

**PART B:**  
**MAJOR COMPONENTS (CIVIL & STRUCTURAL WORKS)**  
**ATTACHMENT TO PART B-3- ADDITIONAL / PARTICULAR SPECIFICATIONS – CIVIL WORKS**

**SECTION 08 51 13**  
**ALUMINIUM DOORS AND WINDOWS**

**PART 1 – GENERAL**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

Comply with all the mandatory local requirements associated with this and related specification sections.

Sustainability rating to be coordinated with the Engineer.

**1.1 SECTION INCLUDES**

- A. Design, engineering, supply, fabrication, installation and test of aluminium framed doors/windows, accessories, complete with reinforcing, shims, anchors, and attachment devices, etc. as specified and as shown on drawings and perform all services and operations necessary for the complete supply and installation of all glazed windows & door systems including but not limited to the following:
  - 1. Bespoke sliding aluminium window system with integrated glass railing.
  - 2. Lift and slide aluminium window door system for balcony access.
  - 3. Side hung outward openable window and door systems.
  - 4. Fixed louver windows.
  - 5. Aluminum trims, snap in sealant stops, flashings and similar items in conjunction with aluminum window & door systems and assemblies.
  - 6. Painting and coating in conjunction with the above aluminum and steel items.
  - 7. Internal and perimeter sealants, weeps, vents, and gasket systems. Anchors, embeds, shims, fasteners, inserts, expansion devices, accessories, support brackets and attachments.
  - 8. Glazing for the door and window systems.
  - 9. All locking arrangements to be as per consultant advise, if any deviation is required as per façade contractor's proposed system - the façade contractor to demonstrate compliance to the system performance with the help of relevant calculations and test certificates without any additional cost to the client.
- B. This part in conjunction with the architectural drawings define the scope of the works and establishes requirements for the materials/assembly's performance requirements and aesthetic effects as indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
- C. Delegated Design: Notwithstanding the drawings and other information provided, the Contractor shall be fully responsible for the design including comprehensive engineering analysis by an experienced façade professional engineer, detailing of the works, described herein, and shall provide a complete, and secure installation, which shall meet the specified performance requirements and the design criteria indicated in this specification.

- D. The contractor shall be responsible for obtaining all relevant data including the full extent and detailing of the works specified in this part and allow for all necessary monetary and time provision to ensure the proper and complete installation of the system; and shall be fully responsible for all engineering calculations and detail designs of the works.
- E. This specification shall be taken as a single contract for the works specified in this part and shall not be sub-divided into multi-trade packages.
- F. Design to follow the architectural intent indicated in the design drawings.
- G. This section to be read in conjunction with the related wall types or exterior wall system drawings submitted as a part of the Windows tender package.

## 1.2 DOOR AND WINDOW TYPES (GENERAL)

- A. 3 Track 3 Shutter Window at Living Area The system should be designed with EPDM gasket for airtightness between sliding and fixed elements of the system and should not rely on any wool pile type elements. The number and location of system accessories to comply with architectural requirement, the façade drawings, and as per manufacturer requirement to meet the performance parameters demanded in the specification.
- B. 2 Track 2 Shutter Sliding Window at Bedroom The system should be designed with EPDM gasket for airtightness between sliding and fixed elements of the system and should not rely on any wool pile type elements. The number and location of system accessories to comply with architectural requirement, the façade drawings, and as per manufacturer requirement to meet the performance parameters demanded in the specification.
- C. 2 Track 2 Shutter Sliding Window at Bedroom The system should be designed with EPDM gasket for airtightness between sliding and fixed elements of the system and should not rely on any wool pile type elements. The number and location of system accessories to comply with architectural requirement, the Windows drawings, and as per manufacturer requirement to meet the performance parameters demanded in the specification. The system should be compatible for integrating glass railing on the inside between the fixed shutter frame.
- D. 2 Track 2 Shutter Sliding with top fixed glass + exhaust fan provision Window at Kitchen. The system should be designed with EPDM gasket for airtightness between sliding and fixed elements of the system and should not rely on any wool pile type elements. The number and location of system accessories to comply with architectural requirement, the façade drawings, and as per manufacturer requirement to meet the performance parameters demanded in the specification. The system should be compatible for integrating glass railing on the inside between the fixed shutter and the outer frame. The system is to be compatible for integration with the unitized curtain wall at tower top floors.
- E. Fixed Window System The system should be designed with EPDM gasket for airtightness between moving and fixed elements of the system. The number and location of system accessories to comply with architectural requirement, the façade drawings, and as per manufacturer requirement to meet the performance parameters demanded in the specification.
- F. Side Hung Openable Door System – Glazed aluminium door system which consists of outward opening single/double leaf with overhead concealed door closure accessory opening and default lock-in positions as per client/architect requirement. The system should be designed with EPDM

gasket for airtightness between moving and fixed elements of the system. The number and location of system accessories to comply with architectural requirement, the façade drawings, and as per manufacturer requirement to meet the performance parameters demanded in the specification. The system is to be compatible for integration with the stick curtain wall at podium club and retail levels. The door system is also to be used at the utility area in the main tower.

- G. Aluminium Louver Windows – Extruded aluminium louver fixed window system with aluminium louver shutter fixed to an aluminium outer frame.

### 1.3 RELATED SECTIONS

- |                    |   |                                |
|--------------------|---|--------------------------------|
| 1. Section 01 4500 | - | Quality Control.               |
| 2. Section 05 7500 | - | Decorative Formed Metal.       |
| 3. Section 07 2500 | - | Weather Barrier.               |
| 4. Section 07 6200 | - | Sheet Metal Flashing and Trim. |
| 5. Section 07 9200 | - | Joint Sealants.                |
| 6. Section 08 4413 | - | Glazed Aluminium Curtain Wall  |
| 7. Section 08 8000 | - | Glazing.                       |

### 1.4 REFERENCES

- A. The minimum standards for products specified in this section shall be including as under but not limited to the following. Except as otherwise specified herein, perform work in accordance with specifications, codes and standards cited therein, and their latest editions, revisions, applicable addenda and supplements. Where there is conflict between the referenced standards the most stringent of the conditions/requirements shall be applicable.
- B. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes
- C. ASTM A 36/A 36M: Standard Specification for Carbon Structural Steel.
- D. ASTM A 123/A 123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A 1008/A 1008M: Standard Specification for Steel Sheet, Cold Rolled, Carbon, Structural, High Strength, Low Alloy and High Strength, Low Alloy Improved Formability.
- F. ASTM A 1011/A 1011M: Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High Strength, Low-Alloy and High-Strength, Low-Alloy with Improved Formability.
- G. ASTM B 209/B 209M: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM B 211/B 221M: Standard Specification for Aluminum and Aluminum-Alloy, Bar, Rod and Wire.
- I. ASTM C 509: Standard Specification for Elastomeric Cellular Pre-Formed Gasket and Sealing Material.

- J. ASTM C 864: Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spaces.
- K. ASTM D 2000: Standard Classification System for Rubber Products in Automatic Applications.
- L. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- M. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- N. ASTM E 783: Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
- O. ASTM E 1105: Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Doors, Skylights and Curtain Walls by Uniform or Cycle Static Air Pressure Difference.
- P. AAMA 701/702: Combined Voluntary Specifications for Pile weather strip and replaceable weather seals.
- Q. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- R. AAMA 2604: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- S. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels.
- T. ANSI/AAMA/NWDA 101/I.S.2: Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

## 1.5 PERFORMANCE REQUIREMENTS

- A. The design and performance specified are minimum requirements. Methods which may be suggested by these specifications are not intended to limit methods of achieving the required design and performance criteria. All the drawings must be reviewed, approved, stamped, and certified for the design of this project by the system supplier company (not manufacturer) and a third-party professional Engineer.
- B. General: Provide glazed aluminium window and door systems; including anchorage, capable of withstanding, without failure, the effects of the following:
  - 1. Structural loads.
  - 2. Thermal Movements.
  - 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

4. Dimensional tolerances of building frame and other adjacent construction.
  5. Failure includes the following (not limited to):
    - a. Deflection exceeding specified limits.
    - b. Thermal stresses transferred to building structure.
    - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
    - d. Glazing-to-glazing contact.
    - e. Noise or vibration created by wind and thermal and structural movements.
    - f. Loosening or weakening of fasteners, attachments, and other components.
    - g. Spontaneous breakage of the tempered glass as a result of NiS inclusion.
    - h. Sealant failure.
    - i. Air leakage, water leakage, exceeding specified limits.
- C. Air Infiltration: Air movement through the work, building interior to building exterior and building exterior to building interior shall not exceed.
1. For Fixed Element: 1.5 m<sup>3</sup>/h per m<sup>2</sup> when tested according to ASTM E 283 at a minimum static-air-pressure differential 600 Pa.
  2. For Operable Elements When closed: 2.0 m<sup>3</sup>/h per meter of crack length when tested according to ASTM E 283 at a minimum static-air-pressure differential 300 Pa.
- D. Water Infiltration:
1. Work to quickly drain any water and condensate moisture which may enter within the cladding components to the building exterior.
  2. Work to prevent entry of water and moisture to the building interior side of the work.
  3. Provide window and door systems with glazing and panel fittings that does not show evidence of water leakage when tested according to ASTM E 331 at minimum pressure differential of 20 percent of inward acting wind-load design pressure, but not less than 600 Pa.
  4. Provide window and door systems with glazing and panel fittings that does not show evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of wind-load design pressure, but not less than 600 Pa.
  5. Water leakage is defined as follows:
    - a. Uncontrolled water infiltrating system or appearing on system's normally exposed interior surfaces from sources other than condensation according to AAMA 501.1. Water controlled by flashing and gutters that is drained back to the exterior and not causing damage to the adjacent materials or finishes is not water leakage.
- E. Structural Loads:
1. Wind load: 1.7 kPa, Refer BoQ for design loads as calculated as per latest edition of IS 875 part 3.
  2. Deflection of framing members:
    - a. Deflection Normal to Wall Plane: Limited to 1/175 of clear span up to a length of 4.1m. above 4.1m, the deflection is limited to 1/240+6.35. However, such deflection shall not influence the integrity of adjacent trade like bulkhead, wall connections etc.
    - b. Deflection parallel to Glazing Plane: Limited to L/360 of clear span or 3.2mm, whichever is smaller.
    - c. Operable Units: Provide a minimum 1.6mm clearance between framing members and

- operable units.
- d. Cantilever Deflection: Where framing members overhang an anchor point, limited to 2 times the length of cantilevered member, divided by 175.
- 3. Deflection of Infills: Horizontal deflection for four way supported glazing infills shall be as follows:
  - e. For center of glass deflection: L/60 or 19mm (for SGU) and L/90 or 19mm (DGU) whichever is minimum.
  - f. For the supported glass edge L/175.
  - g. Maximum center deflection (vertical) for four side supported horizontal glazing shall be L/100.
  - h. For center of aluminium cladding sheet panels or aluminium sandwich panel: Maximum deflection (ver./hor.); L/120 or 15mm, whichever is smaller; including for the panel stiffeners.
- 4. Seismic: Glazed aluminum windows & doors shall withstand the effects of earthquake motions as per local regulation or in accordance to the UBC 1997 Edition, as acceptable to the local authorities and the Engineer/Employer.
  - a. Seismic test to be carried out according to AAMA 501.4 for static (lateral/horizontal wind sway), AAMA 501.6 for dynamic (lateral/horizontal wind sway) and AAMA 501.7 for static (vertical wind sway).
  - b. Seismic load – as required by UBC - 97.
- 5. Structural Test Performance: Provide glazed window and door systems tested according to ASTM E330 as follows:
  - a. Test Pressure: At 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2% of span.
  - b. Test Duration: As required by design wind velocity but not less than 10 seconds.
- 6. Dead loads:
  - a. Maximum full dead load deflections, parallel (in-plane) to wall plane, of framing members shall not reduce glass bite or glass coverage, to less than 75% of the design dimension, and shall not reduce edge clearance to less than 25% of design dimension or 3 mm whichever is greater.
  - b. Twisting (rotation) of the horizontals due to the weight of the glass shall not exceed 1 degree, measured between ends and center of each span.

F. Structural Performance (Integrated railing):

- 1. Wind load: (Tower– 1.8 kPa) at its latest revision for the design loads or as calculated as per latest edition of IS 875 part 3.
- 2. Deflection of framing members:
  - i. Lateral deflection of framing members for the railing infill shall be limited to L/65 or 25mm, whichever is lesser.
  - j. Capable of withstanding horizontal uniformly distributed line load of 1.5 kN/m.
  - k. Vertical load of 0.60 kN/m or a concentrated load of 1.0 kN, whichever gives the worst design condition in combination with the horizontal loading.
- 3. Deflection of Infill, (Structural laminated glass):
  - a. Maximum deflection (ver./hor.); L/30 as per AS 1288.
  - b. Capable of withstanding uniformly distributed load of 1.5 kN/m<sup>2</sup>.
  - c. Capable of withstanding point load of 0.9 kN applied to any part of infill.
  - d. Vertical load of 0.75 kN/m or a concentrated load of 0.9 kN, whichever gives the worst design condition in combination with the horizontal loading.

4. The glass railings at tower balcony to be designed as per IS 875 part 2 with a horizontal load of 0.75 kN/rmt along the top cover/handrail.
  5. The capping/profile at the top of the railing glass to be designed to span over 3 glass panels such that it offers additional support if one of the glasses are broken. If there are lesser than 3 glasses, the top capping/profiles to be designed as a single piece.
- G. Thermal requirements: Framing systems and its associated structure like anchoring structures shall accommodate expansion and contraction movement due to surface temperature differential without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.
- H. Base engineering calculation on surface temperatures of materials due to both solar heat gains and nighttime-sky heat loss.
1. Temperature Change (Range): 70 deg. F, ambient; 100 deg. F, material surfaces.
  2. Nighttime or lower range: +50 deg. F.
- I. Thermal Criteria (Windows & Doors)
1. The design should accommodate thermal expansion and contraction tolerances, within the components of façade system and its associated structure like anchoring structures, due to difference in temperature.
  2. Thermal performance conductance of work, to be as follows:
 

Window & Door U-Value	U.w&d <=	6.5 W/m <sup>2</sup> k, as per EN ISO 12631- 2013
Glass U-Value	U.g <=	5.0 W/m <sup>2</sup> k as per EN 673
Solar Heat Gain Coefficient	SHGC <=	
- J. Glazing: As specified in Part "Glazing 08 8000", of this Specification.
1. Glazing systems to allow for characteristics of framing and effects of connections and sealant.
  2. Work metal, glass, glazing to ensure no more than 8 glass units per 1000 break during the building's life.
  3. Glazing gasket, sealant on building exterior side of glass in exterior walls shall be non-conductive. Gaskets used in exterior walls shall be fused or sealed at corners and shall be of high performance EDPM quality.
  4. Glass retaining devices shall apply uniform continuous pressure to glass to prevent:
    - a. Distortion, oil canning and pillowing of glass.
    - b. Pressure points on the glass which could contribute to stress breakage.
  5. Metal in direct contact with glass not permitted.
  6. Insulating glass units must not have their seal in contact with water.
- K. Glazing-to-glazing joints accommodate thermal and mechanical movements of glazing and system, prevent glazing-to-glazing contact, and maintain required edge clearances.
- L. Load Testing Requirements: Testing shall comply with the following horizontal imposed loads and impact loads as a minimum to glazing and cladding elements in accordance with local and regional standards, regulations and testing requirements:
1. Imposed Loads:
    - a. Horizontally uniformly distributed line load to act at a height of 1100mm above the finished floor level: 1.5kN/m.
    - b. A uniformly distributed load applied to the infill: 1.5kN/m<sup>2</sup>.

- c. A point load applied to part of the infill: 1.5kN.
- 2. Imposed Testing:
  - a. A hard body impact test with the hard body impact energy not less than 10Nm.
  - b. A soft body impact test to glazed elements with the soft body impact energy not less than 500Nm.
  - c. A soft body impact test to non-glazed elements with the soft body impact energy not less than 500Nm.
- M. Acoustics: Provide complete installation free of rattles wind whistles and other noise due to thermal and structural movements and due to differential atmospheric pressure.
- N. Sound Transmission: Provide window and door systems to comply with most stringent of the acoustic requirement as per project acoustic report or Indian Standard IS 1950 (1965) – Code of Practice for Sound Insulation of Non-Industrial Buildings. (Min. 35dB STC). To meet the acoustic design requirement laminated glass shall be used.
- O. UV and Heat Resistance: All material provided which are exposed to atmospheric heat and which are exposed to sunlight including materials exposed through glass shall be formulated not to lose properties due to exposure to heat and due to exposure to ultra-violet radiation.
  - 1. Joints:
  - 2. The joint between the transom and mullions shall be sealed in accordance with the system supplier's standard EPDM solution to be used as sealing strips or equivalent option (not sealant).
  - 3. Transom and mullions shall be assembled by using miter corner design, wherever possible. Visible screws or connectors will not be acceptable.
- P. Interface:
  - 1. Furnish inserts and anchoring devices which need to be preset and built into structure to appropriate trade.
  - 2. Supply on timely basis to avoid delay in Work.
  - 3. Instruct other trades of proper location and position.
  - 4. Furnish setting drawings, diagrams, templates and installation instructions.
- Q. External Feature:
  - 1. In case of structural support penetrating the building envelop, thermal bridging has to be minimized, either with the design or by using low conductive material.
  - 2. The connection and joint design will have to consider the building movement and thermal expansion possibilities.
  - 3. The sizes and dimensions shown in the drawing is the minimum requirement. However, the dimension of the members shall be decided as per the structural requirements.
  - 4. The module, shape, section and distribution has to be as per the drawing.
- R. Building Frame Movement: Design, fabricate and install glazed aluminum window and door systems to withstand building movements including thermal movements, loading deflections, shrinkage, creep and similar movements without glass breakage, anchor failures, or structural damage.
- S. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows

identical to those specified, according to AAMA 506 and requirements of authorities having jurisdiction.

- T. Cyclic Performance Requirement: All proposed windows, doors, and accessories are to be designed, tested, certified as per the below mentioned criteria at an approved third-party testing lab:
1. Complete Window/Door System: BS EN 1191 – 25,000 cycles
  2. Sliding Window Rollers: BS EN 13126-15 – 25,000 cycles
  3. Lift & Slide Window Rollers: BS EN 13126-15 – 25,000 cycles
  4. Finger Point Lock: BS EN 13126-7 – 25,000 cycles
  5. Espag Lock: BS EN 13126-4 – 25,000 cycles
  6. Turnable Handle Set: BS EN 13126-2 – 25,000 cycles
  7. Hinges: EN 1935 – 25,000 cycles
- U. Approved Cyclic Testing Lab: Winwall Technology India Private Limited

## 1.6 DESIGN REQUIREMENTS

- a) Have this work designed by a Professional Engineer licensed to design structures and registered in the Place of the Work.
- b) System manufacturer/supplier shall verify and confirm the façade design prepared by the façade manufacturer/fabricator.
- c) Design shall be verified and confirmed by a qualified third-party façade specialist to ensure design compliance to performance requirements.
- d) Third party specialist Engineer to be appointed for the review and approval of design calculation and shop drawings.
- e) System manufacturer shall provide window and door systems, including necessary modifications to meet specified requirements and maintaining visual design concepts.
- f) Provide concealed fastening.
- g) Design members and their connections to withstand, within specified deflection limitations, their own weight, the weight of the glass and external feature, loads imposed by the motion of operable elements, maintenance loads and the maximum design loads and combination of loads due to rain, seismic loads, the pressure, and suction of wind.
- h) Follow profiles perimeter sizes and arrangements of components and assemblies indicated to obtain the required appearance.
- i) All structural silicone adhesion applications and exposed weather-seal gaskets shall be shop installed under environmentally controlled conditions.
- j) Make provisions to drain to the exterior face of the assembly, any water entering at joints and any condensation occurring within the building envelope assembly.

- k) Design, fabricate and install the assembly to be watertight to the interior under the interior and exterior design conditions in combination with movements occurring due to loads imposed and all allowable tolerances as specified.
- l) The Work shall accommodate, by means of expansion and contraction provisions, any movements in the building envelope assemblies themselves and between the assemblies and the building structure, caused by structural movements, both deflection and racking; and/or thermal expansion and contraction, without distortion, damage, misalignment of joints, breakage of air/vapor barriers, water and air penetration through the assembly, or glass breakage.
- m) The Work shall have a method of attachment to the structure which shall take into account site peculiarities so that there shall be no possibility of site and air vibrations or normal temperature movements of the building to loosen, weaken and/or fracture the connection between building envelope assembly components and the structure or between the components themselves.
- n) Reinforce building envelope assembly components, as required (generally, for the non-typical panel widths (or wind pressures) more than 3~3.5m, corners, roof levels etc.), so that the members can safely sustain design loads.
- o) Unless otherwise indicated, the requirements for an air barrier and a vapor barrier are intended to be provided at the same plane in the building envelope design. The definition of the air/vapor barrier for the purpose of these Specifications is "a continuous membrane including joints of membrane between components and to adjacent construction which prevents or retards penetration of moisture laden air and the diffusion of water vapor through it".
- p) Design, engineer, assemble and secure assemblies in manner which will keep stresses on sealants below the sealant manufacturer's recommended maximum.
- q) All glass units of each type shall be the same and shall have a consistent, uniform color and appearance. The external glass layer shall have a constant thickness in directly connected façade areas (elevation).
- r) Installed glass components shall be free of oil caning and pillowing.
- s) Exposed metal components shall be of uniform color, sheen and appearance, within components and from component to component and shall match approved samples and mock-ups.
- t) Installed components panels shall be of uniform color, and visually flat under all lighting conditions.
- u) Exposed metal sheets, plates and extrusions shall be visually flat under all lighting conditions.
- v) Engineer and install glass units so as each glass unit can be removed without removing adjacent glass units. Glazing shall be replaceable from the interior of the respective window/door location.
- w) Accurately size mullions at intersecting joints to obtain minimal joints just wide enough to permit thermal expansion and contractions so no damages and distortions to the work occurs due to thermally induced movements.

- x) Provide a continuous fire and smoke seal at junctions between edges of suspended concrete slabs and building envelope to prevent passage of fire and smoke from floor to floor and from floor to roof.
- y) Ensure components and assemblies drain to building exterior.
- z) Ensure components are designed, fabricated and installed to prevent build-up of sand within the Windows and cladding cavities and glazing pockets which could cause blockages to air pressure equalization and to drainage of water.
- aa) Work to resist forces imposed by window washing stages, maintenance unit cradles, any other building services.
- bb) Design vertical mullions to include means of preventing the passage of smoke, noise, airflow and constant electrical connection within the mullions over the height of the building using closure pieces or seals or insulating barriers (disconnectors).
- cc) All tempered glass (except those are used internally) shall be heat soaked. Use a safety factor for tempered glass to the statistical probability of failure. Provide statistical analysis of test data that the probability of failure is not greater than 1 in 54,000 sq.ft. of tempered glass. Provide certifications, that the oven is QM controlled, and these stating the manner. Written warranties against nickel sulphide inclusions or statistical heat soaking in lieu of heat soaking will not be accepted.
- dd) Use a safety factor of 5:1 and a design strength of 138 kPa (20 psi) maximum for structural silicone sealant design, including glass unit edge seal.
- ee) The vertical aluminum/steel profile shall be drained and ventilated to the outside before profile expansion joints.
- ff) The expansion joint of the vertical profile shall be sealed to prevent any leakage of water from the profile drainage groove to the inside section.
- gg) The transom-mullion joint shall be overlapped and watertight, airtight developed by a system-controlled solution.
- hh) All the gasket joints shall be welded compatible to the gasket material. Glue connections are only acceptable for site installed continuous turning gutter gasket. The connection shall have an overlapping lip and a controlled bonding surface.
- ii) Drawings and details are diagrammatic and are intended to show design concept, configuration, components and arrangements; they are not intended to identify nor solve completely the problems of thermal and structural performance and movements, air pressure equalization, air and vapor barriers, assembly framing, fixings and anchorages, moisture disposal, water penetration and problems at the glass line associated with glazing installation, movements, pressure fracture or thermal shock and weather seal.
- jj) Tolerances shall not be cumulative.

- kk) The external cladding material shall be in accordance to the local civil defence department regulations.
- ll) System to accommodate concrete/structural tolerance as per the contract documents without additional cost to the client; coordinate with the Engineer/Employer in case of any conflict.
- mm) All cladding material to be non-combustible.

#### 1.7 SUBMITTALS:

- A. General: During the tender bid submission, provide documents to confirm the design intent compliance. Submit in accordance with the Section "Submittal".
- B. Submittals for tender submission shall include but not limited to the following:
  - 1. Initial design drawings.
  - 2. Initial structural calculations.
  - 3. Initial thermal calculations.
  - 4. Criteria compliance statement.
  - 5. Proposed system performance information.
  - 6. Product details of major façade elements.
- C. Products Data:
  - 1. Submit system supplier's printed literature indicating product specification and installation instructions and all relevant testing reports for each product required by this section.
  - 2. Glass performance parameter calculated by manufacturer using Window software and verified by a certified third party.
  - 3. Include erection and glazing details and maintenance and cleaning instructions.
  - 4. Include information for factory finishes, accessories and other required components.
  - 5. Include colour chart for finish indicating manufacturer's standard colours available for selection.
  - 6. Furnish data clearly describing re-glazing techniques.
  - 7. Furnish maintenance and cleaning instructions.
  - 8. Thermal assessment to express thermal performance of proposed system.
  - 9. Statement to confirm the compliance to acoustic requirement.
  - 10. Submit system supplier's instructions for manufacturers to be an approved, certified manufacturer.
- D. Calculations:
  - 1. Submit calculations, under seal and signature of the sub-contractor's professional Engineer, showing following:
    - a. Design load overview according to specifications and wind tunnel test, if available.
    - b. Detailed engineering of all structural system members of CW.
    - c. Moment of inertia of all designed compounds (typical and non-typical areas).
    - d. Detailed engineering of anchorage hardware, sub structure, brackets, clip angles, washers, and anchor bolts, welds, torque pressures.
    - e. Materials proposed and their allowable sheet and bending stresses.
    - f. Deflections and expansion and contractions in accordance with all thermal and structural impacts.

- g. Comprehensive glass calculation (dead load, live load, thermal load, bonding surfaces IGU).
  2. Prepare calculations in a clear comprehensive manner to permit easy review together with drafts of the unit and location at the project and the applicable specific wind load according to the project wind tunnel test. Incomplete calculations will be rejected un-reviewed.
- E. Shop Drawings:
  1. Submit shop drawings covering fabrication, installation of specified system.
  2. Submit drawings indicating elevations, detailed design, dimensions, member profiles, and joint locations, arrangement of units, member connections, and thickness of various components.
  3. Each shop drawing shall bear seal and signature of the sub-contractors third party Professional Engineer.
  4. Show the following:
    - a. Elevations.
    - b. Details of special shapes.
    - c. Reinforcing.
    - d. Anchorage system.
    - e. Interfacing with building construction.
    - f. Furthermore: Detailed design, dimensions, members, profiles, joint location, and sizes, arrangement of units, horizontal to vertical connections thickness details of special shapes, reinforcing, drainage details, and flow diagrams, pressure equalization system and air barrier system interfacing with building structure, connections and joints and seals to adjacent building envelop systems, provisions for thermally induced expansion, and contraction, provisions for absorption of building structure movement and creep, thermal break details and locations, acoustic provision, safety provisions.
  5. Indicate glazing details, method, locations of various types and thickness of glass, emergency breakout locations, and internal sealant requirements.
  6. Location of exposed fasteners and joints for Engineer's acceptance.
  7. Clearly show where and how manufacturer's system deviates from Contract Drawings and these specifications.
  8. Panels, related reinforcement and securing methods.
  9. Installation space for getting each unit in position.
  10. All treatments of material to reach the architectural intention and the expected long thermal quality (coatings, tapings, bonding, e.g.)
  11. All used material in general as numbered material component list without any exception.
- F. Pre-Contract Samples
  1. Window/Door Systems:
    - a. Technical Literature.
    - b. Minimum 300mm x 300mm sample of framing material inclusive of proposed finish.
    - c. Minimum 300mm x 300mm sample of proposed glass build-up including coatings.
    - d. Minimum 300mm length or 300mm x 300mm sample of all other visible elements inclusive of proposed finish.
    - e. Sample of all ironmongery.
  2. Panel Cladding System:
    - a. Technical Literature.
    - b. Minimum 300mm x 300mm sample of cladding panel inclusive of proposed finish.

3. External Through Colour Rendering:
  - a. Technical Literature.
  - b. Minimum 300mm x 300mm sample with applied finishes.

G. Post-Contract Samples

1. All samples are to be submitted/couriered to the client, architect, and façade consultant; by the vendor – the cost of the same to be considered within the quote.
2. Window/Door Systems:
  - a. Minimum 1000mm length of framing inclusive of proposed finish.
  - b. Minimum 2000mm x 1500mm sample of proposed glass build-up including coatings.
  - c. Minimum 1000mm length or 1000mm x 1000mm sample of all other visible elements inclusive of proposed finish.
  - d. Provide samples for the following where applicable:
    - 1) All items of ironmongery.
    - 2) Structural silicone.
    - 3) Fire stop.
    - 4) Insulation.
    - 5) Gasket.
    - 6) Fasteners/anchors
    - 7) Flashing/Trims
    - 8) Extrusions
    - 9) Membrane
3. Panel Cladding System:
  - a. Minimum 1000mm x 1000mm sample of cladding panel inclusive of proposed finish.
  - b. Minimum 1000mm length of framing sample inclusive of proposed finish.
  - c. Sample of all visible fixings and fittings.
4. External Through Colour Rendering:
  - a. Minimum 600mm x 600mm sample with applied finishes.
  - b. Sample of all colour-matching fixings.
5. Doors:
  - a. Minimum 600mm x 600mm section of door leaf and frame inclusive of proposed finish.
  - b. Samples of ironmongery.
  - c. Samples of fire and smoke seals.
  - d. Samples of acoustic seals.
  - e. If veneered, provide samples to indicate maximum range of variance.

H. Glass Stress Analysis Reports: Submit glass stress analysis performed by glass manufacturer supplier of all glass. Identify locations of each glass unit for the building, its stress factors and statement whether glass unit is to be annealed, heat strengthened or tempered. Bid price shall include for providing glass consistent with minimum results as determined by the glass stress analysis.

I. Certifications:

1. Submit statements certified by the Professional Engineer stating:
  - a. Work of this section is engineered, supplied and installed as specified herein.
2. Submit statement certified by the sealant manufacturers attesting that:
  - a. Sealants selected are suitable for purpose intended.
  - b. Sealants will not deteriorate due to exposure to ultraviolet radiation / sun light.

- c. Joint designs are correct.
  - d. Sealants are compatible with other materials with which they come in contact.
  - e. Sealants are suitable for temperature and humidity conditions at time of application.
  - f. Surfaces are properly prepared and primed to accept sealants.
- J. Manufacturer's Instructions: Submit Data books, manufacturers printed installation instructions, Operating Instructions Manual for work of this section and as specified.
- K. Preconstruction Test Reports from a qualified independent testing agency indicating and interpreting test results relative to compliance with performance requirements of window and door systems.
- L. Product Test Reports from a qualified independent testing agency evidencing compliance of glazed window and door systems with requirements based on comprehensive testing of manufacturer's current system.
- M. Project Closeout Data: Submit Data Books, Operating Instructions Manual and Preventive Maintenance Manual for work of this section and as specified.
- N. Submit test reports of performance testing being carried out by an independent testing agency, including controlled dismantling report.
- O. Structural Sealant Data
  - 1. Submit product information on the sealants to be used including the following from sealant manufacturer:
    - a. Recommendations and installation instructions, including cleaning and priming procedures.
    - b. Test reports on adhesion to substrate and glass production samples tested in accordance with ASTM C 794.
    - c. Compatibility statement that all materials in contact with the sealants and gaskets are compatible with the sealants in accordance with procedures of ASTM C 1087.
    - d. Statement and test data indicating that the stress on the sealants and gaskets when exposed to the maximum load does not exceed 138 kPa and a safety factor of 5:1.
    - e. Verification that sealants and gaskets are suitable for purposes intended, and is suitable for temperature, humidity and weather conditions at time of application.
- P. Qualification Data: For qualified testing agency, Manufacturer, and Installer.
- Q. Welding certificates according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code-Aluminum".
  - 2. AWS D1.3/D1.3M, "Structural Welding Code-Sheet Steel".
  - 3. AWS D1.6/D1.6M, "Structural Welding Code-Stainless Steel".
- R. Preconstruction Test Reports: For preconstruction mock-up submittals of glazed aluminum window and door systems, accessories, and components, from manufacturer, to include the following:
  - 1. Testing Program: Developed specifically for Project.
  - 2. Test Report: Prepare by a qualified preconstruction testing agency for each mock-up test.
  - 3. Record Drawings: As-built drawings of preconstruction laboratory mock-ups showing changes made during preconstruction laboratory mock-up testing.

- S. Field quality-control reports.
- T. Warranties: Sample of special warranties.
- U. Energy Performance Certificate: for glazed aluminium window and door systems, accessories, and components, from manufacturer.
- V. Submit copies of instructions covering re-glazing, adjustments and other relevant maintenance data for inclusion in Operating and Maintenance Instructions Manual. Submit detailed cleaning procedures for glazing and prefinished aluminum. Include requirements for removal of excess fluid run-offs from silicon sealants, sealant primers and adhesive.
- W. Schedule for the visual and performance mock-up; including, for quality benchmark to be provided in advance for Engineers review.

## 1.8 QUALITY ASSURANCE

- A. Quality System: Comply with ISO 9001/9002 Quality System as minimum.
- B. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to the Engineer satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Testing agency shall have a valid Singapore Accreditation Council (SAC)/National Accreditation Board for Testing and Calibration Laboratories (NABL) or similar accreditation as ISO 17025.
- D. Professional Engineer Qualifications: A professional Engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of Glazed Aluminum window and door systems that are similar to those indicated for this Project in material, design and extent.
- E. Installer Qualifications: A qualified firm specializing in performing the work of this Section with minimum ten years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Engineers and Employers, and other information specified:
  - 1. Engineering Responsibility: Engage a qualified professional Engineer to prepare or supervise the preparation of data for the Glazed Aluminum window and door systems, including drawings, testing program development, test-result interpretation and comprehensive engineering analysis that shows systems' compliance with specified requirements.
  - 2. Able to demonstrate thorough understanding of the principles of rain screen, stack effect, air seals, dynamic forces behavior of cast-in-place concrete structures, water and weather controls as affecting building cladding systems.

- F. Source Limitations: Obtain Glazed window and door systems from one source and by a single system supplier confirming the availability of components during the warranty period.
- G. Insulating glass units shall be manufactured by company specializing in the fabrication of insulating glass units with minimum 10 (ten) years' experience, ample facilities to produce unit required and which have installations of units of similar composition to that required on the Project that have been in place without failure for 5 years. Glass of the same type shall be by one manufacturer.
- H. Tempering glass units shall be performed by a company specializing in the production of tempered glass with 10 (ten) years' experience, modern tempering equipment and facilities capable of treating post temperable glass units (low-E coating applied to glass prior to tempering) of maximum sizes required on the project, while maintaining tight roller wave tolerances specified and which have installations of post temperable units of similar composition to that required on the Project that are in place showing acceptable limits of distortion, by the Engineer/Employer.
- I. Glazing installer shall be an experienced installer who has completed glazing work similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.
- J. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
- K. Structural sealant work, both insulating glass unit fabrication, window and door systems, shall be performed by specialists, experienced and qualified in structural silicone sealant application of similar nature, and approved in writing by the manufacturer of the sealant materials.
- L. Comply with most stringent of the local code or acceptable national/international building standard requirements for VOC's limits.
- M. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code-Aluminum."
  - 1. Engage welders who have satisfactorily passed AWS qualification tests for welding processes involved and who are currently certified for these processes.
- N. Review of the system design and drawing is required to be done by approved 3rd. party and system supplier.
- O. Certified testing supervisor to be engaged for project installation and supervision till the project completion.
- P. Provide an on-site mock-up of the exterior wall assembly complete with all materials and products used to provide the finished installation, corner mullions, finishes, sealants and glazing, insulation, air/vapor barrier, weep/drainage system, as or shown on drawings or directed by Engineer, for review of quality of workmanship and appearance before proceeding with the remainder of the installation. Window and door systems mock-up shall be 1 unit of the respective

type, erected in location as shown on drawings or determined by Engineer/Employer. Adjust mock-up as required to gain acceptance. Accepted work may form a part of the final installation.

- Q. Wet applied seals for the purpose of preventing the ingress of water shall not be accepted with the exception of the structural silicone seals or wet seals used for sealing the works against adjacent interfacing systems.
- R. The Detailed Design and construction of the works shall be such that all rigid or fixed joints shall remain rigid and accommodate all specified thermal, building structure or other movements and any applicable loads without compromising its watertightness. All movement joints shall also be finally designed and constructed to accommodate such loads or movements without compromising the glazing's watertightness of glazing, glazed walls and associated cladding.
- S. All unitized panels to be factory finished, prefixed with glass, operable elements etc.; except non-standard panels with bigger frame/ glass dimensions.

#### 1.9 OFF-SITE MOCKUP

- A. Shop Drawings of Glazed Window and Door Systems Mock-Up: Submit shop drawings of window and door systems mock-up showing details of the test specimen and locations of instrumentation requirements under full design loading:
  - 1. Submit engineering calculations to show that maximum deflection does not exceed specified performance.
  - 2. Submit a detailed outline of each test procedure specified.
- B. Provide an off-site test mock-up including an exterior wall assembly installation of window and door systems, insulation, air/vapor barrier, sealants, and all associated accessories; areas as indicated on drawings. The façade shall also include its external feature which is making a part of the window and door systems.
- C. Erect test assemblies securely connected to test frame to simulate actual job conditions. Connections to test frame shall be exactly as per connections to the building.
- D. Mock-up shall be delivered to and erected at inspected and testing company facilities, as directed, to the requirements of the testing company and to the approval of the Engineer. Cooperate with the inspection and testing company with regards to scheduling, delivery of materials and removal of test panel after completion of testing.
- E. Testing Service: Engage a qualified independent testing agency to the approval of the Engineer which is equipped and experienced in conducting the required tests. The Contractor's own test facilities won't be acceptable. Testing agent shall have NABL or similar certificate. Façade contractor shall provide minimum of two options for the testing agency.
- F. The system shall not be considered as suitable for the project if the performance mock-up is failed in two attempts and such failure is due to system design deficiency.
- G. Contractor to confirm the supervisor and the leads of performance mock-up preparation team shall be from the team assigned for site installation of the façade works.

H. Mock-Ups

1. To be provided where agreed, to the acceptance of architect/client.

I. Prototype

1. To be provided where agreed, to the acceptance of architect/client.

J. Quality Benchmarks

1. Window and Door Systems: First completed structural bay on site accepted by architect/client.

K. If the performance mock-up fails the second time, all the subsequent mock-up expenses to be borne by the façade contractor.

1.10 OFF-SITE TESTING

A. Refer to section 1.7 Performance Requirements.

B. Façade contractor to submit test report both in hardcopy and PDF soft copy. Façade contractor shall also submit HD recording of testing from installation to dismantling.

C. Static Air Infiltration and Exfiltration Test.

1. Perform testing in accordance with ASTM E283, except as otherwise specified herein.
2. From these tests the following results shall be attained:
  - a. Air infiltration and exfiltration through the completed window and door systems shall not exceed requirements specified herein.

D. Static Water Penetration Test.

1. Perform testing in accordance with ASTM E331, except as otherwise specified herein.
2. From these tests the following results shall be attained:
  - a. No water penetration inboard of the air barrier plane of the assembly shall occur at design conditions.

E. Dynamic Wind and Rain Test.

1. Perform testing in accordance with Architectural Aluminum Manufacturers Association, AAMA 501.1 or as otherwise approved.
2. From these tests the following results shall be attained:
  - a. There shall be no infiltration of water to the interior face of the assembly (any water inboard of the air barrier plane).

F. Static Structural Performance Test.

1. Perform testing in accordance with ASTM E330, except as otherwise specified herein.
2. From these tests the following results shall be attained:
  - a. The inward deflection on any part of the assembly shall not be sufficient to cause such member to touch any part of the main structure or impose loads onto any non-load bearing exterior wall members.
  - b. All components shall return to their original positions under zero load, proving that the elastic limit of the materials has not been exceeded test pressure to be held for 60 seconds for 100% load, and 10 seconds for 150% load.

- c. In all cases the deflection of members shall not exceed specified tolerances. No failures or permanent deformation in excess of 1/1000 shall occur.
  - d. Anchorage shall not show permanent set or signs of slackening off. The deflection of these members shall not be sufficient to damage non-load bearing members of the inner wall assembly.
  - e. No noise shall occur due to movement of components.
- G. Durability Test: All major window/door types are to be tested, and certified to meet the below mentioned criteria:
- 1. Complete Window/Door System: BS EN 1191 – 25,000 cycles
  - 2. Sliding Window Rollers: BS EN 13126-15 – 25,000 cycles
  - 3. Lift & Slide Window Rollers: BS EN 13126-15 – 25,000 cycles
  - 4. Finger Point Lock: BS EN 13126-7 – 25,000 cycles
  - 5. Espag Lock: BS EN 13126-4 – 25,000 cycles
  - 6. Turnable Handle Set: BS EN 13126-2 – 25,000 cycles
  - 7. Hinges: EN 1935 – 25,000 cycles

#### 1.11 OFF SITE TESTING SEQUENCE AND PRESSURES

- A. Perform tests in the following sequence and at the pressures stated:
- 1. Test for air infiltration not exceeding 1.5 cum/hr/sq.m at 600 Pa static pressure difference to ASTM E283. Pressure shall be applied as per CWCT recommendations.
  - 2. Test for water penetration under design static pressure of 600 Pa.
  - 3. Test for water penetration under design dynamic pressure of 600 Pa.
  - 4. Test for structural performance under positive and negative loading at one half and full design load with allowable deflections per Specifications and in accordance with wind pressures as defined by wind study report.
  - 5. Repeat test for air filtration.
  - 6. Repeat test for water penetration under static pressure.
  - 7. Test for structural performance under positive and negative loading at full design load and at 1 ½ time full design load (to demonstrate a 1.5 safety factor) with no failures nor permanent deformation in excess of 1/1000.
  - 8. Controlled Dismantling: Contractor shall discuss with the Engineer for the sequence and program of controlled dismantling.
- Note: Seismic to be included as well in the above sequence; in case of any conflict, CWCT sequence B be followed as agreed with the Engineer.

#### 1.12 ON SITE TESTING SEQUENCE AND PRESSURES

- A. Air & Water Penetration Test.
- 1. Perform testing in accordance with ASTM 502-12, except as otherwise specified herein:
    - a. Water penetration resistance tests shall be conducted at a static test pressure equal to 2/3 of the tested and rated laboratory performance test pressure as advised in AAMA 502-12 section 5.3.2.
    - b. Allowable air infiltration can be x1.5 times more during field testing than lab test certification as advised by AAM 502.

2. From these tests the following results shall be attained:
  - a. No water penetration/spillage shall be observed towards the interior from the assembly at site.

B. Water Penetration Test on total installation:

1. Perform testing in accordance with AAMA 501.2 - With spray rate maintained at a minimum of 25 PSI for openable systems, and 35 PSI for fixed glazing systems.

### 1.13 ACOUSTICAL FIELD TESTING

- A. Perform field testing in accordance with ASTM E966 to verify that specific sound transmission class (STC) rating has been attained in designated areas, as per Project Acoustic Report requirements.

### 1.14 PRE-INSTALLATION CONFERENCE

- A. Conduct pre-installation conference in accordance with general requirements.
- B. Conference Purpose and Agenda:
  1. Arrange with Engineer and representative of window and sealant manufacturer to visit Project site before beginning glazing operation to analyze site condition and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
  2. Discuss following items:
    - a. Weather conditions under which work will be done.
    - b. Anticipated frequency and extend of joint movement.
    - c. Joint design.
    - d. Glazing procedures.

### 1.15 DELIVERY, STORAGE AND HANDLING

- A. As per manufacturer's recommendations.
- B. Deliver components in the manufacturer's original protective packaging.
- C. Handle and store material in such a manner that no damage will be done to the materials or to the work of other Sections.
- D. Provide removable protective covering over all aluminum to be exposed in the completed work.
- E. Do not use adhesive papers or sprayed coatings which will become bonded when exposed to sunlight or weather.
- F. Remove temporary protection after installation when acceptable to the Engineer. Do not leave coating residue on any surface.

- G. Deliver glass units with manufacturer's labels intact on interior side of glass. Ensure labels indicate glass thickness, unit location, glass strength and orientation of units in vertical position.
- H. Protect glass edges and corners to prevent chipping, cracking, and other similar damages.
- I. Store components in a clean dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.

#### 1.16 PROJECT CONDITIONS

- A. Field Measurements:
  - 1. Verify dimensions of units by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 2. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

#### 1.17 CORROSION PROTECTION

- A. Allow for protection against all corrosion arising from exposure to seawater, non-saline water, soil, high humidity, low or high temperatures, chemical acids and alkalis, abrasion and impact, fungi, and bacteria.
- B. Ensure that protective measures are taken to avoid any corrosion, or any deleterious effects caused by manufacturing, finishing, transportation, storage and installation of materials.
- C. Ensure full resistance to any corrosion for components that are secured or bolted to each other, paying particular attention to the surface damage caused by such bolting or securing.
- D. Contractor upon Engineers approval, to install non-corroding products and materials where appropriate including aluminium, stainless steel, other non-corroding metals, and plastics (fire resistant). In the case where no alternative to steel or other oxidizing metal is possible (or where the specifications specifically indicate the use of steel/stainless steel), the steel or other material must be effectively protected against corrosion by galvanization and/or protective paint coatings, for example with an anti-corrosion guarantee of 10 (ten) years.
- E. In all other cases, the Contractor will be asked to modify, if necessary, the proposed product (even if a catalogue or manufactured item) and to replace the corroding-type materials by non-corroding materials.

#### 1.18 MAINTENANCE AND REPAIR

- A. Contractor shall engage suppliers of materials, products, and equipment's having an office and maintenance service based in the country of project location.

1.19 WORK REASONABLY INFERRED

- A. Where Contractor shall execute the Work in accordance with the intent and meaning of the Drawings and Specification and shall supply all accessories and other items essential for the proper Performance and Completion of the Work and shall execute all Work, including the supply of necessary materials, which can be reasonably inferred, whether or not specifically shown or described in the Drawings and Specification.

1.20 WARRANTY

- A. General Warranty: The Contractor is to provide a written agreement to indemnify the Employer against any defects in the design, fabrication, workmanship, and quality of materials, water tightness or performance of the Works included in this Part and to repair or replace defective design, fabrication, workmanship, or materials of the window and door systems during the warranty period. Defective materials and workmanship include but not limited to:
1. Abnormal deterioration, ageing and weathering of the walling system.
  2. Leakage of water or air exceeding specified limits.
  3. Structural failure of components resulting from exposure to pressures and forces within specified limits.
  4. Failure of operating parts to function normally.
  5. Glass breakage due to defective design, manufacture or installation or exposure to pressures and forces within specified limits
  6. Spontaneous breakage of the tempered glass.
  7. Deterioration or discoloration of finishes in excess of normal weathering and ageing.
  8. Failure of the window and door systems to meet any other specified performance requirements.
  9. Noise or vibration caused by thermal movement.
  10. Adhesive or cohesive sealant failures.
  11. Glass and glazing damage from the weld spatters.
  12. Water leakage.
  13. Glazing breakage.
- B. The warranty shall not include damage caused by vandalism, or natural conditions exceeding the performance requirements.
- C. Warranty Period (in reference to contract conditions):
1. Windows/Doors system: Twenty (20) years from date of substantial completion.
    - a. Structural design & engineering: Twenty-Five (25) years
    - b. Air & Watertightness: Min. Ten (10) years
    - c. Manufacturing, fabrication, & workmanship errors: Min. Ten (10) years
    - d. Hardware & accessories: Five (5) years
    - e. Gaskets: Ten (10) years
  2. Glazing:
    - a. Insulated Glass Units (IGU/DGU): Min. Ten (10) years.
    - b. Performance Coating: Min. Ten (10) years.
    - c. Laminated Glass Units: Min. Five (5) years.
  3. Super Durable Powder Coating Finish: Twenty-Five (25) years (for product) from date of substantial completion.
  4. Anodized Coating Finish: Ten (10) years (for product) from date of substantial completion.

- D. Finish repairs to be covered by the same warranty period requirements mentioned above.
- E. The Operation and Maintenance (O&M) operation manual, need to be provided by façade contractor (and approved by Employer's Engineer) and has to be in compliance with the façade warranty period.
- F. Provide a written warranty of 10 (ten) years for gaskets to be free from defects and to be replaced when failed.
- G. Special Finish Warranty: Where special finishes (a Finish required by the design, but not a manufacturer's standard finish) are specified, the Contractor shall obtain a warranty from the manufacturer covering failure of the applied finish and agreeing to repair or replace items that show evidence of finish deterioration. Deterioration of Finish includes but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity. Special Warranty to be confirmed by Employer/Engineer.

#### 1.21 PROPOSAL SUBMISSION

- A. Same as for Specification Section 08 4413 Glazed Aluminium Curtain Wall.

### PART 2 – PRODUCTS

#### 2.1 SUBSTITUTIONS

- A. Manufacturers and products specified hereinafter are for the purpose of establishing minimum quality standards. Manufacturers which are equal to or better than those specified, and which conform to the design requirements and color selections, may be acceptable subject to Engineer's approval. This request shall be accompanied by:
  - 1. A certificate of compliance from the material manufacturer stating that the proposed products meet or exceed the requirements of this specification.
  - 2. Documented proof that the proposed material has a proven record of successful performance for more than 25 (Twenty-five) years, confirmed by at least five local projects that may be examined.

#### 2.2 ACCEPTABLE SYSTEM MANUFACTURERS

- A. Section Manufacturers
  - 1. Schuco, India/Middle East.
  - 2. Reynaers, India/Middle East.
  - 3. Eternia, India

#### 2.3 MATERIALS

- A. Aluminum: Conform to the requirements published in the Aluminum Association's "Aluminum Standards and Data", referenced ASTM standards and the following. All aluminum extrusions

shall be manufactured to dimensional tolerances so as to eliminate any edge projection or misalignment at joints. Unless otherwise specified, provide alloy and temper as required to suit performance requirements and finishes indicated. Provide concealed extruded bars, rods, shapes and tubes in alloys as recommended by the fabricator to join or reinforce assembly of exposed aluminum components.

1. Sheet and Plate: Alloy 5005 ASTM B 209 (ASTM B 209M).
  2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M). Alloy 6063, T54, T5, T6 tempered.
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Sheet and plate aluminum: ASTM B209M, extruded anodizing quality, AA5052-H14 or 3003-H 14 or other acceptable temper and alloy suitable for purpose (exposed/non-exposed) and finish required, of one type throughout, nominal thickness of 3.2 mm, special hardness for flat panel application, tension leveled quality of flatness, free from perceptible distortions, waves, twists, bucking or other deficiencies in appearance and performance, spray coat finished after forming and welding is complete.
- C. Steel Reinforcement: ASTM A 36 (ASTM A 36) for structural shapes, plates, and bars; ASTM A 1008/A 1008 M for cold-rolled sheet and strip; or ASTM A 1011 (ASTM A 1011 M) for hot-rolled sheet and strip.
- D. Stainless Steel: ASTM A 240 for plate, sheet, and strip; A 269 for tubing and A 312 for pipe.
1. Surface preparation: Remove tool and die marks and stretch lines, or blend into finish.
  2. Grade and Finishes:
    - a. Exterior & Interior Use: Type 316 minimum; surface finish as per ASTM A 480, to meet architectural intent.
- E. Anchors and Fasteners:
1. Material: Stainless Steel.
  2. Anchor and Fastener Metal Alloy Types, Designations and Standards: Alloys as selected by fabricator to prevent corrosion resistance with the components fastened.
  3. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
- F. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types compatible with sealants and suitable for joint movement and system performance requirements. Gaskets shall be black resilient, elastomeric type.
- G. Air/vapor barrier gasket seals: Neoprene, ethylene propylene diene monomer (EPDM), thermoplastic, silicone, or other accepted material, designed to remain flexible and heat resistant.
- H. Concrete Protective Coating: Acrylic based one component protective coating, solvent free with excellent resistance against carbonation and ingress of chloride ions, sulphates and oxygen. Suitable for use in hot climate condition. Class A, according to ASTM E84-16.
- I. Primer for ferrous metals: ASTM D4146.
- J. Touch up primer for galvanized steel: Zinc rich anti-corrosion coating containing 92-95% zinc in dried film providing electro-chemical protection on ferrous metals.

- K. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.
- L. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- M. Glazing Gaskets:
  - 1. Compression type design, replaceable, molded or extruded ethylene propylene diene monomer (EPDM), designed to remain flexible and heat resistant.
  - 2. Comply with ASTM C509 or C864.
  - 3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
  - 4. Manufacturer's standard black colour unless otherwise specified, all gaskets should be marked with the supplier and the section reference.

## 2.4 SEALANTS

- A. Concealed Sealing Materials: All sealing materials concealed within the glazed aluminum window and door systems shall be silicone compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.
- B. Sealants and gasket seals shall be non-bleeding, non-staining and capable of supporting their own weight. Sealants and gasket seals exposed to exterior shall also be UV resistant and ozone resistant. Sealants used in glazing systems shall also be capable of supporting specified loads associated with the glazing systems.
- C. Primers, cleaning materials and joint backing: Recommended by the sealant manufacturer to suit the various substrates and conditions of the Work, compatible with each other and with sealant.
- D. Sealants shall be from the same manufacturer for all work of this Section.
- E. Sealant at exposed locations: ASTM C920, type which minimize silicone fluid leaching, one component, neutral cure, medium modulus, 'Silruf NB-SCS9000' by GE Silicones or Spectrum 3 or 'Spectrum 4' by Tremco Ltd., or 756 SMS' by Dow Corning Corporation or equivalent.
- F. Structural silicone and heal bead for shop and field application (where shop application is not possible): ASTM C920, one part/component, '795' by Dow Corning Corporation, 'Utraglaze 4000' by GE Silicones, or 'Spectrum 2' by Tremco Ltd. or equivalent.
- G. Structural silicone sealant for shop glazing: Two part/component '983' by Dow Corning Corporation, 'Utraglaze 4400' by GE Silicones, or 'Proglaze II' by Tremco Ltd. or equivalent.
- H. Sealants used in structural joints shall have adequate strength to retain insulating units to the metal framing under the design conditions.
- I. Sealants used in contact with edges of laminated glass shall not cause damage or disfigurement or laminate interlayer of the laminated glass.
- J. Sealant where concealed: Sealant as specified for exposed locations.
- K. Air seal sealants: For back pan seals; one part/component elastomer sealant.

- L. Sealant colors: To be selected by the Engineer, not necessarily from the sealant manufacturer's standard color range.
- M. Sealant tape (concealed locations): Extruded, ribbon-shaped, non-drying, non-skinning, non-oxidizing, reinforced, polyisobutylene tape of sufficient width and thickness, 6-7mm minimum, to permit a continuous seal, 'Tremco 440 Tape' by Termco Ltd., or equivalent from other approved manufacture.

## 2.5 COMPONENTS

- A. Insulating glass units: ASTM E2190, and IGMA TM-3000, certified by the Insulating Glass Certification Council (IGCC) or equivalent European standards BS EN 1279, consisting of 2/3 panes separated by a 12/16/20 mm wide factory double time sealed, dehydrated and air/argon gas filled cavity space utilizing black (recommended for aesthetics) stainless steel/warm edge spacer, without metal edge banding. Seal color to be selected by Engineer. Air/Gas pressure within the glass cavity space shall suit atmospheric conditions at the location of the installation to prevent distortion of the installed units. Edges of glass shall be straight cut, free from nicks and other imperfections conducive to breakage. Units shall be manufactured in IGMA or equivalent European certified facility. All edges of glass adjacent to structural silicone glazing.
  - 1. Glass Type: As indicated on drawings and as per specification Section-08 8000 "Glazing".
  - 2. Glass: Fully tempered shall be heat soak tested to remove Nickel Sulfide inclusions, which may otherwise cause spontaneous breakage in situ. All edgework and holes must be completed before tempering. Written warranties against nickel sulphide inclusions in lieu of heat soaking will not be accepted.
  - 3. Insulated glass spacers shall be straight and evenly set into glass units. Reflective and low emissivity coatings shall be edge deleted over entire depth of spacer and edge seal at locations where silicone sealant is in contact with glass.
  - 4. Use 2-part silicone sealant for secondary seal of the insulating glass units at structural silicone glazing. Remove excess silicone seal from glass edges of outer lite
  - 5. The glass manufacturer shall confirm that the recommended glass thickness and stress levels are compatible with a safe and service design.
  - 6. All glass will be manufactured and processed in a factory where the Quality Control procedures are accredited to ISO 9000 and are independently maintained.
- B. Setting Blocks: Silicone rubber, compatible with silicone sealants, 85 plus or minus 5 Durometer A hardness, by Tremco Ltd. or equivalent from other approved manufacturer. Silicone compatible EPDM may be used instead of silicone where tested and approved by the manufacturers of the silicone sealant and the setting blocks.
- C. Spacers: Continuous, bond breaker type and compatible with silicone sealant, 'Norton Thermabond V-2100 or V-2200' by Saint-Gobain Performance Plastics Corporation, approved equivalent by Tremco Ltd., or equivalent from other approved manufacturer.
- D. Gaskets: Continuous silicone rubber, compatible with silicone sealant, or silicone compatible EPDM, 60 plus or minus 5 Durometer A hardness.
- E. Prefinished Aluminum Panel System

1. Prefinished Aluminum Panel system shall consist of pre-finished Sheet aluminum compiling ASTM B209M, extruded anodizing quality, AA5052-H14 or 3003-H 14 or other acceptable temper and alloy suitable for purpose and finish required, of one type throughout, nominal thickness of 3 or 3.2mm, special hardness for flat panel application, tension leveled quality of flatness, free from perceptible distortions, waves, twists, bucking or other deficiencies in appearance and performance, spray coat finished after forming and welding is complete.
2. Prefinished Sheet shall be non-sequential, non-progressive, flat profiled aluminum panel system mounted with concealed fasteners, and clips.
3. Provide continuous insulation and air/vapor barrier behind wall cladding assemblies.
4. Provide matching flashings, copings, trims and closures, and sealant work.
5. Provide all primary and secondary steel framing secured to structure.

F. Air/vapor barrier

1. Self-adhesive membrane air/vapor barrier: High temperature resistant, self-adhesive type with release liner on adhesive side, EPDM membrane, minimum 1mm thick or as recommended by the manufacturer. Primer, mastic, stainless steel fastening bars and fasteners, as recommended by membrane manufacturer.
2. Sheet metal for metal air/vapor barrier and air seal tie-ins to adjacent construction: aluminium sheet, BS 1470 alloy and/or ASTM B 209, tension leveled and anodized to a minimum standard of AAMA 611, class I or equivalent performing chromatinized finish, nominal core thickness 0.91mm; where possible provide preformed sheet steel liner panels with factory applied caulking at side lap joints.
3. Waterproofing sheet membrane at ledges, projecting features, copings and parapets: High temperature resistant, sheet rubber, 1.5mm thick EPDM, neoprene, butyl, or other approved manufacturer.
4. Adhesive takes and sealant for membrane: Recommended by the membrane manufacturer. Ensure compatibility of flashing membrane with roofing and waterproofing membranes, and air/vapor barriers.
5. Support for flexible membrane across air spaces: Minimum 1.5mm chromatinized aluminium sheet.

G. Brackets and Reinforcements: Provide manufacturer's standard high-strength aluminum brackets and reinforcements. Provide non-staining, nonferrous shims for aligning system components.

H. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.

## 2.6 FABRICATION–PREFINISHED ALUMINUM PANEL SYSTEM

- A. Fabricate aluminum panels and concealed support members in a manner which will provide an installation free of exposed fastenings, with sufficient support and allowance for thermal movement to prevent facing panel distortion and stresses.
- B. Fabricate exterior and interior panels, true, free of marks, without visible distortion and with edges straight and true. Panel lines, breaks and angles shall be sharp and true; panel surfaces to be free from warp, twist, kinks, dents, buckle or other imperfections which may affect appearance or serviceability. Make all planes true, corners square and bends of minimum radius. Panels shall have neat, flat, flush appearance, at all times, under all design conditions, and shall be free

of reinforcement or fastener telegraphing. Make allowance for field adjustments in manner recommended by manufacturer.

- C. Forming, reinforcing and fastening of flat metal stock shall be done in a manner which does not cause distortion of finished surfaces.
- D. Thickness of metal and details of assembly and support shall provide sufficient strength and stiffness to resist distortion of finished surface.
- E. Joints and intersecting members shall be accurately fitted to true planes, adequately and securely fastened, aligned, and made weathertight. Ensure structurally sound panel system that allows no uncontrolled water penetration on the inside face of the panel system. Connections and joints exposed to the weather shall be constructed to exclude water. Component fastening devices shall be of adequate strength and concealed, except as otherwise specified or approved.
- F. Fabricate flat panels, uniformly curved panels, corner units, filler pieces, trims, decorative features, cap flashings, copings and closures to the profiles shown and as required. Perform welding prior to application of finish.
- G. Exposed edges and ends of metal shall be dressed smooth, free from sharp edges.
- H. Provide proprietary aluminum extrusions compatible with panel edges, manufacturer's profiles and vertical and horizontal joint closures and perimeter trim as required for complete installation.
- I. Maximum allowable tolerances shall be as follows:
  - 1. Panel flatness in all directions across the surface to be maximum of 0.2%.
  - 2. Width or length plus/minus 0.3 mm up to 1.2 m.
  - 3. Width or length plus/minus 1.6 mm over 1.2 m.
  - 4. Thickness plus/minus 0.2 mm.
  - 5. Squareness less than 1.6 mm diagonally.
  - 6. Camber plus/minus 0.8 mm.
- J. Panels shall be constructed with flanges on all sides and framed with aluminum extrusions. Panels shall have uniform radiused corners 1.5T material thickness, with factory-welded corners, ground smooth.
- K. Reinforce panels by concealed means as necessary to meet the specified design requirements and the installation shown, to maintain profile and flatness of panel faces and to prevent oil-canning effect or other distortion.
- L. Fabricate aluminum securement members required for the adequate anchorage and attachment of the panels to the structure for the support of the system, including brackets, clip angles, straps, "U" and "Z" clips, shims, nuts, washers, and other fastenings required. Design attachments to provide for accurate alignment, and to compensate for structural tolerances.
- M. Provide inconspicuous, baffled weep holes to properly drain system to exterior in individual panels.
- N. Provide flashings of 1.5mm minimum thickness aluminum sheet, prefinished to match panels, formed to configurations to suit site conditions.

- O. Copings, cap flashings and sill flashings shall be of same gauge and finish as panel, complete with reinforced back-up splice plates at joints and directional changes. Coordinate cap flashing and coping profiles with work of other trades to ensure uniformity of appearance throughout the project.

## 2.7 ALUMINIUM FINISHES

- A. All visible aluminium surfaces exposed to the building exterior interior: Aluminium surfaces shall be finished with Super Durable Powder Coating complying with ROHS (Non-lead), low VOC, Qualicoat Class 2, GSB Master and AAMA 2604-13 and that are thermoset, with minimum dry film thickness of 60 microns, colour as per approved sample. During pre-treatment – the base material to be etched to a minimum 2 grams per m<sup>2</sup> to ensure performance in a C5 corrosion category, or as advised by the coating manufacturer.
- B. Concealed Aluminum Surfaces: Any aluminum sections which are completely concealed and therefore do not require any visible color shall be clear (silver) anodized to a minimum standard of AAMA 611, class I or equivalent performing chromatinized finish – with warranty to a minimum of 20 years.
- C. Identification marks shall not appear on finished surfaces.
- D. Salt spray test to be conducted for the all the coatings uniformity; Submit samples with test area noted on each sample for the Engineers information and acceptance.
- E. Adhesion: No removal of coating (Super Durable Powder Coating) after 1.5mm cross hatching to base metal, impacting to the point of metal rupture, and subjecting to application and quick removal of cellophane tape.

## 2.8 STEEL PRIMING

- A. General: Requirements and specification for finishes on carbon steel as referred to this Section shall comply to the following:
  - 1. All surfaces of steel members incorporated in Works shall be finished as required in this Section and based on environmental classification for exposed and no exposed surfaces.
- B. Finishes (Mild Steel and Galvanized Steel)
  - 1. Application shall be in strict conformance with the manufacturer's recommendations. Substrate preparation requirements as per manufacturer's instructions shall be fully compiled.
  - 2. Finish Systems:
    - a. Paint System (For Mild Steel)
      - 1) Description: Epoxy or Polyurethane System
      - 2) Type: Epoxy primer/Polyurethane topcoat
      - 3) Surfaces(s): Mild Steel
      - 4) Preparation: Blast cleaning to Sa 2.5
      - 5) Initial Coats: Strip coating, and one full coat of two pack epoxy primer @ 100 microns as a primer. (solid% by volume: >48, Mixing ration 4:1)

- 6) Intermediate: One full coat of two pack epoxy primer @ 125 microns as an intermediate coat. (solid% by volume: >48, Mixing ration 4:1)
  - 7) Finish Coats: Two coats of polyurethane topcoat each @ 50 microns (solid% by volume: >48, Mixing ration 4:1)
- b. Paint System (GI Surfaces)
- 1) Description: Epoxy or Polyurethane System
  - 2) Type: Epoxy primer/Polyurethane topcoat
  - 3) Surfaces(s): Galvanized Steel
  - 4) Preparation: Blast cleaning to Sa 2.5
  - 5) Initial Coats: Strip coating, and one full coat of two pack epoxy primer @ 125 microns as a primer. (solid% by volume: >48, Mixing ration 4:1)
  - 6) Finish Coats: Two coats of polyurethane topcoat each @ 50 microns (solid% by volume: >48, Mixing ration 4:1)
3. Time between coatings shall be as per manufacturer's instruction.
  4. Use spray coating for painting. The minimum thickness shall be maintained on all corners, edged, and ends of pieces. Do not paint outdoors in rainy and dusty weathers.
  5. Hot dip galvanized coating thickness to be minimum 100 microns and complying to ASTM A 123 / A 123M.

## 2.9 REFERENCED STANDARDS

- A. ASTM A 36/A 36M: Standard Specification for Carbon Structural Steel
- B. ASTM A 123/A 123M: Standard specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- C. ASTM A 153/A 153M: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- D. ASTM A 1008/1008M: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- E. ASTM A 1011/A 1011M: Standard Specification for Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability
- F. ASTM B 209/B 209M: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- G. ASTM B 221/B 221M: Standard Specification for Aluminum And Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, And Tubes
- H. ASTM B 429: Standard Specification for Aluminium and Aluminium-Alloy Extruded Structural Pipe and Tube
- I. ASTM E 90: Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

- J. ASTM E 699: Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components
- K. ASTM E 783: Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- L. ASTM E 1105: Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- M. ASTM E 2190: Standard Specification for Insulating Glass Unit Performance and Evaluation
- N. AAMA CW-RS-1: The Rain Screen Principle and Pressure Equalized Design.
- O. AAMA 501.1: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
- P. AAMA 501.5: Test method for Thermal Cycling of Exterior Walls.
- Q. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
- R. AAMA 2604-05: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels
- S. AWS D1.2: American Welding Society, Structural Welding Code-Aluminum
- T. GANA: Glass Association of North America Glazing Manual

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of glazed window and door systems. Do not proceed with installation until unsatisfactory conditions have been corrected or accommodations acceptable.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Material Testing: Façade contractor is responsible for conducting and producing material tests as per the below mentioned standards on the batches of profiles, sheets, items, etc. delivered at site to confirm grade/quality/performance compliance to the site management team appointed by the client:
  - 1. Aluminium
    - a. Grade Verification: ASTM E1251/IS 504

- b. Mechanical Properties: ASTM E8/E8M
  - 2. Steel
    - a. Grade Verification: ASTM E 415/ASTM E 349
    - b. Mechanical Properties: ASTM A370
  - 3. Stainless Steel
    - a. Grade Verification: ASTM E1086/ASTM E353
    - b. Mechanical Properties: ASTM A370
    - c. Chemical Test: To differentiate between SS304 and SS316
  - 4. Laminated Glass
    - a. Content Verification: EDXRF Method
    - b. Lamination Quality & Durability: ASTM C1914 or IS 2553/IS 17004
    - c. Optical Distortions: ASTM C1901 & C1651/C1652 or IS 14900
  - 5. Insulated Glass
    - a. Content Verification: EDXRF Method
    - b. Seal Quality & Durability: ASTM E576 & C1265 & E2190 or IS 17346
    - c. Optical Distortions: ASTM C1901 & C1651/C1652 or IS 14900
    - d. Acoustic: ASTM E90
    - e. Thermal & Solar Performance: ASTM E1084 or EN 673,674,675, & EN 410 (Optional)
- D. Approved testing labs for glazing:
- 1. Winwall, India & Singapore
  - 2. TÜV Rheinland, India & Germany
  - 3. PSB Lab, Singapore

### 3.2 PREPARATION

- A. Supply anchorage devices and inserts to the appropriate trades where required for building in or casting-in-place and instruct as to proper location and position.
- B. Ensure that masonry and concrete surfaces to receive adhesive and sealants are dry, firm, sound, smooth, suitable for bond, and free from loose material, projections, ice, frost, slick, grease, oil and other matter detrimental to bond.
- C. Maintain surface of substrates and ambient temperatures constantly within range recommended by material manufacturer during application and curing of sealants and adhesives, and during installation of glazing.
- D. Remove dust and other loose material from openings.

### 3.3 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazed window and door systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight, unless otherwise indicated. Provide means to drain water to the exterior to produce a permanently weatherproof system.

- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by applying the aluminium with powder coating or anodized finishes.
- C. Air/Vapor Barrier and Insulation
1. Provide thermal insulation and air/vapor barriers to ensure a uniform, continuous thermal and vapor barrier effect. Where adjacent insulation and vapor barriers are to be provided under other Sections, coordinate the work such that thermal and vapor barrier continuity is achieved.
  2. Coordinate work of this Section with and provide connection for compartmentalization of air spaces provided under other Sections.
  3. Gun applied continuous bead of sealant to joints and air/vapor barrier junctions with adjacent construction. Liberally butter screw fastenings with sealant.
  4. Provide airtight seals at penetrations and joints in air/vapor barriers.
  5. Isolate metal air/vapor barriers with thermal breaks and spacers.
  6. Provide sheet steel and/or flexible, continuous membrane and gasket air/vapor barrier seals between work of this Section and adjacent construction, and at deflection and expansion connections, where required. Prime substrates, apply membranes and gaskets to concrete and masonry with adhesive and retain with continuous aluminum or galvanized steel plates or bars and non-corrosive mechanical fasteners. Vulcanize or overlap joints to ensure a continuous seal.
  7. Install self-adhesive membrane air/vapor barrier installation and mechanical fastening of insulation at exterior sheathing locations, around structural steel and at concrete and masonry substrate locations.
  8. Apply insulation to the exterior side of air/vapor barriers.
  9. Adhere stick clips for insulation to metal air/vapor barriers at 300 mm c/c both ways. Support adhesive-applied clips in place until adhesive has set. As an alternative, gun weld apply pins to metal substrates in lieu of stick clips, provided clips do not easily break off and weld burn-through does not occur.
  10. Cut insulation as required and fit snugly to penetrations, obstructions, openings and corners. Butt insulation boards tightly. Cut out back of board insulation as required to accommodate substrate irregularities and build up over cut out areas on the other side as required to ensure thermal barrier uniformity unless otherwise indicated or approved.
  11. Press insulation boards firmly and tightly to barrier or substrate impaling them on clips without bending clips. Butt insulation boards tightly at joints. Install retainers to clips.
  12. Fill irregular shaped voids within assemblies with fibrous packing insulation to maintain continuity of thermal barrier.
- D. Provide structural framing and supports required to support work of the section.
- E. Install operable window, as applicable and related hardware, at location indicated and ensure weathertight, rattle-free closure when unit is in the closed and locked position.
- F. Install components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- G. Install framing components plumb and true in alignment with established lines and grades.

- H. Anchorage: After system components are positioned, fix connections to building structure as indicated on Shop Drawings.
  - 1. Provide separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- I. Welding: Weld components to comply with referenced standard and Shop Drawings, unless otherwise indicated. Weld in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
  - 1. Install glazing according to Shop Drawings. Comply with requirements of specification Section 08 8000 "Glazing," unless otherwise indicated.

### 3.4 INSTALLATION-GLAZING

- A. General: Install glazing gaskets, beading profiles, and sealants in accordance with manufacturer's instructions without exception, including surface preparations.
- B. Clean rabbets, stops and glass edges of dust, dirt, moisture, oil and other foreign matter detrimental to glazing material adhesion. Ensure drainage holes are not blocked.
- C. Mask surfaces subject to staining, and whenever necessary to ensure neat appearance of the glazing bead. Remove masking as work progresses.
- D. Accurately size glass to fit openings allowing clearances following acceptable trade practices. Cut glass cleanly and carefully; replaces glass with nicked or otherwise damaged edges, scratches or abrasion of faces, or other damage.
- E. Use spacers, setting blocks and shims of proper size to support and hold glass in position independent of the glazing gaskets. Place 2 setting blocks under each unit at adequate points. Place spacers located directly opposite each other on both sides of the glass, at maximum 600 mm centres and maximum 300 mm from corners and uniformly spaced. Arrange spacers, setting blocks and shims so as to avoid blocking water transfer inside window frames and to stay in place during transportation and installation.
- F. Install glazing gaskets in continuous lengths between corners, not stretched, and seal, vulcanize, or weld joints at corners to prevent entry of water and air.
- G. Handle, prepare and install glass in accordance with manufacturer's directions.
- H. Ensure a weathertight continuous seal between glazed element and frame flush with sightline and rattle free setting for glass.

### 3.5 INSTALLATION PREFINISHED ALUMINUM PANEL SYSTEM

- A. Erect work plumb, level, true and square, with joints parallel and uniform, in correct relationship to work of other Sections and established lines and levels indicated. After correct position has been determined, and allowances for expansion, building movement, uniform joint width and alignment of all parts has been determined, positively lock anchorage devices to prevent movement other than those designed for expansion and contraction.

- B. Do not cut, trim, weld or braze component parts during erection in a manner which would damage finish, impair strength, or result in visual imperfection or failure in performance. Return component parts which require alteration to shop for refabrication or for replacement with new parts where field adjustment is not possible.
- C. Installed panels shall not deviate from overall plane or alignment by more than 1:1000. Joints shall be not less than their dimensioned width or more than 5% greater than their dimensioned width at any location along their full length and shall not be wavy, out of line, or of different width from panel to panel.
- D. Support system shall be attached to the structure to transmit design loads. Framing and other components shall be straight to match plane of panel as required to meet the installed panel tolerances with straight, sharply formed edges.
- E. Install exterior aluminum cladding to structural supports by concealed mechanical fasteners, clips and perimeter framed extrusions.
- F. Construct expansion joints over similar joints in structure, and cladding control/expansion joints as required. Where system expansion joints are required, they shall be located with support member on each side of joint. Use cover sheets, of same material and finish as adjacent material. Provide flexible membrane at back of expansion joints. Mechanically fasten and seal membrane to adjacent air/vapor barrier.
- G. Provide closures, caps, copings, fascias, covers and trims as required. Provide flashings to divert all moisture to the exterior. At horizontal and sloped surfaces detail and seal joints to control and minimize water entering cavity.
- H. Ensure continuity of "pressure equalization" of rain screen principle. Provide continuous formed aluminum closure plates/baffles, minimum 3 mm thick, within the aluminum cladding assembly, drained to exterior; coordinate work of this Section with, and provide connection for compartmentalization of air spaces provided under other Sections. Baffle all weep holes to prevent entry of wind-blown sand.
- I. Finished work shall be securely anchored, free of distortion and surface imperfections, uniform in color and gloss.
- J. Backpaint metal surfaces in contact with concrete, masonry and dissimilar metals with acrylic based protective paint/coating. Separate dissimilar metals and use gasketed fasteners to eliminate possibility of corrosive or electrolytic action between metals.

### 3.6 INSTALLATION-SEALANT

- A. Seal joints between frame assemblies and adjacent construction, and within glazed assemblies where required to maintain weather-tightness and integrity of air/vapor barrier. Seal junctions in sheet metal air/vapor barriers and between air/vapor barriers and adjacent construction. Cover fasteners penetrating the air/vapor barriers with sealant.

B. Preparation

1. Ensure that ambient and surface temperatures are within range recommended by sealant manufacturer and joint conditions are suitable for the materials to be installed.
2. Ensure that surfaces to be sealed are sound, dry, and free from dirt, water loose scale, corrosion, or other contaminants which may adversely affect the performance of the sealing material. Remove oil or grease films.
3. Perform cleaning to the extent required to achieve acceptable joint surfaces.
4. Protect cleaned and primed surfaces from further contamination by oil, dust, rain, condensation and other materials detrimental to sealant bonding strength. Re-clean and re-prime contaminated surfaces.
5. Install filler strips as backup for sealant to provide optimum joint profile, but not less than 6mm depth of sealant bead.
6. Mask areas adjacent to the joints to prevent contamination of adjacent surfaces. Remove masking promptly after the joint has been completed.
7. If recommended by the manufacturer of the sealing material, prime joints to prevent attaining, or to assist the bond.
8. Apply primer with a brush which will permit all joint surfaces to be primed. Perform priming immediately before installation of sealant.

C. Cleaning and Priming for Structural Silicone Glazing.

1. Do not clean and prime surfaces for structural glazing that cannot be glazed within 2 hours.
2. Use clean, soft, absorbent, lint-free cloth for cleaning and priming. Each piece of cloth shall be used only once.
3. Do not use brush for cleaning operation.
4. Pour cleaning solvent from container onto cloth to avoid contamination; do not dip cloth into solvent.
5. Dry wipe immediately before cleaning solvent evaporates and dries on the substrate.
6. Prime all surfaces to receive glazing materials unless recommended specifically to the contrary, in writing, by the sealant manufacturer.
7. Apply a thin film (one pass) of primer; remove excess primer by wiping with a clean dry cloth according to manufacturer's specification.

D. Installation

1. Install materials in accordance with the manufacturer's instructions.
2. Do not exceed shelf life, and pot life of the materials and installation times, as stated by the manufacturers.
3. Be familiar with the work life of the sealant to be used.
4. Before any sealing is commenced, test the materials for indications of staining or poor adhesion.
5. Sealants shall be of gun grade consistency to suit the joint condition. Use pressure operated guns with nozzles of the proper sizes to suit the joints and the sealant material.
6. Use sufficient pressure to fill all voids and joints full. Sealants shall bond to both sides of joint and shall not adhere to the filler material.
7. Ensure that the correct sealant depth is maintained. Superficial painting with a skin bead will not be accepted.
8. Sealant installations shall be full bead free from air pockets and embedded impurities and having smooth surfaces, free from ridges, wrinkles, and sags.
9. After joints have been completely filled tool them neatly to a slight concave surface.
10. Install exposed silicone sealants at glazing so that top surfaces of the beads are formed to drain water away from the glass.

11. Trim and clean excess sealants from glass and framing surfaces immediately after installation.
12. Immediately clean adjacent surfaces which have been soiled and leave work in a neat, clean condition. Remove excess materials and droppings using recommended cleaners and solvents.

### 3.7 TOLERANCES

- A. Erection Tolerances: Install glazed window and door systems to comply with the following maximum tolerances:
  1. Plumb: 2 mm in 3m; 3 mm in 12 m.
  2. Level: 2 mm in 6m; 3 mm in 12 m.
  3. Alignment: Where surfaces about in line, limit offset from true alignment to 1.5 mm; where a reveal or protruding element separates aligned surfaces by less than 50mm, limit offset to 3 mm.
  4. Location: Limit variation from plane or location shown on Shop Drawings to 2 mm in 3 m; 3 mm over total length.

### 3.8 CLEANING

- A. Test and adjust hardware installed under this Section and replace or repair all faulty items. Adjust weather stripping so as to leave each opening unit in its most weathertight position. Test operable elements and ensure easy smooth operation.
- B. Repair and touch-up minor surface damage. Remove and replace damaged panels as directed.
- C. Clean and make good surfaces soiled or otherwise damaged in connection with this work. Replace finishes or components that cannot be satisfactorily cleaned.
- D. Handover a proper cleaned hardware.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Shall be responsible during the installation of the Glazed Aluminum window and door systems for the supervision, inspections and tests carried out in accordance with, but not limited to, the requirements detailed in this Specification Section, and those adopted from the accepted Method Statement prepared by the Inspection and Testing Agency. Inspection and Test Reports shall be submitted periodically to the Contractor, Installer and Engineer during installation of the Works, and in accordance with the stipulations of the accepted Method Statement.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place in successive stages as required. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

- C. Air Infiltration: Test areas of installed system for compliance with system performance requirements according to ASTM E 783.
- D. Water Spray Test: After completing the installation of 1 unit of glazed window and door system type, test system for water penetration according to AAMA 501.2 in a 2-bay area directed.
- E. Repair or remove Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

### 3.10 MANUFACTURER'S FIELD SERVICES

- A. Window and door systems, and glass product manufacturers to provide field surveillance of installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.
- C. Repair and touch-up minor surface damage. Remove and replace damaged panels as directed.

### 3.11 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer that ensure glazed window and door systems is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 5113

**SECTION 01 10 00**  
**GENERAL SPECIFICATIONS**

**PART 1 – GENERAL**

**1.22 INTRODUCTION**

- U. The site of the Contract Works is for the proposed residential development at IIT Mumbai. The project consists of cluster of G + 22 story Two residential tower.
- V. This specification should be read along with tender documents covers the façade works contract. This specification covers the Windows contract works of podium exterior cladding, aluminium, and glass work.
- W. The setting out of the building should be taken from the Architectural Drawings.
- X. This technical specification shall be read in its entirety in conjunction with all the following:
  - 1. All contract conditions documents.
  - 2. All design intent drawings & documents.
  - 3. All appendixes to this specification.
  - 4. Architectural drawings including general façade, all 2D / any 3D drawings for contractor.
  - 5. The geometrical setting out of the building should be defined based on the architectural drawings.
  - 6. Structural engineering drawings including any 2D/3D drawings.
  - 7. Drawings for other interfacing building elements.
  - 8. Lighting requirement documents (If Applicable).

**1.23 TECHNICAL SPECIFICATION**

- A. This is a Performance based Technical Specification. The Contract documents provide the design intent for the building envelope systems and associated works. The Contractor is to produce shop drawing in line with the design drawings attached with tender covering all façade elements and all interface detail related to that Windows and fabrication drawings that will fully comply with the specified requirements and design drawings and within the agreed time frame (not more than 01 months from LOI). Submissions shall be covering the complete design submission covering all typical and non-typical details with the various conditions of the specific windows item and partial submissions (on piece meal basis) will not be accepted.
- B. The tender drawing & architecture drawing will consist of the following:
  - 1. Definition of proposed geometry of the façade elements. The Contractor to verify actual dimensions and resolve detailed dimensions.
  - 2. Design details for majority of conditions.
  - 3. Plans, Elevations and Sections showing the modulation of panels.

- C. The Specification together with the Drawings and list of sketches indicates the design intent and scope of the works. Together they illustrate the mandatory geometry of Windows components including extrusion forms, materials to be used in the design, define the performance parameters for the Windows, provide minimum acceptable standards and establish a regime for verification of the design, fabrication, and installation processes.
- D. The Contractor shall assume responsibility for the detailed implementation of the design, procurement, fabrication, and installation of all Façade (Building Envelope) elements and related elements in accordance with the Contract Documents to satisfy the performance requirements stated in this Specification.
- E. The Contractor shall engage its own Professional Qualified & Experienced Engineers and shall be jointly responsible for all submissions.
- F. It shall be the Contractor's responsibility to warrant the above to the building owner, and to ensure that all materials and work meet the requirements of the Contract documents and are fit for their intended purpose.
- G. As scope and performance documents, the Drawings and Specifications do not necessarily indicate or describe in detail all work required for the full performance and completion of the Contract Works. The Contractor shall provide all items required for proper completion of the Contract Works without adjustment to the contract price unless otherwise agreed in writing.

#### 1.24 DRAWINGS

- A. This Specification shall be read in conjunction with the concept drawings which:
  - 1. Show solutions for the problems of thermal or structural movement, weather resistance, pressure equalization, fixings and anchorage, flatness, and stability of fixing.
  - 2. Indicate profile and configuration required together with relationship to structural frame and interior building elements.
  - 3. Contain details that suggest directions for solving some of the major design issues. The Contractor may use the intent of these details and develop them, as he deems best.
  - 4. Dimension on drawings are indicative only, Façade contractor should verify the actual dimensions on site prior to produce shop drawings and fabrication drawings and should be brought to the attention of engineer for any variations on site dimension. The Façade contractor cannot claim any additional time or cost on these aspects.
  - 5. Architect however reserve the right to suggest/ approve changes in the profile dimensions, modify the extent of stiffener profile or architrave width, strengthen the junction details, colour of profile at any location etc which should not be construed as a change/ additional work and vendor should accommodate such changes without any time or price variation.

#### 1.3.1 WINDOW DETAILS FROM CONSULTANT

- A. Window tender drawings as verified & approved by EFSPL are representing the following:
  - 1. Issued as concept details to be followed.
  - 2. Contractor should not make any changes in concept drawings. If any potential issues with the issued concept details, then it should be highlighted during tender stage prior to award of contract. It is the duty of Contractor to comply with design intent as defined in the tender

documents. Any non-compliance with respect to contract after award of work will not be acceptable under any circumstances & employer will have the authority to cancel the contract after deducting / forfeiting the performance bond

## 1.25 CONTRACTOR'S RESPONSIBILITY

- A. Within this section, contract requirements, such as preliminaries and schedules of duties will take precedence over this specification if there are any contradictions in responsibilities.

1. This list is a minimum requirement and should not be considered exhaustive:

Item	Description
1	The Contractor to provide protection of all works, materials & finishes from any damage that may occur during the fabrication installation adjustment of all façade works under the full Contract works. Protection to all existing finishes and structures that are within the proximity of the works.
2	Supervision of all activities. The Contractor shall nominate a suitably qualified staff member for supervision with minimum 10-year façade experience, in high rise buildings.
3	Waterproofing and drainage of all associated coping, flashings, and co-ordination/penetrations. The Contractor to provide/ trade cleans of any Contract Works affected by concrete or slurry spillage and/or fire spray material within 1 week of occurrence.
4	All temporary lifting/hoisting/crainage, and lowering frames, rigs and systems. The provision of all temporary hoarding, protection, barriers arrester, protected walkways, protected entrances and the maintenance of such in approved condition during the whole term of the project. All works such works to be approved by a suitable qualified professional Engineer employed by the Contractor. Protection platforms catch frames panels, and netting required to complete the works in a safe manner.
5	Co-ordination of work with the overall project requirements including all areas of interfaces with internal finishes and external finishes. The Contractor shall nominate a suitably qualified staff member to be responsible for coordination.
6	Co-ordination of required facilities and storage including activities required to execute the works. Temporary facilities and storage areas required to complete the works.
7	Co-ordination of required equipment and site logistics including activities required to execute the works
8	Alignment and verticality survey of the completed Windows.
9	Expansion Joint. Contractor to coordinate all interfaces detailing between the Windows component and structure.
10	External safety netting wrapping.
11	To undertake full structural survey of the external building line and present such information to the Consultant/Employer for review prior to the start of site installation works for the Windows. (prior to any bracket installation stage)
12	Preparation, submission & getting approval of shop drawing, VMU drawing, Die drawings, as built drawing within the agreed time frame. Any drawing submitted for each Windows element should be accompanied with complete schedule, all elevations, sections, plan with all façade elements & all relevant details required to complete the scope of work as

	per contract. Identify all different type of interface with building / adjacent work and submit detail for all such interfaces in the project.
13	Pre-qualification of suppliers with technical specification and all document as per contract to be submitted and got approved within 15 days of LOI as per agreed timelines.
14	Submit & get approval on sample board within 1 month of LOI or as per agreed timelines for all colours, accessories, fittings, hardware, extrusion, anchors, glass, gaskets, etc. required to complete the work for each façade element.
15	VMU-Contractor to make arrangements for VMU at site as per contract.
16	<del>Coordination and fixing of BMU restraint pin on Windows as per BMU suppliers' requirement. (Receiver to be supplied and fixed by Windows Contractor wherever it interfaces on the façade. And necessary strengthening of the façade to receive the BMU pin is in façade contractor scop to architect's approval.</del>
17	Façade Contractor on approval of shop drawings & VMU, PMU should procure and fabricate all Windows elements required for making the building water tight within agreed timelines.
18	The contractor shall take responsibility for the approval of shop drawings & sample board, approval of VMU & further procurement, fabrication, and installation of all Windows elements in accordance with the contract documents to satisfy the performance requirements stated in this specification. It shall be the contractor's responsibility to warrant the above to the client and to ensure that all materials and work are entirely fit for their intended purpose.
19	This is a design and build contract and the contractors are deemed to have reviewed the system after verifying with all the component suppliers/ manufacturers that all products meet the intended architectural intent and performance parameters laid out in the tender for both as component and system at large right from design, fabrication, assembly, packaging, hoisting, installing and in service condition which should be guaranteed for the minimum years as stipulated in the contract both for components and system as a whole. No extra time and cost implications shall be entertained whatsoever in this regard.
20	This is design & built contract wherein intent designed system drawings, will be provided by consultant & vendor need to submit the shop drawings for the complete building based on architecture drawings showing clearly the interface with other trades like structural, finishing, MEP, lighting, lightening. Contractor is responsible for setting out & sizes of façade elements. Material list, cutting list shall be developed by vendor based on approved shop drawings & site tolerances/conditions.
21	Its contractor's responsibility to check with all components suppliers, for compatibility & technicality and raise queries with consultant at tender stage before submission of price bids. Bidder is responsible for all time & cost for any changes the bidders will have to make due to any compatibility, technicality, fabrication, processing issues as all these costs are deemed to have been included in the price bid & no extra cost shall be paid by Lodha group whatsoever on this account. This includes all elements required to meet the performance and aesthetic requirements of the project.
22	Bidders will be responsible for any variation in weight of the aluminium profiles and no increase in cost will be paid for the same. Bidders to verify the same with their extruders prior to bidding. No extra cost will be paid.
23	As scope and performance documents, the drawings and specifications do not necessarily indicate or describe in detail all work required for the full performance and completion of the contract works. The contractor shall provide all items required for proper completion of the contract works without any additional cost.
24	The project manager is responsible for the review of the Contractor 's submissions and conducting representative inspections of the fabrication and installation process, to verify that the proposed design details and fabrications/installation process satisfactorily address

	the intent of the requirements of the contract. Notwithstanding any comments made or omitted during that review process, the responsibility for the performance of the Contract works (supply, manufacture & erection) remains entirely with the façade Contractor.
26	Temporary services for Contractor activities including but not limited to: <ul style="list-style-type: none"> <li>- Power</li> <li>- Water</li> <li>- General site lighting</li> <li>- Site amenities. Example: Toilets, site offices.</li> </ul> Temporary storage and holding area.
27	Hoisting, lifting, man and materials movements. Lifting and crainage as required. Protection to all existing finishes and structures that are within the proximity of the works.
28	Provide temporary measures to minimise rainwater from seeping into the floor wherever windows are not installed as per schedule.
29	Final cleaning of Windows

#### 1.26 RESPONSIBILITIES OF COMPLIANCE TO CONTRACT

- A. Notwithstanding any comments made or omitted during the review process, the responsibility for the performance of the Main Façade Contract works (design, manufacture & erection) remains entirely with the Windows Contractor, without any additional cost to the client.

#### 1.27 SCOPE OF WORK

- A. This section shall be read in conjunction with the main contract documents.
- B. The scope of work for the contractor shall include complete design development from attached drawings issued, procure, fabricate, pack, deliver, install, clean & handover and all that is necessary for the completion of work of all elements entailed within the scope for the following packages to complete satisfaction of architect, consultant & employer for the construction of the façade wall types as defined in this tender package.
- C. The Contract Works covered in this specification shall include finalized design, procurement and verification, co-ordination of interfacing trades, fabrication, installation, and maintenance of the façade systems that comprises of the entire building envelope.
- D. The specification shall be read in conjunction with the architecture & tender drawings.
- E. The Contractor is to review the drawings and will be fully responsible for indemnifying all individual elements of the complete façade system. When applicable refer to the relevant Parts of the specification for requirements.
- F. No extra claims will be entertained once the contract is awarded.
- G. For each façade type, it shall include but not limited to the following elements and components:
1. Window walls and glazing systems: sliding door / window, punch window with & without exhaust fan, full height window, unitized curtain wall, stick curtain wall.

- a. Brackets and other connections to the structural frame.
  - b. Framing.
  - c. Glazing.
  - d. Insulation.
  - e. Sealants.
  - f. Gaskets and beads.
  - g. Fixings and fastenings.
  - h. General flashings.
  - i. Vapor barriers.
  - j. Finishes, coatings, and surface treatments.
  - k. ~~Smoke flashings and fire separations.~~
  - l. ~~Structural steel secondary framing and associated fireproofing (i.e., necessary support framing which has not been detailed on the Structural Engineers Drawings).~~
  - m. ~~Parapet copings.~~
  - n. ~~Edge, soffit cladding, and closure panels.~~
  - o. Trims.
  - p. Penetrations for services.
  - q. ~~Lightning protection connection points.~~
  - r. Preparation of maintenance manuals.
  - s. ~~Any penetrations for signs, lighting, BMU restraint pins and related power or data supply.~~
  - t. ~~Any support for signs, drainage, lighting, BMU restraint pins, internal media projection screen & penetration for lighting conduit.~~
  - u. Contractor to provide resolution of interface details with façade elements and prepare drawings for co-ordination.
  - v. Electrical continuity and earthing of all systems.
2. Miscellaneous Works: Aluminium screen, frameless glass railing, Aluminium fixed /openable louvers, aluminium cladding.
- a. Adjoining finishes required to complete the works to match existing
  - b. Preparation of Maintenance Manuals for all systems
  - c. Statutory approvals
  - d. Protection of all works during construction, including the retained support elements of the glass wall, adjoining, finishes, and canopy
  - e. Survey and acceptance of building structure in interfaces with other building elements and connection points
  - f. Cleaning of all works during construction
  - g. Provision of service crews and maintenance equipment during the Maintenance Period.
  - h. Prototypes and testing:
    - i. Visual mock-ups at site using actual profile approved for use in the project.
    - ii. Quality-Control samples.
    - iii. On site water hose testing as required as per project specification.
3. Submissions including:
- a. All Authority submittals, approvals, permits, and payments of fees and charges
  - b. All shop drawings, samples and material certificates for inspection by the consultant.

- c. Design Certificates and Producers Statements
- d. Executed Warranty Deeds
- e. Evidence of possession and maintenance of all appropriate insurance policies as required under the contract, including:
  - i. Public liability (Contractor)
  - ii. Professional Indemnity (Contractor)
  - iii. Accident Compensation (Contractor)
- f. Evidence of formulation and application of Quality Assurance and Quality Assurance (QA/QC) plans.
- g. Method Statement before works commencement.
- h. Work programs and schedules including design review, fabrication milestones (e.g., die cutting), delivery & installation of visual mock-ups, fabrication, installation, and on-site testing.
- i. Method Statement before works commencement.

#### 1.28 INTERFACING WITH OTHER TRADES

- A. The Contractor shall ensure that the Works carried out under this specification are fully interfaced and co-ordinated with the other specification sections for interfacing trades, namely:
  - 1. Walls and adjoining façade system.
  - 2. Building Maintenance system.
  - 3. Lighting and electrical.
  - 4. Lightning protection.
  - 5. Roofing and gutters/drainage.
  - 6. Mechanical services.
  - 7. Electrical services.
  - 8. Fire services.
  - 9. Security systems.
  - 10. Internal finishes i.e., walls, ceilings, and floors.
  - 11. External works and paving.
  - 12. LED lighting services.
  - 13. Landscaping works.
  - 14. Signages.
  - 15. Swimming pool/water bodies.

#### 1.29 HOLD POINTS

- A. Do not proceed with the following works until:
  - 1. Preliminary review before visual mock-up & performance mockup until extrusion die cutting.
  - 2. Ordering of glass and glazing material/cladding materials: until relevant design shop drawings, samples & VMU have been approved.
  - 3. Commence fabrication: until an Inspection and Test Plan & Project Quality Plan has been approved for the fabrication and installation and fully complying structural and weatherproofing test has been approved.
  - 4. Welding of structural steel sections: Until relevant quality control samples have been approved.
  - 5. Painting of steel structures: Until relevant quality control samples have been approved.

6. Commence installation: - Only after unit installation method statement reviewed and cleared by S.O. Installation shall only proceed after site mobilization by Windows contractor is found to be satisfactory to show that the Windows contractor has adequate facilities to start site installation.

### 1.30 FACILITIES INSPECTION

- A. The Contractor shall make provision in his tender the costs for the following units by client team accommodation, transportation/air travel arrangement, visas & related living, and travel expenses to attend the inspections.
- B. Pre-production audit inspection visit to the following:
  1. Glass factory
  2. Aluminium extrusion factory
  3. Curtain wall/window wall (façade system) fabrication/assembly factory.
  4. Other key Windows (building envelope) component factory e.g., fabrication facilities.
- C. During production periodical fabrication inspection visits up to 2 visits to the following:
  1. Glass factory
  2. Aluminium extrusion factory
  3. Curtain wall/window wall (façade system) fabrication/assembly factory.
  4. Other key Windows (building envelope) component factory e.g., fabrication facilities.
- D. Additional inspection trips may be required if the quality of works is not to the S.O.'s acceptance or as deemed necessary by the S.O.

### 1.31 SPARE MATERIALS

- A. For any façade replacement within the warranty period, the spare materials for future replacement or repairs shall be as follows:
  1. The Contractor to make provisions for replacement of up to **a percentage of the total glass (Windows) area as agreed with client**. The necessary components including glass, panels, glazing materials and fasteners to reinstate one glass panel of each type or size installed in the building to be provided for. For any façade replacement within the warranty period, the spare materials for future replacement or repairs shall be kept in the Contractor's own storage.
  2. The Contractor to submit methodology for glass replacement on site which will include (but not limited to) access methods, temporary glass source and provision, lead time for order of glass.

### 1.32 PROCEDURAL MATTERS

- A. The Contractor shall assemble the submissions as required and submit these for review by the S.O. The recording of this process shall be in accordance with the requirements of the Contract Documents.

- B. When Works are ready for inspection and or testing, the Contractor shall submit for review by the S.O. The notification and recording of this process shall be in accordance with the requirements of the Contract Documents.

### 1.33 COMPLIANT TENDERS

- A. It will be a requirement that the Tenderer shall comply with this Contract Document without any qualifications. Tenderer must therefore present any concerns they have at the Tender Interviews. Each Tender shall:
  - 1. Provide a list of any inadequacies, deficiencies or omissions in the Tender Documents that could affect the performance, appearance, or the cost of the Works.
  - 2. Clearly describe any works necessary for the full completion of the works which have not been included in his Tender, which will involve works to be carried out and cost incurred by others.
  - 3. Any such work not specifically described in the Tender return, shall be deemed to be included for in the Tender.
  - 4. Identify any prescriptive requirements, which will not satisfy the performances requirements, as set out in this Contract Document, and shall submit proposals, which provide the required performance.
  - 5. Only tenders, which satisfy the above requirements will be considered to be valid.
  - 6. Any non-compliance with contract after getting the work will not be acceptable under any circumstances and client will have the authority to cancel the contract after deducting/ forfeiting the performance bond.

### 1.34 MATERIALS

- A. The agreed brands, materials are attached in Annexure however the use of same is subject to meeting the performance criteria as per the GCC & SCC & architectural intent as per the work order specifications. There shall be no variation/escalation in pricing permissible if the same is changed on account of performance criteria & architecture intent.

### 1.35 DIE OWNERSHIP

- A. The ownership of the die shall remain with the system Supplier to be utilized for the same project only at no extra cost.

### 1.36 TYPE OF BID

- A. This is a firm price item rate bid and all the rates furnished by the Contractor in the annexed Bill of Quantities (hereinafter referred as BOQ) shall remain valid and firm till completion for all work under the scope, irrespective of any subsequent increase/decrease in quantities & change in construction schedule or any other conditions throughout the contract period or extension period thereof.
- B. The Contractor will quote the item rates for the detailed Bill of Quantities given in the annexure, keeping in mind the scope of work detailed in the Instruction to Tenderer as well as all the special conditions & general conditions of Contract specified in the tender document.
- C. The Rates quoted in the BOQ shall be deemed to include cost of detail design, engineering,

supply, fabricate, inspection, testing, packaging with all materials including wherever applicable, labour, tools, tackle, plant & machinery, equipment, protection, cleaning, duties, octroi, transportation, loading and unloading, insurance, handling required, warranties & guarantees, any other applicable taxes, duties etc., and Contractor's overheads & profits.

- D. This is a design and build contract and the contractor is solely responsible for ensuring that performance/output criteria (/criterion) are met. The specifications stated herein are sufficient to meet the performance/output criteria in the preliminary opinion of the Owner's technical consultants – however, the Contractor should independently verify the said specifications and their suitability to meet the desired performance/output criteria/ warranties and guarantees as specified elsewhere in the tender documents prior to the submission of its bid. The Contractor shall be solely responsible for ensuring that all material and equipment used for the purposes of this contract are suitable to meet the performance/output criteria specified in the tender/contract document. Any up gradation in the specifications of the material or equipment (from what is stated in the specifications attached to this tender/contract) which is required to meet the specified performance/output criteria shall solely be in the contractor's scope and the Owner shall not be responsible for payment of any escalations for the same.
- E. The items contained in the BOQ are the only payment items required to be paid for the completion of the scope of work stated in this tender/contract. No additional payment items shall be accepted by the Owner for the said scope of work, unless the same is agreed upon prior to the submission of the bid.
- F. The quantities in the BOQ are indicative and the contractor is required to ensure that any changes to these quantities are approved in writing by the owner during the final CD (Construction Drawing) approval process or within 90 days of award of contract, whichever is earlier. The quantities as stated in the BOQ (or as amended in writing by mutual consent of the Owner and Contractor during the CD approval process) shall be the maximum quantity payable for each item and no increase beyond that quantity shall be payable by the Owner, irrespective of actual quantities consumed.
- G. In case of any major change in the scope of work, the payment items and quantities related to such change shall need to similarly agree upon within 90 days of the intimation of such change in the scope of work. All such major changes in the scope of work and related quantity changes should be agreed upon in writing.

### 1.37 COLOUR SCHEDULE

- A. A colour schedule will be issued by the Architect. The Contractor, his Trade Contractors, and material suppliers shall cooperate in furnishing required colour samples to aid in the final selection. Where special colours are selected by the Architects / Façade Consultant, furnish accurate reproductions for these colours, on actual material to be furnished to the project, for review & approval.

### 1.38 COORDINATION

- A. Coordinate construction operations of all trades to ensure installation of each part of the work. Coordinate construction under different sections that depend on each other connection, and operation.
  - 1. Schedule construction operations in the sequence results where installation of one part of the work depends on components, before or after its own installation.
  - 2. Coordinate installation of different components accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled.
  4. Coordinate with adjacent works & finishes.
  5. Coordinate with exterior plumbing works.
  - ~~6. Coordinate with lightening protection system.~~
  - ~~7. Coordinate with aircraft warning light.~~
  - ~~8. Coordinate with wind sensors.~~
  - ~~9. Coordinate with gas pipelines.~~
  - ~~10. Coordinate with building maintenance system.~~
  11. Coordinate with convenience outlets.
  12. Coordinate with building structure construction team.
  - ~~13. Coordinate with landscape works.~~
  - ~~14. Coordinate with waterbody/swimming pool works.~~
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
1. Prepare similar memoranda for the Employer and separate Contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
1. Preparation of schedules.
  2. Installation and removal of temporary facilities.
  3. Delivery and processing of submittals.
  4. Progress meetings.
  5. Project closeout activities.
  6. Task tracking and scheduling.
  7. Labour time and scheduling.
- D. Conservation: Coordinate construction operations to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work.

### 1.39 SUBMITTALS

- A. General: Make all submissions to Employer / Architect / Windows Consultant. Hard copy(A3 size) of the shop drawings to be couriered to the Architect/consultant/employer for review and soft copy to be emailed. (DWG + PDF)
- B. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.
- C. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
1. Show the relationship of components shown on separate shop drawings
  2. Indicate required installation sequences.
  3. Comply with requirements contained in section "submittals".

- D. Staff names: Within 14 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the project site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.
  2. To arrange full time qualified project manager with having more than 10 years of Windows industries experience with Client/ Consultant approval.

#### 1.40 SURVEY DATA

- A. Establish necessary reference lines and permanent benchmarks from which building lines and elevations shall be established. Engage a registered land surveyor for this purpose to lay out the work. Establish not less than two such benchmarks in widely separated locations. Be responsible for the proper location and level of the work and for maintenance of the reference lines and benchmarks. Establish benchmarks and axis lines at each floor showing exact floor elevations and other lines and dimensional reference points as required for the information and guidance of all trades; field checking of the structure and surveys thereof as may be required by the technical Sections of the Specifications; the marking and layout of walls and partitions; and the taking of settlement readings as hereinafter specified.
1. Take floor elevations and survey points of existing buildings

#### 1.41 SHOP DRAWINGS AND SAMPLES

- A. Shop drawings shall be submitted by the Contractor for review by the Owners/its consultants prior to execution of the related works. Such drawings shall be reviewed by the Owners/its consultants and comments/suggestions are to be incorporated by the Contractor into its design. However, it is clarified that in all such cases, the Contractor is responsible for the design and execution of the works and any review/approval by the Owners/its consultants shall be a limited review and the Contractor shall be solely responsible for the successful execution and operations of the works in its scope. The Owners/its consultants shall have no responsibility whatsoever for the said works or their technical correctness/safety/execution process etc."
- B. The Contractor shall be responsible for coordinating the schedule for submittal of shop drawings and samples with his progress schedule and the requirements of the Contract Schedule and submit a coordinated schedule of submission of all shop drawings and samples to the Employer/Architect/Windows Consultant at the beginning of construction.
- C. Failure of the Contractor to schedule and submit shop drawings and samples in ample time for checking, correction, and rechecking will not justify any delay in the Contract Schedule. Allow ample time for items to be tested, including time for retesting if the tests or mock-ups fail.
- D. Samples, shop drawings, manufacturers' literature, and other required information shall be submitted in sufficient time to permit proper consideration and action on same before any materials and items are delivered on the work. Stagger submissions so that the Employer / Architect / Windows Consultant can review the documents in an orderly and timely manner. All samples of materials requiring laboratory tests shall be submitted to the laboratory for testing not less than 90 days before such materials are required to be used in the work. All other samples, manufacturers' literature, and other sample information shall be submitted for approval within 10

days of approval of shop drawings.

- E. Shop drawings for each Section of the work shall be numbered consecutively, and the numbering system shall be retained throughout all revisions. Each drawing shall have a clear space for the stamps of the Employer/Architect/Windows Consultants.
- F. All shop drawings shall be thoroughly checked by the Contractor for compliance with the Contract Documents before submitting them to the Façade Consultant and shall bear the Contractor's stamp of approval certifying that they have been so checked. Any shop drawings submitted without this stamp of approval and certification, and shop drawings which, in the Windows Consultant's opinion, are incomplete, contains errors or have not been checked, or only checked superficially, will be returned unchecked by the Windows Consultant for re-submission by the Contractor.
- G. In checking shop drawings, the Contractor shall verify all dimensions and field conditions and shall check and coordinate the shop drawings of any Section or trade with the requirements of all other Sections or trades whose work is related thereto, as required for proper and complete installation of the work. The Windows Consultant will review shop drawings. The Windows Consultant's acceptance of shop drawings is for design only and not method of assembly or erection. Acceptance shall in no way be construed as (1) permitting any departure whatsoever from the Contract Documents; (2) relieving the Contractor of full responsibility for any error in details, dimensions, omissions, or otherwise that may exist; (3) relieving the Contractor of full responsibility for adequate field connections, erection techniques, bracing, or deficiencies in strength; (4) relieving the Contractor of full responsibility for satisfactory performance of all work and coordination with the work of his Trade Contractors and other pertinent entities; or (5) permitting departure from additional details or instructions previously furnished by the Windows Consultant. Acceptance of such drawings shall not be construed as a complete check, nor shall it relieve the Contractor from responsibility for proper fitting of the work, nor from the necessity of furnishing any work which may not be indicated on shop drawings when approved. The Contractor shall be solely responsible for any quantities which may be shown on the shop drawings.
- H. No work shall be fabricated, manufactured, or installed from shop drawings stamped "Make Corrections Noted, Resubmit Specified Items" or "Rejected", and such shop drawings shall be corrected and resubmitted by the Contractor until accepted by the Windows Consultant. At least one complete set of "No Exceptions Taken, Make Corrections Noted" shop drawings shall be kept at the site in the Contractor's field office for reference at all times. "Make Corrections Noted, Resubmit Specified Items" or "Rejected" shop drawings shall not be permitted at the site.
- I. Submittals marked "No Exceptions Taken":
  - 1. Submittals which require no corrections by the Windows Consultant will be marked "No Exceptions Taken".
- J. Submittals marked "Make Corrections Noted":
  - 1. Submittals which require only a minor amount of correcting shall be marked "Make Corrections Noted". This mark shall mean that checking is complete, and all corrections are obvious without ambiguity. Fabrication will be allowed on work "Make Corrections Noted", provided such action will expedite construction and noted corrections are adhered to. If fabrication is not made strictly in accordance with corrections noted, the item shall be rejected in the field, and the Contractor will be required to replace such work in accordance

with corrected submittals.

- K. Submittals marked "Make Corrections Noted, Resubmit Specified Items" or "Rejected":
  - 1. When submittals are contrary to contract requirements or too many corrections are required, they shall be marked "Make Corrections Noted, Resubmit Specified Items" or "Rejected". No work shall be fabricated under this mark. The Windows Consultant shall list his reasons for rejection on the submittals or in the transmittal letter accompanying their return. The submittals must be corrected and resubmitted for approval.
- L. All shop drawings and samples shall be identified as follows:
  - 1. Date of submittal.
  - 2. Title of project.
  - 3. Name of Contractor and date of his approval.
  - 4. Name of Trade Contractor or supplier and date of submittal to Contractor.
  - 5. Any qualification, departure, or deviation from the requirements of the Contract.
  - 6. Specification number where required.
  - 7. Such additional information as may be required by the Specifications for the particular material being furnished.
- M. If the Contractor wishes to deviate from the materials or details as shown in Specifications or Drawings, he shall submit the proposed deviation with shop drawings and/or samples stating the extent and the materials or details being replaced. The Contractor shall also submit information on the allowed credit or extra cost required for the proposed deviation, and all information relating to the work of other Sections revised by the proposed deviation.
- N. The Windows Consultant will review and approve shop drawings and samples for approval within 15 business days, but only for conformance with the design concept of the work and with information contained in the Contract Documents. The second submission will be reviewed by the Windows Consultant Liable to review only two submissions.
- O. Incomplete shop drawings will be returned without checking for proper submission, and this shall not be considered as cause for delay of the work or extra compensation to the Contractor.
- P. The Contractor shall submit appropriate transmittal forms with every submittal of shop drawings, manufacturer's literature, and samples. All reproducible shall be rolled on cardboard tubes for resubmittal. The Contractor shall submit all required shop drawings, manufacturer's literature, and samples in accordance with the procedures specified herein.
- Q. Unless otherwise specifically directed by the Windows Consultant, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the work.
- R. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing. Revised shop drawings shall have clouds indicating revisions from first submission.
- S. Submit one copy of each standard referred to in the Specifications (ASTM, Fed. Spec., etc.) With the submission of each respective shop drawing, sample, or literature.

#### 1.42 SUBMISSION OF SHOP DRAWINGS

- A. Exterior Cladding, Aluminium, and Glazing Work: Submit one (1) soft copy (DWG & PDF) and three (3) hard copies of shop drawing set to the Windows Consultant/architect/employer for approval.
  - 1. Drawings should possibly be submitted in A3 in legible scale. If not maximum in A2 size for ease of transmitting of comments back via email.
  - 2. If approved, the architect will email soft Copy stamped "No Exceptions Taken" or "Make Corrections Noted", and the Contractor shall print the required number of copies.
  - 3. In the event the Windows Consultant emails soft copy stamped "Make Corrections Noted, Resubmit Specified Items" or "Rejected", the Contractor shall make indicated changes and resubmit one (1) soft copy (DWG & PDF) and three (3) hard copies to the façade consultant/ architect/employer.
- B. Prints: The Contractor shall provide all prints or shop drawings as reasonably required by his Trade Contractors, material suppliers, superintendents, inspectors, and others as required for the work, or as directed by the architect/ Façade Consultant. The Contractor shall pay all costs in connection with printing and distribution of shop drawings.
- C. The submitted shop drawings shall be commented/ approved within 14 working days from the date of receipt of drawings at the façade consultant's/architect's/client's office.
- D. The shop drawings shall be supported with structural calculations for review & approval by Façade Consultant/Architect. Submittals shall be considered invalid & rejected if not submitted with the required calculations.
- E. Submission of Manufacturer's Literature, Including Catalogue, Catalogue Cuts, Brochures, Charts, Test Data, and Similar Information Manufacturer's literature will receive consideration only when accompanied by the transmittal form properly filled out, as indicated, and listing each item of literature, as well as the Specification Section and paragraph numbers describing such materials. Any deviations from contract requirements shall be stated on the above form or attached to it.
- F. Exterior Cladding, Aluminium, and Glazing Work: Submit soft copies and (3) hard copies of manufacturer's literature to the Windows Consultant/architect/employer for approval for acceptance.
  - 1. If accepted, the Windows Consultant will email soft copies stamped "No Exceptions Taken" or "Make Corrections Noted".
  - 2. In the event the Windows Consultant emails soft copy stamped "Make Corrections Noted, Resubmit Specified Items" or "Rejected", the Contractor shall make indicated changes and resubmit the manufacturer's literature soft copy and three (3) hard copies to the façade consultant/ architect/employer.
- G. No shop drawings shall be issued to site or for execution if they have not been approved by the architect/ Windows consultant. Drawings that are to be issued to site must be acknowledged by the responsible architect and consultants.

- H. All copies of manufacturer's literature required to be resubmitted hereunder shall be original printed material. Reproductions of printed material will not receive consideration.

#### 1.43 SUBMISSION OF SAMPLES

- A. All samples shall be submitted or couriered to the client, architect, and façade consultant in triplicate unless otherwise indicated in the Specifications, with no additional cost to the client.
- B. Samples will receive consideration only when accompanied by the transmittal form properly filled out, as indicated, and listing each sample, as well as the listing of any ASTM, Federal or other standard references specified, or applicable and such additional information as may be required by the Specifications for the materials being submitted. Any deviation from the contract requirements shall be so stated on the above form or attached to it.
- C. The Windows Consultant shall have the right to require submission of samples of any materials, whether or not specifically indicated in the various Sections of the Specifications.
- D. Unless otherwise specified, samples of sufficient size (minimum 300x300 mm as Requested by the Architect) to indicate general visual effect shall be submitted. Where samples must show a range of colour, texture, finish, graining, or other similar property, the Contractor shall submit sets of pairs illustrating the full scope of the range. Reasonable samples, colours and assembled extrusion profiles that can be couriered are to be submitted to the client, architect, and façade consultant for approval. Duplicated colour samples must be submitted so that one can be retained by the architect for reference.
- E. One (1) sample of each submission will be returned to the Contractor. Samples stamped "Make Corrections Noted, Resubmit Specified Items" or "Rejected" by the Windows Consultant shall be resubmitted in triplicate by the Contractor.
- F. All samples stamped "No Exceptions Taken" or "Make Corrections Noted" shall be kept at the site in the Contractor's field office facilities for reference at all times. "Make Corrections Noted, Resubmit Specified Items" or "Rejected" samples shall not be kept at the site.
- G. The submitted samples shall be commented/approved within 14 working days from the date of submission. The contractor to submit samples of all components forming a part of assembly for approval along with the technical data sheets.
- H. Document submittals :
1. Document submittals as per given format.
  2. Index with cover sheet and revision details.
  3. Compliance certificate of manufacturer/ supplier as per specs.
  4. Product catalogue with manufacturer details.
  5. Product technical data sheet and certifications.
  6. Mill test certificates.
  7. Assembly test certificates.
  8. Samples.
  9. Item location marked on shop drawings/plan etc.

#### 1.44 COORDINATED DRAWINGS

- A. The Contractor shall call as many meetings with his Trade Contractors as are necessary to resolve any conflicts that become apparent. He shall call on the services of the respective Consulting Engineer or Windows Consultant where necessary. The Contractor is responsible for the coordination of the Drawings.
  - 1. Each Trade Contractor shall prepare his Shop Drawings in accordance integrated Drawings. No work will be permitted without approved Shop Drawings. It is therefore essential that this procedure be instituted as quickly as Exterior Wall Drawings
  - 2. Contractor of the exterior wall shall coordinate and document adjacent conditions within their respective drawings.
- B. Responsibility for the engineering, procurement, fabrication and installation of the visual mock-ups and field-testing work based upon the Drawings and the requirements of this Specification.
- C. Responsibility for the final selection of materials, sizes, thickness, types, locations of fixings and related accessories, all in accordance with specified standards detailed herein and submissions for review and approval by the Architects / Façade Consultants prior to fabrication and/or manufacture and installation of testing specimens.

#### 1.45 REFERENCE STANDARDS

- A. Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. All reference to Indian, British, Australian, American, and other standards, regulations and requirements of statutory bodies and shall mean the latest published editions at the time of contract. Where such standards, regulations and requirements are amended and affect the contractor's responsibilities during the course of the works, the contractor shall immediately inform the Consultant of his intentions in respect of the revisions. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict between referenced standards, this specification or within themselves, the more Stringent standard or requirement shall govern.

END OF SECTION 01 1000

**SECTION 07 92 00  
JOINT SEALANTS**

**PART 1 – GENERAL**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

Comply with all the mandatory local requirements associated with this and related specification sections.

Sustainability rating to be coordinated with the Engineer.

**1.46 SECTION INCLUDES**

- A. Furnish all labor, materials, tools appliances and equipment, and perform all operations and services necessary for the complete installation of sealants for the following applications, including those specified by reference to this Section.
- B. This Section includes sealants for the following applications:
  - 1. Exterior joints in the following vertical surfaces and non-traffic horizontal surfaces:
    - a. Cladding panel joints and cladding interfaces with the adjacent element/structure
    - b. Curtain wall interface with the adjacent element/structure.
    - c. Copping and flashing joints and interfaces with the adjacent element/structure.
    - d. Curtain wall expansion joints.
    - e. Perimeter joints between materials listed above and frames of aluminium doors, windows, louvers etc.
  - 2. Other joints as indicated in the drawings. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
    - a. Perimeter joints of exterior openings/elements such as aluminium doors, windows, etc.
    - b. Shadowbox and back pan assembly joints.
    - c. Joints between insulated glass pane and IGU spacer.
    - d. All perimeters' joints and interfaces, and areas to accomplish a sealed building.
    - e. Other joints as indicated in the drawings.
- C. Design to follow the architectural intent indicated in the design drawings.
- D. This section to be read in conjunction with the related wall types or exterior wall system drawings submitted as a part of the Windows tender package.

**1.47 RELATED SECTIONS**

- A. This schedule is intended to be used as a helpful indication of the related sections within the Project Specifications. It is not necessarily comprehensive or complete and it is the Contractor's responsibility to ascertain all applicable sections required to understand the full scope of Works intended.

- B. Work to be coordinated and used in conjunction with this specification includes but is not restricted to:

1. Section 01 4500 - Quality Control.
2. Section 07 2100 - Thermal Insulation
3. Section 07 2500 - Weather Barrier
4. Section 07 6200 - Sheet Metal Flashing and Trim
5. Section 08 4413 - Glazed Aluminium Curtain Wall
6. Section 08 5113 - Aluminium Doors and Windows
7. Section 08 8000 - Glazing

#### 1.48 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates when testing against the following given below tests as a part of curtain wall or building envelope element.
1. Resist air leakage when tested in accordance with ASTM E283 as an integral part of the curtain wall assembly.
  2. Resist water penetration when tested in accordance with ASTM E331 and AAMA 501.1 as an integral part of the curtain wall assembly.
  3. Resist sealant joint failure when tested in accordance with ASTM E330 as an integral part of the curtain wall assembly.

#### 1.49 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Pre-Contract Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Post Contract Samples: For each kind and color of joint sealant required, provide Samples with joint sealants in 13mm to 15mm wide joints formed between two (2) 300mm long strips of actual material the sealant to be with. To be inspected for staining one week and four weeks after the sample is submitted.
- D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Sealant will not stain metal, stone and glass panels or other substrates when tested in accordance with ASTM C 1248, or other acceptable testing criteria.
  3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. G. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.
- H. H. Submit a detailed schedule of sealant usage for all locations. List each sealant material (including manufacturer and product name), joint fillers, and sealant color and product data for each location of use.
- I. Method statement for tooling, maintenance, and repair of joint sealant assemblies.
- J. Qualification Data: For qualified Installer.
- K. Printed statement for VOC content.

#### 1.50 QUALITY ASSURANCE

- A. Installer Qualifications: Perform installation with experienced and trained installers supervised by trained personnel who shall have at least three (3) years successful experience in installation of similar size and scope.
- B. Manufacturers Qualifications: A firm experienced a minimum five (5) years in manufacturing products or system similar to those indicated for this project with a record of successful in-services performance.
- C. Manufacturer of sealants shall provide a qualified technical representative who will visit the site for the purpose of advising the Installer of the proper procedures and precautions in the application of the materials.
- D. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- E. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Submit not fewer than ten pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
- F. Product Testing: Obtain test results from an independent qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
  2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
  3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- G. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
- H. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Engineer.
  2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  3. Notify Engineer seven days in advance of dates and times when test joints will be erected.
  4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
- I. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
- J. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
- K. Mockups: Before installing joint sealants, apply elastomeric sealants, as follows, to verify selections made under sample Submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution:
1. Locate mock-up in the location or, if not indicated, as directed by the Engineer.
  2. Build Mock-up to the satisfaction of the Engineer. If the required standard is not achieved, the Contractor shall replace (at the contractor's cost) until the required standard is achieved as judged by the Engineer.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain written approval of mock-up from the Engineer before starting fabrication.
  5. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work if approved by the Engineer.
- L. Conduct sealant field adhesion tests to Project joint substrates prior to installation.

## 1.51 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Mark product with shop drawing reference, unless already properly marked.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.52 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
  - 2. When joint substrates are wet or dusty.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.
- D. Compatibility:
  - 1. Determine compatibility characteristics of sealants in contact with sealant backings by test method ASTM C1087.
  - 2. Provide joint sealants, joint fillers and accessory joint materials that are compatible with one another and with joint substrates under project conditions.
  - 3. Install joint sealants, joint fillers and related joint materials that are non-staining to visible joint surfaces and surrounding substrate surfaces
- E. Scheduling:
  - 1. Schedule applications of waterproofing, water repellents and preservative finishes after sealant installation unless sealant manufacturer approves otherwise in writing.
  - 2. Ensure that installed sealant is allowed to cure sufficiently prior to subsequent applications.

#### 1.53 WARRANTY

- A. Special Installer's Warranty:
  - 1. Installer's standard form in which installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified herein within specified warranty period.
  - 2. Warranty Period: 10 (ten) years from date of Substantial Completion.

- B. Special Manufacturer's Warranty:
  - 1. Manufacturer's standard form in which the joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified herein within specified warranty period.
  - 2. Warranty Period: 10 (ten) years from date of Substantial Completion.
- C. Special warranties specified herein exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Change in sealant appearance caused by the accumulation of dirt or other atmospheric contaminants.

## PART 2 – PRODUCTS

### 2.10 ACCEPTABLE MANUFACTURERS

- A. Dow Corning Ltd.  
India/UK.
- B. GE,  
India/UAE.

### 2.11 MATERIALS GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Comply with ASTM C 1193 – Standard guide for use of Joint Sealants.
- C. Liquid Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Suitability for Immersion in Liquids: Where sealants are indicated for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 or other similar testing methods acceptable to the authorities having jurisdiction.
- E. Hardness specified is intended to indicate the general range necessary for overall performance. Consult manufacturer's technical representative to determine the actual hardness recommended for the conditions of installation and use. Unless otherwise recommended by the manufacturers technical representative provide sealant within the range of hardness (20 to 60) (Shore A, fully cured at 75oF).

- F. Modulus of Elasticity: For joints subject to either thermal expansion or dynamic movement, provide elastomeric sealants which have the lowest modulus of elasticity which is consistent with exposure to abrasion or vandalism. For horizontal joints subject to traffic, provide sealants with high modulus of elasticity, as required to withstand indentation by stiletto heels. Comply with manufacturer's recommendations wherever no other requirements are indicated.
- G. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Architectural Sealants: < 100 g/L.
- H. Or comply with most stringent of the local code or acceptable national/international building standard requirements for VOC's limits.
- I. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- J. Suitability for Immersion in Liquids: Where sealants are indicated for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 or other similar testing methods acceptable to the authorities having jurisdiction.
- K. Suitability for Contact with Food and Potable water: Where sealants are indicated for joints that will come in repeated contact with food and potable water, provide products approved by NSF or similar acceptable to the authorities having jurisdiction.

## 2.12 SEALANT MATERIALS

- A. Joint Sealer Type AA (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
- B. Joint Sealer Type AP (Acrylic painters caulk): One component acrylic latex caulking/ polysulphide compound, conforming to ASTM C 834, paintable within 24 hours after application, with a minimum movement capability of  $\pm 12.5$  percent.
- C. Joint Sealer Type HL2 (Horizontal-self-Leveling, 2-component): Pouring grade self-leveling multi-component urethane sealant, conforming to FS TT-S-00227E (Interim Federal Specification), Type I, Class A, and ASTM C 920, with a minimum movement capability of  $\pm 25$  percent.
- D. Joint Sealer Type HT (Horizontal-Trowel): Trowel grade multi-component modified urethane/polysulphide sealant, conforming to FS TT-S-00227E (Interim Federal Specification), Type I, Class A, and ASTM C 920, with a minimum movement capability of  $\pm 25$  percent.
- E. Joint Sealer Type P1 (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, use NT, G, A, M, O with a minimum movement capability of  $\pm 50$  percent.
- F. Joint Sealer Type BP2 (Polyurethane/polysulphide, Multi-component): Low modulus type, Multicomponent non-sagging gun-grade polyurethane sealant, conforming to FS TT-S-00227E

(Interim Federal Specification), Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT,M, A and O with a minimum movement capability of  $\pm 50$  percent.

- G. Joint Sealer Type P2 (Polyurethane/polysulphide, Multi-component): Low modulus type, Multi-component non-sagging gun-grade polyurethane sealant, conforming to FS TT-S-00227E (Interim Federal Specification), Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT,M, A and O with a minimum movement capability of  $\pm 50$  percent.
- H. Joint Sealer Type SC (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, use NT, G, A, M, O with a minimum movement capability of  $\pm 50$  percent.
- I. Joint Sealer Type SE (Silicone, Exterior construction): One-part low modulus, moisture curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, FS TT-S-001543A (Interim Federal Specification), Type, Class A with a minimum movement capability of +100 percent and -50 percent.
- J. Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxysilicone rubber, mildew resistant, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, FS TT-S-001543A (Interim Federal Specification), Type Non-Sag, Class A, and FS TT-S-00230C (Interim Federal Specification), Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of  $\pm 25$  percent, and a Shore A hardness of 20.

## 2.13 ELASTOMERIC JOINT SEALANTS (SILICONE)

- A. Elastomeric Sealant Standard: Ultra violet light resistant, nonbleeding, non-staining, non-sag, Multi-component, polyurethane based elastomeric sealant. Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant.
- B. Silicone sealant: One part, ultraviolet light resistant, nonbleeding, non-staining, non-sag, silicone sealant; capable of  $\pm 50\%$  movement as measured in compliance with ASTM C 719; ASTM C920, Type S, Grade NS, Class 25, use 'O' related to joint substrate for vertical joints.

## 2.14 LATEX JOINT-SEALANT

- A. Latex Sealant: One-part non-sag, mildew resistant, acrylic-emulsion sealant complying with ASTM C834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5%.

## 2.15 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Beaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- E. Sealant backer rod shall be compressible rod stock polyethylene foam, polyethylene-jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive closed cell material as recommended for compatibility with sealants by sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.

## 2.16 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

## 2.17 REFERENCED STANDARDS

- A. The minimum standards for products specified in this section shall be including as under but not limited to the following. Except as otherwise specified herein, perform work in accordance with specifications, codes and standards cited therein, and their latest editions, revisions, applicable addenda and supplements. Where there is conflict between the referenced standards the most stringent of the conditions/requirements shall be applicable.
  - 1. ASTM C 717: Terminology of Building Seals and Sealants
  - 2. ASTM C 719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement.
  - 3. ASTM C 794: Standard Test Method for Adhesion-in-Peel of elastomeric Joint Sealants.

4. ASTM C 834: Standard Specifications for Latex Sealants
5. ASTM C 919: Standard Practice for Use of Sealant in Application
6. ASTM C 920: Standard Specifications for Elastomeric Joint Sealants.
7. ASTM C 1193: Standard Guide for use of Joint Sealants.
8. ASTM C 1248: Standard Test Method for Staining of Porous Substrate by Joint Sealants.
9. ASTM C 1330: Standard Specification for Cylindrical Sealant Backing of use with Cold Liquid Applied Sealants.
10. ASTM D 1056: Standard Specifications for Flexible Cellular Materials – Sponge or Expanded Rubber.
11. ASTM E 90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

## PART 3 – EXECUTION

### 3.12 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Surface Condition: Prior to the work of this section, carefully inspect the installed work of other trade and verify that such work is complete to a stage where this installation may properly commence. In the event of any discrepancy do not proceed with the installation until all such discrepancies have been fully resolved.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verification of Conditions:
  1. Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
  2. Consult with sealant manufacturers to determine whether priming is necessary.
  3. Provide joints properly dimensioned to receive the approved sealant system.
  4. Provide joint surfaces that are clean, dry, sound and free of voids, deformations, protrusions and contaminants that may inhibit application or performance of the joint sealant.
  5. Test substrate as needed to verify proper conditions.
- E. Pre-installation Conference: Conduct conference at Project Site.

### 3.13 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
    - a. Clean, porous joint substrate surfaces like concrete, masonry, unglazed surfaces of ceramic tiles etc. by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  - 2. Remove laitance and form-release agents from concrete.
  - 3. Clean nonporous surfaces like metal, glass, porcelain enamel, glazed surfaces of ceramic tile etc. with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- D. Substrate preparation and joint seal application in accordance with manufacturer's instructions.

### 3.14 ENVIRONMENTAL PROCEDURES

- A. Comply, at minimum, with sealant and sealant primer manufacturer recommendations for space ventilation during and after installation. Where feasible, the following ventilation conditions shall be maintained during the sealant/sealant primer curing period or for 72 (seventy-two) hours after installation.
- B. To the extent practical, allow sealant and sealant primer installations to cure prior to the installation of materials that adsorb volatile organic content (VOC). Materials that adsorb VOCs include carpets, textiles, unprimed GWB, and acoustical ceiling panels.

### 3.15 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Provide the selected sealant system where shown on the Drawings, and in strict accord with the manufacturer's recommendations as reviewed by the Designer.
- D. Install sealant immediately after joint preparation.
- E. Mix and apply multi-component sealants in accord with manufacturer's printed instructions.
- F. Install sealant to fill joints completely from the back, without void or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surface.
- G. Install sealant backings of type indicated or required to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- H. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- I. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- J. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealants from surfaces adjacent to joint.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 8A in ASTM C 1193, unless otherwise indicated.
  - 4. Provide flush joint configuration, per Figure 8B in ASTM C 1193, where indicated.
  - 5. Provide recessed joint configuration, per Figure 8C in ASTM C 1193, of recess depth and at locations indicated.
  - 6. Use masking tape to protect adjacent surfaces of recessed tooled joints.

### 3.16 FIELD QUALITY CONTROL

- A. Inspect joints for complete fill, for absence of voids, and for joint configuration. Any sealant found out of plumb or cracking or any work otherwise defective shall be taken out and replaced to approval, at no additional cost to the Project.
- B. Manufacturer's Field Services: Manufacturer's field representative to inspect and approve of installation prior to issuing warranty.
- C. Perform Field-Adhesion test.
- D. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or non-compliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.17 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- B. At completion of construction activity of other trades, touch up and restore damaged or defaced coated surfaces.
- C. At end of each workday, remove rubbish and other discarded material from project site.

### 3.18 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 9200