coated aluminium, where scheduled.
- k) Keys: Nickel silver.
- l) Other Items: Brass or bronze, satin chromium plated, code 626, unless otherwise specified.

**(02) Templates**

Where templates are furnished for preparation of other work to receive builder's hardware, provide hardware conforming to the templates.

**(03) Hand of Door**

The drawings show the swing of each door leaf. Furnish each item of hardware for proper installation and operation of the door swing as shown and for hand of door conforming to final hardware schedule.

**(04) Bi-Lingual Identification**

Where words are required on hardware (such as "push" or "pull") provide them in both Urdu and English.

**(05) Fasteners**

- a) Furnish necessary screws for installation of each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed and partially exposed screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish. Do not provide hardware which has been prepared for self-tapping sheet metal screws except as specifically indicated. Furnish wood screws for all connections to wood doors, and machine screws for all connections to metal parts and assemblies.
- b) Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard-manufacturer units of the type specified are available with concealed fasteners.
- c) Fasten closers on doors with hex bolts.
- d) Fasten items mounted on hollow plaster, stone, marble and ceramic tile partitions with machine screws into metal backing plates secured to studs.

- e) Provide fasteners which are compatible with both the unit fastened and the substrate and which will not cause corrosion or deterioration of hardware, base material or fasteners.

**(06) Butts and Hinges**

ANSI A 156.1, Grade 1 where specified and where heavy weight hinges are required, others Grade 2; full mortise, template, fast button tips, square cornered, non-removable pins at hinges exposed at exterior, unless otherwise specified or scheduled.

- a) Bearings: Ball bearings at fire rated doors; ball or anti-friction bearings at other doors; plain bearings only where specified. Provide ball or oil-impregnated porous metal bearings at all doors with closers, except do not use oil-impregnated bearings at fire doors.
- b) Number of Hinges: Provide 1 1/2 pair hinges (butts) on each door leaf more than 1.52 m (60 in.) high and up to 2.29 m (90 in.) high; provide one additional hinge on each leaf for each additional .762 m (30in.) of height, or fractions thereof, in excess of 2.29 m (90 in.). For each leaf less than 1.52 m (60 in.) high provide one pair of hinges.
- c) Hinges Sizes:
- Heights: except as otherwise scheduled, provide heights and weights as follows for doors 44 mm (1 3/4 in.) thick:

Door Leaf Width mm (in.)	Hinge Height mm (in.)	Weight	Thickness mm (in.)
914 (36") or less	114 (4 1/2)	Standard	3.4 (.134)
Over 914 (36") to 1066 (42")	127 (5)	Standard	3.7 (.146)
Over 1066 (42") to 1219 (48")	127 (5)	Heavy	4.8 (.190)

- Provide heavy weight hinges conforming to Note "A", Paragraph 1.9, ANSI A 156.1 for doors 50 mm (2 in.) or more thick and for other heavy doors.
  - Widths: Provide hinge widths equal to twice the door thickness plus trim projection. For doors thicker than 63 mm (2 1/2 in.) add an additional 6 mm (1/4 in.) to hinge width. If width so determined is not a standard size for the specified height, provide next larger standard width.
- d) Spring hinges: Bommer No.4010-4, McKinney-Chicago 2002-4 or approved equal, single acting, square corners, standard template hinge, or approved equal, installed reversed to hold door open approximately 30 degrees.

**(07) Pivots**

- a) Centre Hung Interior: ANSI A 156.1, A 2742 pivot set, concealed, double acting, as scheduled.
- b) Offset Pivots: ANSI A 15.61, as scheduled.

**(08) Locksets and Latchets**

ANSI A 156.13, Operational Grade 1, Security Grade 2, mortise type, Products whose functions are identified by NBHA numbers shall be identical in all other respects to the ANSI standards specified. All locksets and Latchets shall be products of the same manufacturer.

- a) Knobs and Trim:
  - Knobs and Trim: Conform to ANSI A 156.2, Paragraph 7.2, with design similar to Schlage Lock Company 83, Sargent SBS, or approved equal.
- b) Deadlocking: Provide locks for doors at exterior, corridors and halls with automatic deadlocking latch bolts.
- c) Strikes: Wrought box type; lips curved and returned to door frame or frame trim, or to astragal or face of door at pairs of doors, with minimum projection necessary for protection of frame and trim.
- d) Exiting Function: All locks shall be open able from the inside without use of a key or any special knowledge or effort.
- e) Auxiliary locks shall conform to ASNI A 156.5 as scheduled.

**(09) Cylinders**

- a) Seven pin tumblers; finish-exposed surfaces to match lock trim.
- b) Furnish all cylinders with "Best-Suffix B" Key-removable interchangeable cores.
  - Furnish all exterior cylinders with "Best 1 E784" dust covers.
  - Control key shall function on all seven pin tumblers.
  - Furnish bottom pins in hardened steel, and mushroom type pins for master pins.
  - Furnish all cylinders with internal concealed setscrews.
  - All cylinder core faces shall be drill resistant.
  - Furnish cylinders and cores for all scheduled locks. including electric locks furnished by others.
  - All permanent cores and keys shall be shipped by manufacturer to Client. Installation of cores will be by Client.

**(10) Padlocks**

BHMA 501, E 18121 with shackles modified when required to properly fit item locked, cases, shackles and all inner arts plated for corrosion resistance, keyed in the keying system, alike or differently as directed or scheduled in the final schedule.



**(11) Keying and Master Keying**

- a) General: All locksets, padlocks and cylinders shall be great grandmaster-keyed, grand master-keyed, master-keyed and change-keyed at the factory where records shall be established and maintained. Key locks as directed.
- b) Special design and markings are required for control keys, and a separate special design and marking system are required for all other keys. The Contractor shall prepare a comprehensive keying plan for approval by the Engineer.
- c) Identification: Identify all great grandmaster, grandmaster and master keys with a registry number, not with "Master" or the letter "M". Stamp individual change keys with a plain identification number, not a key cut. Factory cut all keys and stamp with "Do Not Duplicate". Make key markings in Urdu one side, English on other side, except numbering shall be in English only. Provide lists of identification numbers for each key showing the room names and door numbers for each key, corresponding to the identification numbers stamped on the keys. Indicate on the lists which keys are great grandmaster, grandmaster and master keys. Maintain lists in confidence; deliver directly to the Engineer.
- d) Construction Keys: All locksets, padlocks and cylinders shall be construction keyed.
- e) Key Quantity:
  - Change keys: Three each lock
  - Master Keys: 12 each master key group
  - Great Grand Master Keys: 6 each great grand master key group.
  - Construction master Key: Twenty four.
  - Uncut Keys: 20 percent of total. Match key way and special standard designs, artwork, and markings as applicable, for other keys specified in this section.
  - Control Keys: 6 for each control key group

**(12) Exit Devices**

ANSI A 156.3. Provide outside knob and trim to match those on locksets as closely as practicably.

- a) Surface Mounted Strikes: Roller type
- b) Strikes Not Otherwise Required: Mortise type

**(13) Closers**

ANSI A 156.4 conforming to following unless otherwise specified:

- a) Materials: Manufacturer's Standard
- b) Surface Closers: Grade 2 modern type, regular or parallel arm as required for mounting closers on inside face (room side) of doors. Provide drop brackets

on doors with narrow top rails. Bracket mounting of closers in the opening is not permitted. Provide soffit brackets for arms of parallel arm closers.

- c) Concealed Closers: Overhead concealed with concealed arm, Grade 2, to fit within narrow transom bars shown.
- d) Floor Closers: ANSI A 156.4, single-acting Type C 06023 centre pivoted with top pivot.
- e) Coordinating Devices: ANSI A 156.3. Provide wherever the leaves of pairs of doors equipped with closers might close in the wrong sequence for proper meshing of automatic flush bolts, astragal rabbets, latches, bolts or exit devices.
- f) Sizes: Provide closers continuously adjustable through the entire size range.

**(14) Flush Bolts**

BHMA 1201, Type L 14081 or L 14091 as applicable, minimum length 300 mm (12 in.), longer lengths as required so that levers of top bolts are not more than 1.930 m (76 in.) above floor. Provide dust proof strikes, Type L 14011, at bottom bolts, except where threshold construction provides non-recessed strike for bolt.

**(15) Surface Bolts**

BHMA 1201, Type L 14132 or Type L24132

**(16) Automatic Flush Bolts**

Door Controls, Inc., 840 series for metal doors, 940 series for wood doors, provide at top and bottom of inactive leaves, provide No.80 dust-proof strike for each pair.

**(17) Push Plates**

ANSI A 156.6,J 300, Powder coated stainless steel plate, 100 mm x 400 mm x 1.27 mm (4 in. x 16 in. x 0.050 in.).

**(18) Pull Plates**

ANSI A 156.6,J 400, Powder Coated stainless steel, 100 mm x 400 mm (4 in. x 16 in.), style to match push plates, grip projection 49 mm (1 15/16 in.), 130 mm (5 1/8 in.) centre to centre of grip mountings.

**(19) Push Bars**

As schedule in Attachment A.

**(20) Offset Pulls**

Powder Coated Stainless Steel bar 25 mm (1 in.) diameter full length between grip contact surfaces with doors, 250 mm (10 in.) c/c of grip mountings, 57 mm (2 1/4 in.) clearance, 83 mm (3 1/4 in.) projection, offset approximately 64 mm (2 1/2 in.)

**(21) Stops**

BHMA 1201, Grade 1. Provide floor type stops except where otherwise scheduled. Provide roller bumpers only where scheduled.

- a) Floor Stops: Type L 12121, L 12141 or L 12161 as required to properly engage bottom of door. Provide risers as required for carpet and as required to properly engage bottoms of doors.
- b) Wall Stops: Type L 12011, or L 12021 as applicable to wall material.
- c) Combination Bumper/Coat Hook: Bobrick B-212, Mokinney 1048 B, Watrous W-1654, or approved equal.
- d) Roller Bumpers: Grade 1.
- e) Anchor Plates: Builders Brass Works 8017

Quality 530

Trimco 1268

## (22) Holders

BHMA 1201, Grade 1. Provide wall type holders except where there is no suitable location for wall mounting, in which case provide floor type. Provide automatic type except where manual type is scheduled.

- a) Automatic Wall Holders: Same as Type L 11301 except with wall mounted strike adjustable 45 degrees left and right for proper contact with doors.
- b) Manual Wall Holders: Type L 11341 or L 11351 as applicable to wall material.
- c) Automatic Floor Holders: Type L 11301
- d) Manual Floor Holders: Type L 11361 or L 11371 as applicable to floor material.
- e) Electro-Magnetic Holders: ANSI A 156.15, C 00021 or C 00031 floor mounted, as applicable, C 00011 wall mounted where scheduled.

## (23) Overhead Holders

BHMA 311, Grade 1, concealed, C 11511 exterior doors, C 14531 at interior doors, unless otherwise scheduled.

## (24) Thresholds

ANSI A 156.6., J 600, design, shapes and sizes as shown, extruded aluminium unless otherwise scheduled. Lengths to allow notching around fixed stops on doorframes provide light duty thresholds unless heavy duty is specified. Provide thresholds where shown.

### a) Minimum Thicknesses

	Directed Tread surfaces	Secondary Tread Surfaces	Unexposed Flanges and Legs
Light duty	3 mm (1/8 in.)	2.5 mm (1/8 in.)	1.6 mm (1/16 in.)
Heavy duty	6 mm (1/4 in.)	4.8 mm (3/16 in.)	3.0 mm (1/18 in.)

- b) Exterior Thresholds: Corrugated type, modified to 6 mm (1/4 in.) high with 13 mm (1/2 in.) drop offset, 140 mm (5 1/2 in.) wide, unless otherwise shown.
- c) Interior Thresholds: Plane, smooth top surface without abrasive; 13 mm (1/2 in.) high, 100mm (4 in.) wide, tapered sides similar to corrugated type, unless otherwise shown.

**(25) Head and Jamb Weather-strip**

Pemko 114 PF PS, or approved equal.

**(26) Stripping and Seals**

Adjustable bumper type sound stripping with closed cell extruded sponge neoprene, ribbed face insert retained in adjustable metal strip by captive adjustment screws, with metal housing; forming a combination door stop and seal; extruded aluminium, 1.6 mm (1/16 in.) minimum thickness of main walls and flanges. Thickness of seals mounted on stops -13 mm (1/2 in.); seals mounted directly on frames -not over 24 mm (15/16 in.) thick and with 16 mm (5/8 in.) contact face.

- a) Automatic Door Bottoms: Automatic drop-seal, centre mortise, flush recessed, or surface type as scheduled with closed cell sponge neoprene seal bar retained in extruded aluminium bar, capable of operating to close a 19 mm (3/4 in.) gap from door bottom to floor or threshold, housed in extruded aluminium 1.6 mm (1/16 in.) thick.
- b) Finish: Mill finish suitable for paint priming, unless otherwise scheduled.

**(27) Astragal Seals**

Builders Brass Works 9604, Pemki 352AR, or approved equal.

**(28) Magnetic Astragals**

Pemki 351AM, Zero 371, or approved equal.

**(29) Lock Astragals**

Builder Brass Works 9615-1, or approved equal.

**(30) Kick Plates**

ANSI A 156.6, Type J 100, stainless steel, B3E, 250 mm (10 in.) x width of door less distance to clear door stops by 3 mm (1/8 in.), satin finish, code 630.

**(31) Armour Plates**

Same as specified for kick plates except 760 mm (30 in.) high unless otherwise shown or scheduled in Attachment A.

**(32) Roller Latches**

BHMA 501, Type E 19101

**(33)    Unscheduled Hardware**

- a)       Silencers: GHMA 1201; Type L 03011 for metal frames. Provide 3 for each single doorframe and 4 for each double door frame as applicable.
- b)       Set for Locksmith Equipment and Supplies: Provide all of the following as a set, if individual items are scheduled separately provide only the scheduled items. All shall be as manufactured by Best Lock Corporation unless otherwise specified.
  - Key Duplicating Machine: Le Gard L 1011 (for keys for locks other than specified in this section.
  - Key Combinator: AD 432-4 or to suit keying system provided.
  - Combining Kit: CD 431-4 or to suit keying system provided.
  - Letter and Number Dies: DD 502 and DD 503. In addition provide dies comparable to the foregoing including Urdu numerals and complete Urdu alphabet. Size 2.38 mm (3/32 in.)
  - Core and key Marking Plate: DD 514
  - Core Capping Press: CD 517
  - Mortise Cylinder Assembly Tool: ED 212
  - Mortise Cylinder Wrenches: ED 211; provide three.
  - Uncombined Cores: Matching cores for locksets provided; quality equal to 20 percent of the number of locksets provided under this section.
  - Pin segments, Caps, and Springs: Quality and quantity required to combine specified number of uncombined cores.
  - Cylinders: Completely assembled, matching cylinders for locksets provided, less cores; quantity equal to 10 percent of the number of locksets provided under this section.
  - Padlock Shakless and Other Padlock Repair Parts: As required for replacement and repair of 10 percent of padlocks provided under this section, but not less than for 10 padlocks
  - Powdered Graphite Gun: CD 535  
Graphite: CD 535 AI two containers, each containing 0.45 kg, (1 lb).
  - Copy of Factory Key Code: Maintain confidentiality; deliver to personnel designated by the Engineer, directly from the manufacturer.
  - Service Manual: include instructions for keying cores, core information, cutting keys in key machines, and servicing of key machines.
  - Training Programme: Provide as specified in section 01765.

**(34)    Bi-Fold Door Hardware**

- a)       Bi-Fold Hardware Sets: ANSI A 156.9, Type D 8631, complete set with hinges.
- b)       Knobs: BHMA 201, Type D 12132 cabinet knobs.

**(35) Hardware**

Furnish hardware not specifically mentioned, and not specified in another section, corresponding in quality, sizes, function and finish to that specified for similar and corresponding applications, as necessary for proper installation and function. Furnish hardware sets as specified.

**08123 EXECUTION****A- Shipping**

Package each item separately, with identification related to the approved hardware schedule. Include basic installation instructions in the packages.

**B- Installation****(01) General**

All installation shall be in accordance with manufacturer's written instructions and recommendations.

**(02) Locations**

Mount hardware units at heights recommended in "Recommended Locations for Builders' Hardware for Custom Aluminium Doors and Frames" by NGHHA, except as otherwise specifically indicated or required to comply with governing regulations, and except as may be otherwise directed.

**(03) Removal for Finishes**

Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

**(04) Alignment**

Set units level, plumb and true to line and location. Adjust the reinforcement of the attachment substrate as necessary for proper installation and operation.

**(05) Preparation for Fasteners**

Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

**(06) Surface Closers**

Mount on inside face of doors.

**(07) Thresholds**

- a) Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Extend thresholds to frames below weather-stripping and sound seals. Notch ends around stops, which are integral with frames.

- b) Screw thresholds to substrate with 5.0 mm (No.10) or larger screws, of the proper type for permanent anchorage and of stainless steel or other metal, which will not corrode in contact with the threshold metal.
- c) At exterior doors, and elsewhere as indicated, set each edge and close each open end of thresholds in a seal strip of butyl rubber sealant or polyisobutylene mastic sealant.

**(08) Kickplates and Armour Plates**

Mount with uniform reveal two sides and bottom. Mount on side of doors opposite hinges unless otherwise scheduled or shown.

**(09) Lubrication**

Lubricate moving parts with lubrication recommended by manufacturer (graphite if no other recommended) .

**(10) Instructions**

Instruct designated personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

**(11) Key Tagging and Verification**

Verify keying of all cylinders and suitably tag each and identify each cylinder to indicate its location, including emergency keys.

**C. Inspection and Testing**

After the hardware has been installed, various units shall be inspected, adjusted and placed in proper operating condition. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Replace units, which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made. Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance of occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors.

**08124 MEASUREMENT AND PAYMENT**

No separate payment shall be made for finish hardware as contained in this section of the specifications and it shall be included in the rate of the relevant item of the Bill of Quantities.

\*\*\* End of Section 08120 \*\*\*

**08130 STEEL DOORS****08131 GENERAL****A- Description**

The work covered under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the installation of steel doors, complete in strict accordance with this section of the Specifications; and the applicable drawings and subject to the terms and Conditions of the Contract.

**B- Applicable Codes and Standards**

The codes and standards applicable to only a portion of the work specified in this section are referenced in the relevant paragraphs.

**C- Submittals****(01) Shop Drawings**

Contractor shall submit shop drawings, which shall show full construction details, quantities and locations with metal gauges, reinforcing, cut outs, hold fasts and attachment to adjacent construction and materials. Shop drawings shall be submitted at the appropriate time to allow for approved checking, revisions, and time to permit manufacturer the product delivery and the start of installation work. All operations shall conform to the construction programme.

**(02) Sample**

Contractor shall submit representative samples of a typical steel door, hardware, accessories and any other material instructed by the Engineer for his approval well in advance of its installation. For steel doors, the Contractor shall similarly submit corner sections of typical welded frames, in the specified thickness, showing reinforcing, welding and prime paint coat.

**(03) Installation Manuals****(04) Manufacturer's Data****(05) Operation and Maintenance Manuals****(06) Quality Standard**

All steel doors shall be the product of reputable manufacturer as approved by the Engineer. They shall be of the type indicated on the drawings and shall conform to the requirements shown and as specified herein.

**08132 PRODUCTS****A- Steel Doors**

All frames shall be made of mill quality cold rolled steel, exterior frames and doors shall be galvanised steel.

All contours and arises shall be as true and sharp as can be produced in the thickness of metal required.



Construction joint of steel work be welded to full depth and width or equivalent splice plates shall be welded on unexposed faces of frames. Exposed surfaces of welded joints shall be dressed and ground smooth to produce invisible connections.

The finished work shall be strong and rigid, neat in appearance and free from defects. Plain surfaces shall be smooth and free from warp or buckle. Moulded members shall be clean, straight and true. Fastenings shall be concealed where practicable.

Reinforcement and stiffeners shall be welded to inside of frame surfaces.

All frames shall be secured to the structure with strong wrought iron Holdfasts. Holdfasts shall be 50 mm wide and 6 mm thick and shall be screwed to frames. Attachment shall be concealed.

All exterior doors, frames, anchors, reinforcing and related items shall be fabricated from hot dipped galvanised steel, conforming to B.S. 729, Part I. Following fabrication, touch up all welds with liquid zinc.

All surfaces of doors, frames, holdfasts and related item shall be cleaned, followed with bonding or phosphating processes. One coat of zinc chromate or synthetic resin primer in a light grey colour shall then be applied for subsequent application of specified paint.

#### **08133 EXECUTION**

##### **A- Product Delivery and Storage**

Place finished doors individually in a manner, which will ensure complete protection of all door surfaces. Keep doors in up right position, under cover, in a manner preventing rust and damage.

Supply frames with removable angle spreaders securely fastened to the bottom of each joint, do not remove spreader until frames are secured in place. Store frames the same way as doors.

Deliver doors in a manner preventing damage to units and store of the ground, undercover in a manner preventing rust or damage.

##### **B- Installation**

The Contractor shall be responsible for the proper protection and installation of all items furnished. Should the prime coat be damaged, or rust or scale appears, he shall at his own expense and at the Engineer's direction have all exposed surfaces cleaned to bare bright and re- primed with an approved priming coat before finish painting.

All items shall be installed plumb and square and shall be solidly anchored in a good workmanlike manner in accordance with the approved shop drawings. 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 final acceptance.

##### **C- Cleaning and Protection**

###### **(01) Cleaning**

Upon completion of the installation of steel door, clean all exposed metal surface as recommended by the manufacturer.

**(02) Protection**

Protect the work. Repair or replace damaged work as required by the Engineer.

**08134 MEASUREMENT AND PAYMENT****A- Measurement**

Payment for doors and windows will be made by measuring clear opening area in block work or concrete in square feet.

**B- Rate and Payment**

Rates for all the items under this Section shall cover the cost of furnishing all the materials labour, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions of the Engineer. It is particularly mentioned that the rates for fixing doors and windows etc. shall include fixing of all finished hardware iron mongery fittings such as locks, pegs, stays, handles, push plates, kicking plates, door closers, glazing, flexible compounds, rubber lining and appliances at site and performing all operations in accordance with the instructions of the Engineer and specifications.

\*\*\* End of Section 08130 \*\*\*

**08210 WOODEN DOORS****08211 GENERAL****A- Scope of Work**

The work covered under this section of Specifications consists of furnishing all labour and materials and performing all operations in connection with installation of all wood work, mill work, construction, assembly and surface finish treatment, building in of all cabinet type of items, complete in every respect, including all related items, supports etc. of wood or metal and incidentals, associated wood work appurtenances, the application of all 'Hardware' in connection with finished wood work, in strict accordance with requirements of Drawings, as specified herein subject to the terms and conditions of the Contract Documents and to the entire satisfaction of the Engineer. The work under this section shall further conform to the requirements of the British Standard Codes of Practice, e.g. Cp. 161: Part 11: 1957, CP.112.100: 1952 and all the British Standards relied therein and/or bearing relevance to this item of work.

**B- Submittals**

The following submittals are required:

Detail Drawings and/or Shop Drawings

Assembly, Erection and Installation Drawings and Manuals

1. Samples
  - a) Solid wood for transparent finish. Submit finished samples, 19 mm by 75 mm by 300 mm (3/4 inch by 3 inch by 12 inch) for each species.
  - b) Plywood or veneer for transparent finish. Submit three finished samples, 300 mm (12 in.) square, for each species and cut.
  - c) One unit of each type and finish of exposed hardware.
  - d) One unit of each type of material to be used under this section.
2. Manufacturer's Data

**C- Quality assurance**

1. Quality Standards

Except as otherwise shown or specified, comply with specified provisions of the AWI "Quality Standards or WIC Manual of Mill work.
2. Measurements

Before proceeding with woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details as required for accurate fit.
3. Optimum Moisture Content

Kiln dry woodwork to an average moisture content within 6 to 11 percent, or as otherwise recommended by applicable quality standards for the regional climatic conditions involved.

4. Matched Wood Veneers

Fabrication and installation of all architectural woodwork with blueprint or sequence matched wood veneers shall be provided by one firm.

**D- Product Delivery Storage and Handling**

1. General

Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

2. Storage

Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in storage or installation areas.

**E- Job conditions**

Do not install woodwork until the required temperature has been stabilized in installation areas.

Maintain temperature and relative humidity as required for a tolerance of plus or minus 1 percent of the specified optimum moisture content until woodwork receives specified finishes. Maintain temperature until acceptance of the work.

**08212 PRODUCTS**

**A- Materials**

**(01) Timber**

Materials for the work included in this section shall conform to the following:

a) General Characteristics

The timber shall be in accordance with the requirements of BS:1186 'Quality of Timber and Workmanship in Joinery', Part 1, 'Quality of Timber'.

First quality timber shall be from the heart of a sound tree, the sap wood being entirely removed, the wood being uniform in substance, straight in fibre, free from large or dead knots, flaws, shakes or blemishes of any kind. The colour of good timber shall be uniform through out and among coloured timbers, darkness of colour is an apparent indication of strength and durability.

For first quality teak wood, the size of the knot shall not be more than 1/2" and there should not be more than one knot in every 9 Sft. of timber.

For first quality deodar wood, the size of the knot shall not be more than 1" and there shall not be more than one knot in every 4 Sft. of timber.

b) Seasoning of Timber

Timber shall be properly seasoned. It shall be kiln or air dried to reduce the moisture content to a minimum of 20% of its natural weight.

The methods of seasoning timber are as follows:

- Air Seasoning: This consists of sawing the logs into planks or rectangular sections of convenient size for use and stacking them in such a way that air can circulate around the wood, preferably in open sided sheds. The moisture contents will be reduced to about 16%. The time depends on the type of wood, its thickness and the weather. Generally, soft wood takes 2 to 3 months and hard wood about 8 to 12 months for every inch thickness.
- Kiln Seasoning: This process consists of drying the wood in a kiln. The process consists of fanning a blend of warm dry air and warm moist air over the wood at a controlled humidity. Kiln drying is preferable for internal joinery and furniture as air seasoning does not reduce the moisture contents sufficiently to ensure a stable equilibrium. Time taken to kiln dry hard woods varies from a few days in the case of thinner boards upto 3 to 4 weeks for 3 inch planks.

c) Preservation of Timber

Preservatives may be applied in a variety of ways including pressure impregnation, hot and cold open-tank treatment, dipping, brushing and spraying depending upon the use of timber and class of the preservative treatment according to the British Standard Code of Practice CP: 98:1964. Local proprietary products of chemical wood preservatives under the label of "WOOD GUARD" or equivalent shall be used alongwith their implied methods of use etc.

d) Timber Quality

The requirements set forth in BS:1186, Part 1, shall serve as a general guide in selecting timber including plywood of suitable quality.

e) Adhesives

For joiners work animal glues complying with BS:745, 'Animal Glues for Wood' casein glues complying with BS:745, 'Cold Setting Casein Glue for Wood', or synthetic resin adhesive complying with BS:1204, 'Cold Setting Synthetic Resin Adhesives for Construction Work in Wood' shall be used. For flush doors and other forms of construction that rely mainly upon the adhesive, and particularly where exposure conditions are severe and prolonged dampness is likely to occur, one of the more moisture resistant shall be employed, the choice depending upon the severity of the conditions to which the work will be exposed.

f) Nails and Screws

For joiners work, wire nails, chequered head, lost head round or panel pins complying, with BS:1202, 'Wire Nails and Cut Nails for Building Purposes' or wood screws in accordance with BS:1210 shall be used. The gauge of nail or screw used shall be suited to the woods being fixed and to which a fixing is being made, and the length shall be such as will give a sufficiently strong and secure fixing. CP: 112. 'The Structural Use of Timber in Buildings' shall be followed which gives relationship between gauge, amount of penetration and strength. All nails and screws used with reactive timber (becoming stained and disfigured by reaction with ferrous metals) shall be of non-ferrous metals or shall be protected in some manner before use if the wood work is likely to be subjected to moist conditions, e.g. external doors.

**(02) Ply Wood**

BS:565:1963 Section 5, 'Glossary of Terms Applicable to Ply Wood', defines ply wood as 'an assembled product made up of plies and adhesives, the chief characteristic

being the crossed plies which distribute the longitudinal wood strength'. The term plywood in general sense includes similar products such as laminated board, block board and batten board. BS: 1455:1963 shall be used for acceptable standards of plywood.

a) Three Ply and Multiply Ply Wood

Three-ply construction includes a 'face' a 'back' and a core or inner ply. Multiply includes a face, a back and a core of three or more inner plies. With very few exceptions the grain of each veneer in the core runs at right angles to that of the veneers on either side of it.

The construction of plywood may be balanced with an odd number of veneers arranged symmetrically or unbalanced. The tendency of the finished board to distort is reduced by adopting a balanced construction.

The construction may vary for a given panel thickness by the inclusion of veneers various thickness. This will affect the strength properties.

Ply wood according to BS: 1455:1963 is classified into two main types, viz interior and resin bonded.

Interior type plywood is suitable for most interior work including flush doors, door panels wall panelling, balustrades, subflooring, kitchen fitments, and any location where resistance to moisture is not required. Adhesive used include casein, soya, blood albumen and animal glues as well as synthetic resin extended with other substances.

Synthetic resin bonded plywood while being suitable for the same purpose as interior type, has a much greater resistance to moisture. The more resistant types are suitable for external flush doors and door panels, wall sheathing, shop front fascias, sign boards, shuttering and form work for concrete and for any purpose where it may be exposed to moisture. Adhesives used include urea, melamine phenol and resorcinol formaldehyde (arranged in order of increasing moisture resistance).

The Contractor shall procure plywood according to various grades specified in BS: 1455, "Ply Wood Manufactured from Tropical Hard Woods" and are briefly given as under for guidance.

Grade 1 Veneer: Shall be of one or two pieces of firm smoothly cut veneer. When of two pieces, the joint shall be approximately at the centre of the board. The veneers shall be free from knots, worm and beetle holes, splits, dots, glue stains, filling or inlaying of any kind or other defects. No end joints are permissible.

Grade 11 Veneer: Shall present a solid surface free from open defects. Veneers, when jointed need not necessarily be matched for colour or be of equal width. A few sound knots are permitted with occasional minor discoloration and slight glue stains, isolated pinholes not along the plane of the veneer. Occasional splits not wider than 1/32 inch and not longer than 1/10 of the length of the panel or slightly opened joints may be filled with a suitable filler. No end joints are permissible.

Grade 111 Veneer: May include wood defects including work holes which are excluded from Grade 1 and 11 above in number and sized which will not impair the serviceability of the ply wood. It may also include manufacturing defects such as rough cutting, overlaps, gaps or splits provided these do not affect the use of the ply wood. No end joints are permitted.

The uses, for which ply wood made with the grades defined above are considered useful, are outlined hereunder:

Grade 1 For use in its natural state.

Grade 11 For use where subsequent painting and/or veneering is intended.

Grade 111 For use where it is not normally visible.

Under the Specifications where combinations of above grade are required, these combined grades may range from 1/11, 11/11 and 11/111, as additional grades of these Specifications.

b) **Laminated Board**

This is built-up board, with narrow strip 3 to 7 mm wide, faced both sides with either one or two veneers from 1.2 mm to 3.7 mm thick. Where single or double face veneers are used, the grain usually runs at right angles to the grain of the core strip. This type of board when available varies between 1/2 inch to 1 inch and is an ideal base for the highest class of veneered wood. For detailed Specifications, BS:3444, 'Block Board and Laminated Board' shall be used.

c) **Block Board**

This board is of similar construction to laminated board but core is built-up of blocks upto 1 inch wide. It is used as a base for veneering and for painted work but is considered slightly inferior to laminated board for the former use. The range of size and thicknesses in which it is manufactured are similar to those of laminated board. For detailed Specifications BS:3444: 1961, 'Block Board and Laminated Board' shall be used.

d) **Fabrication**

Ply wood can be worked by all normal wood working tools, both hand and machine and can be fixed by panel pins, screws, rivets, gluing, grooving, into framing, tonguing and grooving and by metal tooth plate or split ring connectors. For exterior work, galvanized and copper nails and also waterproof adhesives shall be used.

**(03) Boards**

The proprietary boards are known as fibre building boards and chip boards or particle boards. The fibreboards include hard boards insulation boards and straw boards. These boards follow the description in the following order:

a) **Fibre Building Boards**

Fibre building boards form the largest category with the number of different types as detailed hereunder:

- Hard Board: Density from 30 to 50 lbs per cft. There are three main sub-divisions, being medium (30-50) lbs per cft.) standard medium (50 lbs per cft.) tempered hard board/standard hard board treated to increase hardness and resistance to water.
- Insulation Board: Maximum density 25 lbs per cft. minimum thickness 7/16 inch, maximum thermal conductivity (K) 0.45. They have five sub-divisions, viz homogeneous, laminated bitumen bonded, bitumen impregnated, acoustic (of low density and specially designed often with perforated surface

to increase sound absorption). These boards have good qualities of thermal insulation and sound absorption and are recommended accordingly.

- Straw Boards: These are compressed straw slabs, consisting of straw formed into slabs 2 inches thick by heat and pressure and with proprietary paper glued to the sides. Edges too are bound with paper. The slabs are fairly stiff and have thermal conductivity (K) of 0.6.
- Wood -Chip Board (Particle Board): Chip boards are made from wood particles in the form of chips or shavings of a controlled size combined with a thermosetting synthetic resin glue binder and formed into panels under the influence of mechanical pressure and heat. The process of adhesion is controlled resulting in a variety of boards with different, but predictable physical properties. Chipboard lends itself well to uses such as sheathing, flooring and sub-flooring, wall panelling, partitions, shelves, furniture and veneered boards, core stock. It is little affected dimensionally by changes in atmospheric humidity, but in wet conditions it has a limited resistance to moisture.

The mechanical strength properties are good for high density boards. In the density range 30.55 lbs/cft typical value of the modulus of rupture lies between 1600 to 3000 lbs/sq. inch. An average value for the modulus of elasticity is 300,000 lbs/sq. inch.

The surface finish of standard boards is comparatively rough and to support a good quality paint or varnish finish requires sanding and filling. Special grade of the board are prepared for painting which have a paper surface permanently bonded to the board during manufacture.

Particle boards are made in grades of high, medium and low density but the bulk production has been of medium density mainly in thickness of 1/2" and 3/4". These Specifications rely on BS:2504, 'Medium Density Resin Bonded Wood Chip Board' for quality of the board and requirements for density, strength and other properties. The density range of this board is from 30 lbs/cft to 50 lbs/cft and thermal conductivity is of the order of 0.7 to 1.0 B. T.U. in/ft<sup>2</sup>/h, BS: 1811 will be relied upon for testing of the wood chip board.

## **08213 EXECUTION**

### **A- Carpentry Work**

#### **(01) General**

All work specified in the Bill of Quantities and shown on working Drawings and details is to be carried out in proper manner and to the satisfaction of the Engineer. The Contractor has to provide all loose planks, battens, trestles and ladders and to construct all scaffolding necessary for the proper execution of the work and to remove the same on completion.

#### **(02) Preservative Treatment**

Where preservative treatment is specified, the timber is to be of the correct moisture content and free from surface moisture and dirt. In general, all portions of timber built into or against or close to masonry or concrete, and all junctions or rafters, purlins, framing scribe pieces and wall plates etc. shall be given two coats of hot solignum, creosote or other wood preservative Approved by the Engineer. Preservative material



shall be applied in strict accordance with recommendations of the preservative manufacturer and shall be given to all woodwork which comes in contact with or built into any wall, floor, ceiling or any other structure. All rough woodwork which is not the finished and exposed woodwork whether abutting any structure or not shall be given a preservative treatment. No extra payment shall be made for such coating and will be considered inclusive in the rate of the respective item quoted by the Contract. Treatment is to be carried out after all cutting and shaping is completed and care is to be taken to avoid damage. A liberal application of preservatives is to be made to cut or damaged surface, CP 112: 100, 'Preservative Treatment for Timber used in Buildings' shall be relied upon regarding preservatives and methods in relation to uses of timber.

**(03) Moisture Content**

The timber prior to preservative treatment is to be properly seasoned. Timber fit for carpentry is considered seasoned when it loses 1/5 of its weight and fit for joinery when about 1/3 of its weight has been lost after felling.

**(04) Workmanship and Construction**

'Unwrought' timber shall be 'left from the saw', and shall be full to the dimensions stated except that occasional slight variation in sawing is permissible.

All framing shall be jointed as specified and/or as determined by the Engineer as most appropriate in the circumstances. The joints shall be as per standard practice depicted through architectural details and constructed so that load and stress to which they will be subjected are properly transmitted. The execution of all jointing shall be to the satisfaction of the Engineer.

Unless otherwise stated all joints shall be secured with a suitable type and sufficient number of nails. A butt joint shall, wherever possible, be secured with nails driven from the far side of the flanking member, if any. The joining surfaces of all connections exposed to the weather shall be thickly primed except where adhesives are specified. Where joints are designed in critical relation to loads, the size, spacing, type, positioning and number of nails, wood screws, bolts, washers and timber connectors shall be provided by the Contractor true to design details.

**(05) Procedure**

The operations shall be planned and coordinated keeping in view the requirements and convenience of all tradesmen concerned in the work.

The Contractor shall order materials for sizes and quantities as required to complete the job as per working Drawings and details. All work is to be set out and constructed to the dimensions given and as described on the Drawings and details.

**(06) Protection of Materials**

All materials and assembled units shall be protected from weather and stored in such a way as to prevent attack by fungus, decay and/or insect.

**(07) Inspection**

Facilities shall be given to the Engineer to inspect all work in progress in the workshops and on Site. All work under this section should be first Approved by the Engineer before being fixed in the building.

**(08) Joinery Work****a) General**

All work specified in the Bill of Quantities and shown on working Drawings and details shall be carried out in proper manner and to the satisfaction of the Engineer.

The Contractor shall manufacture, deliver to Site and fix in place all joinery described and shown on the Drawings including supply and fixing of metal, straps, lugs and dowels, priming, preservatives, polishing and all hardware specified and/or shown on the Drawings. Except where special finish is specified the joinery work shall be cleaned and scrubbed. The Contractor shall leave whole of his work in good order and to the complete satisfaction of the Engineer.

**b) Preservative Treatment**

Same as in Clause as above

**(c) Moisture Contents**

Same as in Clause as above

**(d) Priming**

Where priming is specified, the timber shall be coated with a thick mixture of red or white lead and linseed oil and priming shall comply with BS: 2521. The Contractor shall provide for priming and touching up primer where necessary during the progress of work.

Aluminium base primers may be used when timber is particularly resinous. Where synthetic paints are used, Manufacturers must be consulted on the type of primer.

**(e) Workmanship and Construction**

All "Wrought" timber is to be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes shown on the drawings and/or specified.

The arrangement of jointing and fixing of all joinery works shall be such that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work; Reasonable tolerance shall be provided at all connections between joinery works and the building Caracas, whether of masonry or R.C.C. frame construction, so that any irregularities, settlements or other movements shall be adequately compensated.

The joiner shall perform all necessary mortising, tenoning, grooving, matching, tonguing, rebating and all other works necessary for correct jointing. He shall also provide all metal plates, screws, nails and other fixings that may be necessary for the proper execution of the joinery works specified. The joiner shall also carry out all works necessary for the proper construction of all framings, linings, holdfasts and other contrivances as per architectural details and/or instructions of the Engineer for their adequate support and fixing in the building.

Loose joints are to be made where provision is required to be made for shrinkage or other movements acting in the direction other than that of the stresses because of loading. Glued joints are to be used where provision need not be made for shrinkage or other movements in the connection, and where sealed joints are required. All glued joints shall be cross-tongued or otherwise reinforced. All nails, springs etc. shall be punched and puttied. All cutting edges of tools shall be sharp to avoid burnishing.

All wood work, as far as practicable, shall be assembled in shop, finished and prime coated before delivery for fixing. In addition to machine sanding, all woodwork shall be smoothed by hand using "00" sand paper to give the required smooth surface, free from machine and tool marks, abrasions, raised grains and other undesirable defects. All woodwork shall be fitted to plaster and other finished work in a careful manner so as not to injure these surfaces. Where plaster or other work is damaged or disturbed, it shall be restored to its original state by the Contractor at no additional cost.

All woodwork shall be neatly finished to the exact dimensions specified. All nails and screws shall be of approved type. Hammer shall not be used for driving in or starting in the screws. All screws shall be dipped in oil before they are inserted in the wood. The heads of nails or screws shall be sunk and puttied or dealt with as directed by the Engineer.

The Contractor shall give at least 7 days notice to the Engineer in writing where any timber is to be covered in the ground or in walls or otherwise. Failing this, the Engineer may order it to be uncovered at the Contractor's expense.

- Door Frames: Door Frames shall be fabricated of first class Deodar wood where so specified according to design, sizes and sections shown in the Drawings. The wood shall be smoothly planed and all the joinery shall be perfect and strong.

The frames shall be secured to masonry or concrete with m.s. holdfasts 9" to 13" long of type approved by the Engineer. These holdfasts shall be screwed and not nailed to the frames. The holdfasts shall be free of dust, scales, rust etc., and shall be painted with 2 coats of anticorrosive paint before they are secured to masonry or concrete. The holdfasts shall be cast in concrete work. The minimum number of holdfasts used shall be (3x2) unless otherwise specified.

- Flush Doors: The Flush doors shall be obtained from approved manufacturers and shall be of the quality and kind as per these Specifications and of dimensions as shown on Architectural Drawings and shall comply to the requirement of Pakistan Standard No.142.
- Flush doors shall be constructed of plywood as specified earlier. It shall be synthetic resin bounded plywood suitable for both internal and external flush doors and shall be of the grades 1 and 11 as specified earlier. The facing shall be teak or commercial ply as specified with a minimum thickness of 1/8".

The core shall be made up of solid laminated wood or as specified and shown on drawings. It shall have 3" wide solid wood edge rail of deodar wood all around and lock block of minimum 10" wide. The shutter shall be lipped and edged all around with hard wood. The core shall be chemically treated to be anti termite without affecting the inherent qualities of the core material and shall be fabricated with the grain running parallel to the grain of face veneer. Core material shall be accurately machined on all sides to ensure tight fitting core, free of voids throughout the core assembly.

The adhesives used in the door manufacture shall be special urea-resin type (liquid or powder), unaffected by oil, gasoline, solvents, resistant to the growth of fungus and bacteria, immune from insects and shall be such as to remain un-affected by paint and lacquer solvents. It should weigh approximately 10 lbs. per gallon when mixed for use having approximately 60% of solids content.

- Fitting, Hanging and Trimming: Doors shall be fitted, hung and trimmed as indicated on the Drawings. Hinges shall be counter sunk into the doorframes as well as leaves. The recesses being cut to the exact size and depth of the hinge. No subsequent packing shall be allowed. Brass screws shall be used with brass fittings unless otherwise specified. Hardware shall be fixed as specified in the drawings. Locks and

other hardware items shall be fixed at heights as shown on the Drawings or as directed by the Engineer.

**(09) Finish Hardware And Mongery**

Hardware shall be imported of best quality and make the Contractor shall obtain prior approval from the Engineer for quality, shape, pattern and brand of all hardware materials by providing samples and catalogue etc. and shall provide, fix only the approved hardware materials.

**a) Ironmongery**

(Ironmongery means any type of mongery e.g galvanized iron, brass, stainless steel whichever specified on drawings).

The Contractor shall provide and fix the ironmongery required as per schedule shown on the Drawings complete, including all necessary screws, bolts, plugs and other fixings. The use of nails for fixing ironmongery will not be permitted. The Contractor shall hand over all work in a finished state and to the satisfaction of the Engineer.

All ironmongery shall be of first quality and shall be obtained from an approved manufacturer.

The Contractor will be required to submit for approval samples of all items of ironmongery he proposes to use.

**b) Fitting and Testing**

All screws used for fixing ironmongery shall be of the correct type, material, finish, size and shape to the satisfaction of the Engineer.

The hinges on which doors, windows, fly screen doors, etc., are hung shall be carefully housed or let into the door, window, fly screen doors, etc., and to the frames.

All fittings shall be removed before commencing any painting operations and shall be re-fixed in place after all painting work are completed and approved by the Engineer.

All ironmongery shall be carefully wrapped and protected until completion of the work and any items or parts which are damaged or defaced or found to be defective shall be replaced at the Contractor's expense before handing over.

On completion of all locks, catches and similar items of ironmongery they shall be properly cleaned, tested and oiled, and all keys shall be clearly labelled with metal tags approximately 50 x 20mm and securely fixed to the keys and handed to the Engineer.

Door closers shall be fitted a maximum of two weeks before handover.

All floor and door springs are to be fully charged with oil and their operation checked to the satisfaction of the Engineer.

**c) Standard Ironmongery for Internal Doors**

Each door leaf is to be fitted with 1-1/2 pairs of 100 x 75mm satin anodised aluminium or stainless steel washered butts hinges unless otherwise noted in the particular specification and drawings.

**(10) Glazing**

Glazing wherever shown on the drawing shall be as given in the schedule of Doors and Windows and shall conform to latest revised B.S 952.

**(11) Painting**

Over the primer coat, two coats of approved specified colour shall be applied as per manufacturer's specification.

**(12) Made Good Defective Works**

Should any shrinkage or warping occur or any other defects appear in the joiner's work, before the end of Defects Liability Period, such defective work shall be taken down and replaced to the Engineer's satisfaction and any other work disturbed shall be made good at the Contractor's expense.

**08214 MEASUREMENT AND PAYMENT****A- Measurement**

The measurement shall be made in Sq.Ft/m of the actual surfaces completed and approved.

**B- Rate and Payment**

All woodwork shall be paid at the rate as per complete item entered in the Bill of Quantities and in accordance with the Conditions of Contract. Such payment shall constitute full compensation for all material, equipment, labour including frames, all incidentals, necessary to complete the work including fly proofing, glazing, all finished hardware, door lock, iron mongery, fittings and painting and polishing etc.

\*\*\* End of Section 08210 \*\*\*

**08900 STRUCTURAL GLAZED CURTAIN WALL AND SKYLIGHTS****08901 GENERAL****A- Scope of Work**

Furnish all necessary materials, labour and equipment for the complete installation of Glazed Curtain Wall and skylights as shown on the drawings and specified herein.

**B- General Performance Requirements:**

Propose a Framing system (main and sub-frame), which shall be compatible with:

- Structural Frame work of the building;
- Positive and negative pressures withstanding Capability
- Mechanical/Electrical System inside
- Accommodation of structural movements
- Moisture penetration resistance
- Air infiltration resistance
- Automatic window washing/cleaning equipment and catering for such additional loads
- Internal drainage system
- Thermal Performance
- Accommodation of Thermal expansion and contraction of panels and framing

**C- Design Requirements**

- a) The Design wind pressure to which the various elements of glazing and framing will be subjected to shall be calculated in accordance with B.S. CP-3 for a wind speed of 100 MPH (160 km/hr.)

All assemblies must be of appropriate shape, thickness and sections, to enable them to resist the loads produced by repeated imposed wind pressures. The maximum deflection over clear span of any member shall be such that it does not induce cracking in glass panels and render the assembly unsafe. No member shall suffer any permanent deformation. No part of the work shall rattle in use.

Structural performance shall be based on:

- \* Maximum deflection of 1 /175 of the span.
- \* Allowable stress with a safety factor of 1.65.

- b) Work Sizes: All dimensions given on drawings are between structural openings and/or between finished surfaces. Allowances shall be made for variation due to constructional tolerances. The Contractor shall be responsible to measure the final dimensions from the Site before fabrication of Curtain Wall and other assemblies/units.

- c) Weather Tightness: Weather tightness and operations shall suit the weather conditions prevailing in Islamabad. All sections will be fabricated as completely air and water tight units.
- d) Air Tightness: The fixed part shall be as far as possible 100% air tight under all weather conditions. Air infiltration for openable part when fully closed shall not exceed  $3\text{m}^3/\text{hr}/\text{meter}$  length of opening joint at a test pressure of  $498\text{ N}/\text{M}^2$  as tested in accordance with B.S. 4315 part 1 or when tested with ASTM E 283 air infiltration shall not exceed 0.50 CFM per ft. of opening joint when tested at 1.56 psf.
- e) Water Tightness: When tested in accordance with ASTM E 331, no water penetration at a test pressure of 8.0 P.S.F with water applied at 5 gallons/sft./hour.
- f) Acoustic Performance: When installed shall provide an average sound reduction of 28 dB over a frequency range of 100-3150Hz.
- g) Uniform wind load test: No structural deformation or glass breakage at a uniform wind load of 30 psf first in positive inward direction and then in a negative outward direction and deflection shall not exceed  $1/175$  of span, when tested according to ASTM E-330.

**D. Technical and Fabrication Requirements**

**(01) Appearance**

- a) Provide units composed of aluminium shapes with visible portions of profile matching detail indicated on the approved shop drawings, and free from additional slots, grooves, fins or other non-functional details.
- b) Fabricate and assemble all work in the shop wherever possible and otherwise prefit as required to reduce field fabrication to minimum.

**(02) Design**

- a) Design anchors to allow for horizontal and vertical expansion. Screws, nuts, washers, bolts and reinforcements shall be aluminium, AISI Series 300 stainless steel or other material compatible with aluminium, and of adequate strength for the proposed use.

**(03) Workmanship**

- a) Fit member neatly and to hairline accuracy with profile extending into joints without additional trim. Match flush joints to form perfectly smooth plane; match offset joints to hairline butt fit to flat surface by one point of tangency of corner radius. Units using extra trim to conceal misalignment will not be acceptable.
- b) Make all connections by means of concealed fasteners; exposed fasteners will be permitted where essential to proper adjustment of units. Use only countersunk flat head machine screws for exposed fasteners.
- c) Where additional strength of section is required to meet structural requirements, provide additional wall thickness or stiffeners inside the extrusion.
- d) Manufacturer's standard sections will be acceptable only when such extrusions are substantially in accordance with the profiles indicated on the approved shop drawings as accepted by the Engineer.
- e) Surface Smoothness: Submit samples and obtain approval for extent of the finish permissible in all "as extruded" materials.

**E- Submittals****(01) General**

Refer to "Schedule of Required Submittals", section of Division 01000, and other sections referenced therein for special instructions relating to submittals.

**(02) Shop Drawing**

- a) Project Shop Drawings: All fabricated materials and assemblies.

**(03) Manufacturer's Coordination and Services**

- a) Product Certification: Certification of proper use and compatibility for aluminium sealing and lacquer.
- b) Certification of alloy for integral colour finish.
- c) Certification by Aluminium Association designation for class of powder coating and finish.
- d) Maintenance instructions.

**(04) Warranty**

- a) All Aluminium powder coating shall be warranted by the manufacturer for a period of not less than 10 years or such longer periods the manufacturer normally provides.
- b) The fabricator shall certify compliance with all of manufacturer prerequisites for maximum warranty.

**(05) Samples**

- a) Submit Samples in accordance with submittals section 01343 of Division 01000.
- b) Before any work is performed, the following samples shall be submitted:
  - i) Three sets of 300 mm x 300 mm (12 in. x 12 in.) sheets (pairs indicating range) of samples of each type of aluminium finish specified herein. The integral powder coated samples must demonstrate the limits of colour range within which production materials will be processed.
  - ii) Submit samples of all components, including all hardware trim, weather stripping and typical extrusions.
  - iii) Representative samples of welded connections, mitred joint, and butt-weld and typical brake form and bend for bar and sheet stock to show final finished appearance.
- c) Identify samples as to treatment, powder coating thickness, alloy, colour, and portion of the work to which the sample applied. Make samples on sections of similar shape as proposed materials and large enough to establish good comparison.
- d) For project reference, one set of record samples will be retained by the Engineer, and kept available at the job site and one returned to the Contractor.



**(06) Maintenance Instructions**

Prepare and deliver to the Engineer a complete maintenance manual in accordance with the requirements of the "Project Record Documents" section 01720 of Division 01000.

Such documents are an integral part of the requirements of these Specifications and require close cooperation between the basic metal manufacturer, the fabricator and the finisher.

Reference information shall include:

- Complete description of alloy, temper, and finish of each type of material as delivered.
- Description of method by which finish was produced.
- Location in the building of each type.

Maintenance information shall include specific instructions for:

- Routine cleaning instructions with recommendations for materials and schedule applicable to locality and exposure.
- Recommendations for major cleaning as required to maintain powder coated appearance and prevent development of oxidation.
- Instructions for re-finishing and restoration of original appearance.

Appropriate publications shall be included but these shall not be regarded as taking the place of required specific instructions.

**08902 PRODUCTS****A- Materials****(01) Materials Specification**

All sections to comply with B.S. 4873 or equivalent in respect of materials, work sizes and manufacture. The Contractor shall be responsible to determine the adequacy of sections with respect to structural and performance requirements. All extrusions shall be of adequate strength, not only to meet the structural performance, but also to minimize the risk of distortion in the finished surfaces.

**(02) Aluminium**

- a) Sheet Aluminium where specified or required:
  - Natural Colour Sheet: No 55 Architectural Sheet or Anoclad Type 01.
  - Sheets to receive Integral Colour Finish: See Aluminium Finishes".
- b) Extruded Aluminium: Powder coated, dark green Metallic Colour Matching with glazing.
  - Natural Colour Powder Coated Extrusions: 6063-T5 alloy.
  - Natural Colour Powder Coated Snap-in Beads: 6063- T6 alloy.

- Structural Shapes, except where integral colour finish is indicated: 6063- T6 alloy.
- Extrusions for Integral Colour Finish: Special alloy, see "Aluminium Finishes".
- c) Cast Aluminium where Specified or required:
  - Anodized Castings: 214 alloy.
  - Structural Castings: 356- T6 alloy.

**(03) Support Devices**

- a) Fasteners used in assembling sections: Exactly matching adjacent surfaces where exposed or AISI 300 series stainless steel where concealed.
- b) Steel Anchors: Hot dip galvanized, or AISI 300 series stainless steel.
- c) Inserts: For required anchorage into concrete or masonry work, furnish inserts of cast iron, malleable iron or 2.8 mm (12 gauge) steel hot-dip galvanized after fabrication.
- d) Expansion Anchor Devices: Fed. Spec. FF-S-325 Group II, Type 4, Class I, Int. Amendment 3; Molly "Para bolt" or equal.

**(04) Accessory Materials**

- a) Joint Filler: Expanded cellular neoprene, closed cell, tape, coated with non-staining adhesive one surface: ASTM D 1056 "Testing Sponge and Expanded Cellular Rubber Products", type SC-41 ; shape as required.
- b) Thermal Barrier: Solid neoprene, 60 durometer.
- c) Bituminous Paint: Koppers 50 or SSPC Paint 12.
- d) Protective Coverings: After finishing procedures have been completed, apply protective wrappings of paper or plastic film. Keep material dry until wrappings are removed, if used, must be completely removed.

**B. Powder Coating**

**(01) Material**

Fluoropolymer powder coating on chromated Aluminium or superior metal.

Metal Substrate	Chromated A1 (DIN 50939)
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Stoving Schedule	12 min at 200°C
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- a) Finish coating shall be a factory applied finish in approved colour and in accordance with the standards of Aluminium Association based on kynar 500/Duranar XLE or superior.
- b) Application of the finish based on above coating shall be performed under specifications issued by the licensed formulator and by an applicator specifically approved by one (or more) of the formulators. Said applicator shall provide written notification of approval by a formulator prior to application of the finish.

- c) Primer coat shall be corrosion resistant epoxy based primer with dry film thickness averaging from 0.0025 to 0.005 mm (.1 mil to .2 mils). The finished coat shall have a dry film thickness averaging 60 microns.
- d) Testing Standards:
  - Weatherometer: In accordance with ASTM E 24 withstand 500 hours exposure in the Sunshine Aro Weatherometer Model XW-R under 60/60 Dew Cycle conditions without evidence of chalking or withstand 2,000 hours exposure in Atlas Twin/Arc Weatherometer without evidence of chalking or film failure.
  - Humidity: In accordance with ASTM D 2247 withstand 3000 hours at 100 % relative humidity with no more than 5% of surface showing blisters no larger than No. 4 (ASTM D 714).
  - Salt Spray: In accordance with ASTM B 117 withstand 3000 hours at 5% salt fog at 35° C (95° F) with no more than a few blisters no larger than No. 4 ASTM D 714 and no more than 1.6 mm (1/16 in.) creepage and loss of adhesion from line scribed to metal.
  - Pencil Hardness: F-2H.
  - Gloss: 50/90 on 60° glossmeter in accordance with ASTM D 523.
  - Adhesion: No removal of finish after 1.6 mm (1/16 in.) cross-hatching (ASTM D-3359) to bare metal, impacting to point of metal rupture and subjecting to application and quick removal of scotch cellophane tape.
  - Abrasion Resistance: 60 litres/mil. minimum ASTM D-968.
- e) Colour -As approved by the Engineer.

**C- Dissimilar Materials**

**1. Dissimilar Metals**

Where aluminium materials are placed in contact with, or fastened to dissimilar metals they should be separated from such metals by application of bituminous coating, non absorptive tape or gaskets or sealants.

**2. Masonry, Concrete or Plaster**

Where aluminium materials are placed in contact with, or built into, masonry, concrete, or plaster, apply a heavy brush coat of alkali resistant bituminous paint, 1 mm (40 mils) dry film thickness.

**08903 EXECUTION**

**A- Construction Requirements**

The Curtain Wall shall be manufactured by an approved manufacturer in this trade.

The Contractor shall provide shop drawings based on Architectural drawings along with computations for the approval of the Engineer before orders are placed with the manufacturers.

The manufacturer shall use the latest and approved method of jointing employed in the manufacture of high class work viz. mechanical jointing, reinforced with concealed welding shall be used.

The workmanship shall conform to applicable provision of B.S. 990

**B- Fixing**

The fixing of Curtain Wall to concrete structure shall be carried out in an approved method as indicated on the drawings or as directed by the Engineer. Provision of necessary groove or rebate and holdfasts in the concrete shall be made in the form work and no holing or drilling shall be allowed in the exposed concrete finishes. These shall be erected in position after the building structure is completed and by using proper holdfasts as shown on drawings or counter sunk bolts and screws as directed by the Engineer in accordance with site requirements.

**C- Handling**

Care shall be taken in handling various components of the Curtain Wall during transportation and at job site. These shall be stored under cover and shall be installed only by skilled mechanics, set plumb, level, in alignment and properly braced to prevent distortion.

**D- Protection**

- i) The joints should be caulked with approved building mastic for total weather proofing.
- ii) After installation, Curtain Wall shall be protected from construction hazards that will damage its appearance or finish. It shall be cleaned on inside and outside of all mortar, plaster, paint or other foreign matter to present a neat appearance. Hardware and moving parts shall be lubricated.

**E- Glazing**

a) General

The work of fixing glazing to Curtain Wall shall be carried out with the type and special quality of glass specified and as indicated on the drawings or as directed by Engineer.

The sizes of glass indicated on the drawings are approximate only, and the actual sizes required shall be determined by measuring the frames to receive the glass. All glass shall be factory labelled on each pane and the label shall not be removed until finally approved by the Engineer. Glass will be fixed with best quality mastic compound of approved make suitable for the type of glass or as directed by Engineer. Special rubber lining and weather proof brush joints for openable panels shall be provided where indicated.

b) Glass Performance data

Glass Type:	Reflective glass Solarban 550-18(3) solex	
Aesthetics:	Green sapphire	
Visible Light:	Transmittance	-15%
	Reflectance	-32% (Out door)
		-25% (In door)

Total solar:	Transmittance	-8%
	Reflectance	-16%
U-value:	(Winter night time)	
	Imperial	0.44 Winter night 0.53 Summer day
	Metric	2.5 Winter night 3.0 Summer day
Shading Coefficient:		.033
c)	Curtain Wall	Structural Silicon glazing (frame not visible from outside).
	Outer layer	Float glass 6 mm thick reflective fixed with coating facing void.
	Inner layer	Float glass 6mm thick plain clear glass.
d)	Structural Glazed Skylights	Structural Silicone glazing (frame not visible from outside)
	Outer layer	6 mm poly carbonate sheet clear.
	Inner layer	Laminated glass consisting of 6 mm reflective float glass and 6 mm plain float glass (As per 'b' above)
e)	Standards and Performance	<p>Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading for operating sashes without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.</p> <p>Protect glass from edge damage at all times during handling installation and operation of the building.</p> <p>Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives directs otherwise.</p> <p>Inspect each piece of glass immediately before installation, and eliminate any, which have observable edge damage or face imperfections.</p> <p>Cut and install glass as recommended in "Technical Services Report No.104" by PPG Industries.</p> <p>Install polysulfide sealants as recommended by Thiokol Chemical Corp., except as otherwise recommended by the sealant manufacturer.</p>

## f) Preparation for Glazing

Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coating, which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

Do not attempt to cut, seam, nip or abrade glass, which is tempered.

Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that, gaskets will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

## g) Cure, Protection and Cleaning

Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

Protect glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.

Wash and polish glass on both faces not more than 4 days prior to Employer's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

**08904 MEASUREMENT AND PAYMENT****A- Measurement**

Payment for Curtain Wall and Sky Lights will be made by measuring surface areas actually completed and approved in square feet/m.

**B- Rate and Payment**

Rates for all the items under this Section shall cover the cost of furnishing all the materials labour, scaffoldings and appliances at Site and performing all operations in connection with their installation in accordance with instructions of the Engineer. It is particularly mentioned that the rates for fixing Curtain wall shall include fixing of all finished hardware iron mongery fittings such as locks, peg, stays, handles, push plates, kicking plates, door closers, glazing, flexible compounds, rubber lining and appliances at site and performing all operations in accordance with the instructions of the Engineer and specifications.

The wastage for glazing due to breaking, cutting to sizes and replacement during maintenance period shall not be paid for separately but the rates shall be deemed to be inclusive of all these costs.

\*\*\* End of Division 08000 \*\*\*