COOPER UNIVERSITY HEALTH CARE
COOPER UNIVERSITY HOSPITAL - TOWER A
CAMDEN, NEW JERSEY

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes: Custom hollow metal doors and frames and supplementary items necessary for installation:

1. Interior custom hollow-metal doors and frames.
2. Exterior custom hollow-metal doors and frames.

B. Related Requirements:

1. Division 08 Section Door Hardware for door hardware for hollow-metal doors.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

### 1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803.

B. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.

C. Interior: Areas located in conditioned spaces.

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Door core materials and construction.
3. Factory priming or finishing specifications.

4. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Elevations of each door type.
3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Locations of reinforcement and preparations for hardware.
6. Details of each different wall opening condition.
7. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
8. Details of anchorages, joints, field splices, and connections.
9. Details of accessories.
10. Details of moldings, removable stops, and glazing.
11. Clearances.

C. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
2. Fabrication: Prepare Samples approximately 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Oversize Construction Certification: Documentation for assemblies required to be fire rated and exceeding limitations of labeled assemblies.

B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

C. Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80 and NFPA 101.

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

C. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

### 2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

C. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

D. Thermally Rated Exterior Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m) when tested in accordance with ASTM C1363 or ASTM E1423.

E. Exterior Door Air Infiltration: Maximum air leakage of 0.20 cfm/sf (0.09 L/s per sq m) when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sf (75 Pa).

### 2.3 INTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

A. Interior Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A.

1. Locations:

a. Interior doors and frames.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
d. Door Edge Construction: Seamless, continuously welded with no visible seam.

1) End Channels: Close top and bottom edges with continuous flush channels, minimum thickness of 0.053 inch (1.3 mm), fabricated from same material as face sheets and spot welded to face sheets.

e. Core Construction: Steel stiffened.

1) Welded Vertical Steel Stiffeners: Manufacturer's standard vertical steel stiffener extending full-door height, spot welded to face sheets. Fill spaces between stiffeners with mineral-fiber insulation.

f. Fire-Rated Core Construction: Manufacturer's standard vertical steel stiffener core for fire-rated doors.

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm), except 0.067 inch (1.7 mm) for openings exceeding 4 feet (1219 mm) wide.
b. Sidelite and Transom Frames: Fabricated from same material as adjacent door frame.
c. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

1) Knocked down frame construction not permitted.

4. Exposed Finish: Prime.

2.4 EXTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

A. Exterior Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A.

1. Locations:

a. Exterior doors and frames.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.30 mm), with minimum G60 or A60 (ZF180) coating.
d. Door Edge Construction: Seamless, continuously welded with no visible seam.

1) End Channels: Close top and bottom edges with continuous flush channels, minimum thickness of 0.053 inch (1.3 mm), fabricated from same material as face sheets and spot welded to face sheets.

e. Top Edge Closures: Seal joints against water penetration.

f. Bottom Edge Closures: Provide weep hole openings in bottoms of exterior doors to permit moisture to escape.
g. Core Construction: Steel stiffened.

1) Welded Vertical Steel Stiffeners: Manufacturer's standard vertical steel stiffener extending full-door height, spot welded to face sheets. Fill spaces between stiffeners with mineral-fiber insulation.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum G60 or A60 (ZF180) coating.
b. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

1) Knocked down frame construction not permitted.

4. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Borrowed Lite Frames: Fabricate from same materials, construction, and finish as door frame assemblies.

B. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

1. Knocked down frame construction not permitted.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 in (1.10 mm) thick.

b. Masonry Type: Adjustable Z-clip type or T-shaped anchors to suit frame size, not less than 0.042 in (1.10 mm) thick, with corrugated or perforated straps not less than 2 in (50 mm) wide by 10 in (250 mm) long.

2. Quantity and Location:

a. Stud-Wall Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

1) Three anchors per jamb up to 60 in (1500 mm) high.
2) Four anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
3) Five anchors per jamb from 90 to 96 in (2250 to 2400 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 96 in (2400 mm) high.
5) Two anchors per head for frames above 42 in (1050 mm) wide and mounted in metal-stud partitions.

b. Masonry Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

1) Two anchors per jamb up to 60 in (1500 mm) high.
2) Three anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
3) Four anchors per jamb from 90 to 120 in (2250 to 3000 mm) high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 120 in (3000 mm) high.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor; fabricated from same material as frames and welded to bottom of jambs and mullions, minimum thickness 0.0428 in (1.10 mm), terminate bottom of frames at top of finish floor.

1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.

C. Floor Anchors for Concrete Slabs with Underlayment/Topping: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls and other exterior locations, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

## 2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating. Thickness indicated is for uncoated steel.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

1. Available Manufacturers:

a. Construction Materials, Inc.
b. Heckman Building Products, Inc.
c. Hilti Corp.
d. ITW Ramset/Red Head.
e. Powers Fasteners.
f. Simpson Strong Tie Anchor Systems.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Division 08 Section Glazing.

2.9 FABRICATION

A. General Requirements: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Factory fit and assemble units in manufacturer's plant.

1. Manufacturing Standards: ANSI/NAAMM-HMMA 861.

B. Hollow-Metal Doors: Fabricate doors not less than 1-3/4 in (44 mm) thick, seamless hollow metal construction unless otherwise indicated. Construct doors with smooth surfaces and without visible joints or seams on exposed faces.

C. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

D. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware. Minimum Reinforcing Thickness for Door Hardware:

   a. Hinges and Pivots: 0.167 in (4.2 mm) thickness by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge.
   b. Locks, Strikes, Flush Bolts and Closers: 0.093 in (2.3 mm) thickness.
   c. Surface Mounted Hold Open Arms and Panic Devices: 0.093 in (2.3 mm) thickness.
   d. Other Surface Applied Hardware: 0.067 in (1.7 mm) thickness.

2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
3. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections

F. Glazed Lites: Provide continuous frame for glazed openings between face sheets; miter corners, weld frame to face sheets, and grind smooth. Provide stops and moldings around glazed lites. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide stops and moldings around glazed lites, flush with face of door, and with square stops unless otherwise indicated.

   a. Use same materials as door face sheet for frame and loose stop for flush glazing

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed formed frame on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.

   a. Do not overlap frame molding on face of door.

4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

## 2.10 STEEL FINISHES

A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products for recommendations for cleaning, treating, priming, and when specified, finishing.

B. Uncoated Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, Solvent Cleaning; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, Power Tool Cleaning, or SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with primer. Clean welds, mechanical connections, abraded areas and apply galvanizing repair paint.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and other surfaces; comply with SSPC-Paint 20.

D. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

E. Field Applied Coatings: Comply with Division 09 Section Painting for substrate preparation and painting requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

### 3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.4 INSTALLATION

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with post-installed expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

4. Sound Rated Partitions: Solidly pack mineral-fiber insulation inside frames.
5. Exterior Walls: Solidly fill space between frames wall construction with mineral-fiber insulation unless indicated otherwise.
6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

a. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.6 ADJUSTMENTS AND REPAIRS

A. Final Adjustments: Remove and replace defective hollow metal work, including work that is warped, bowed, or otherwise unacceptable.

B. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

1. Inspect hollow metal frames located in wet areas and bathrooms; prepare and reprime damaged areas to prevent rusting and bleed through.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

# SECTION 084213

# ALUMINUM ENTRANCE DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Aluminum framed entrance door systems and supplementary items necessary for installation.

1. Standard thermal entrance doors.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.

### 1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

### 1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.

1. Glazed Aluminum Framing Systems shall be installed to provide a fully sealed building upon completion.

B. Delegated Engineering Responsibility: Contractor shall employ a qualified structural engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified structural engineer.

C. Delegated Engineering Professional Qualifications: Structural engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

D. Coordination of Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

1.4 Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of aluminum entrance door hardware, as well as procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals.

B. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope to this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope to this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope to this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1. Accessible Doors: Unless indicated otherwise, smooth surfaced for width of door in area within 10 in (250 mm) above floor or ground plane.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect materials according to manufacturer's written instructions.

B. Prevent damage to framing, glass and glazing materials from abrasion, soiling, contamination, wetting or condensation, temperature changes, direct exposure to sun, or other causes.

1. Use crating, stacking and storage procedures that prevent damage to finishes and gaskets.

C. Stack vertically or on edge prevent water accumulation on or within materials, using wood or plastic shims between components to provide water drainage and air circulation.

D. Cover materials with suspended tarpaulins or plastic to provide air circulation.

1.10 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.12 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Deterioration of metals and other materials beyond normal weathering.
c. Water penetration through fixed glazing and framing areas.
d. Failure of operating components.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.

B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

C. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

1.13 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

B. Continuing Maintenance Proposal: From installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1. Include 24-hour-per-day, 7-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work and compatible with the curtainwall system.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 ALUMINUM ENTRANCE DOOR SYSTEMS

A. Standard Thermal Entrance Doors: Manufacturer's standard glazed, thermally broken entrance doors for manual-swing operation.

1. Door Construction: 2-1/4 in (57 mm) overall thickness, with minimum 0.125 in (3.2 mm) thick, extruded-aluminum tubular rail and stile members, thermally-broken. Mechanically fasten corners with reinforcing brackets, fillet welded or incorporate concealed tie rods.

2. Door Design: Medium stile; 3-1/2 in (87 mm) nominal width at vertical stiles.

a. Basis of Design: Kawneer; 350T Thermal Entrances, Medium Stile.

3. Glazing Stops and Gaskets: Unless indicated otherwise, square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 / B 209M.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
4. Structural Profiles: ASTM B 308 / B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

## 2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 Door Hardware.

B. General: Provide entrance door hardware for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products and complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

    a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
    b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in 087100 Door Hardware.

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.

## 2.6 GLAZING

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer for joint type.

1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, neutral-curing silicone formulation compatible with system components with which it comes in contact; and recommended by weatherseal-sealant and curtain-wall manufacturers for this use.

    a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
    b. Color: Black, unless otherwise indicated.

2. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

## 2.7 ACCESSORIES

A. Automatic Door Operators: Section 087100 Door Hardware for Automatic Door Operators furnished separately from doors and frames.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Avoid using exposed fasteners. When unavoidable, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

C. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

D. Joint Sealants: For installation at perimeter of aluminum entrance doors, as specified in Division 07 Section "Joint Sealants".

## 2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that is sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing pockets as recommended by glass manufacturer for thickness and type of glass indicated.
6. Fasteners, anchors, and connection devices that are concealed from view.

D. Entrance Door Frames: Provide tubular and channel frame entrance door frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

F. Entrance Door Hardware Installation: Factory-install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

D. Finish Selections: As scheduled or indicated in Design Selections.

2.10 ALUMINUM FINISHES

A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ALUMINUM ENTRANCE DOORS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Install joint filler behind sealant as recommended by sealant manufacturer.

I. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

J. Install entrance doors to produce smooth operation and tight fit at contact points.

K. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

## 3.5 INSTALLATION OF GLAZING

A. Install glazing as specified in Division 08 Section "Glazing".

## 3.6 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 in in 12 ft (3 mm in 3.6 m); 1/4 in (6 mm) over total length.
2. Alignment:

    a. Where surfaces abut in line, limit offset from true alignment to 1/16 in (1.5 mm).
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 in (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in (3 mm).

## 3.7 FIELD QUALITY CONTROL

A. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.

B. Aluminum-framed entrances will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.8 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. Accessible Doors: Adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 in (75 mm) from the latch, measured to the leading door edge.

## 3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as doors and frames are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

B. Replace doors and frames that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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# SECTION 084400

# GLAZED ALUMINUM FRAMING SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Glazed aluminum framing systems and supplementary items necessary for installation.

1. Factory fabricated unitized system, custom aluminum curtain wall and window wall systems.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

### 1.2 DEFINITIONS

A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.
2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces.

### 1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.

1. Glazed Aluminum Framing Systems shall be installed to provide a fully sealed building upon completion.

B. Delegated Engineering Responsibility: Contractor shall employ a qualified structural engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified structural engineer.

C. Delegated Engineering Professional Qualifications: Structural engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

D. Coordination of Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Prepared by manufacturer, not installer.

a. Shop drawings not prepared by manufacturer shall include manufacturer's written approval on shop drawings.
b. Shop drawings shall contain seal of a structural engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.

2. Include typical unit elevations at 1/2 in (12 mm) scale and details at full scale.
3. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
4. Indicate where and how the system deviates from Contract Documents.
5. Provide material properties and other information needed for structural analysis including computations, prepared, signed and sealed by a structural engineer licensed to practice in the jurisdiction where the project is located.

a. Calculations shall include but not limited to the following:

1) Section properties for framing members.
2) Analysis of framing members.

3) Analysis of anchors and embedded anchors in concrete structure.
4) Analysis of stress in structural silicone.
5) Analysis of glass thicknesses and strength.

6. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
7. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
8. Include full-size isometric details of typical and special conditions within the system, showing the following:

a. Mullion details, including reinforcement and stiffeners.
b. Joinery details, including concealed welds.
c. Anchorage.
d. Expansion provisions.
e. Glazing details.
f. Flashing and drainage details.
g. Weather-stripping and weather seals within curtain wall framing.
h. Thermally improved details.
i. Perimeter weather seals and structural seals.
j. Interface with other building construction.
k. Identification and detail of perimeter fire containment system.
l. Window cleaning provisions.
m. De-glazing and re-glazing procedures.

1) Unless indicated otherwise, framing and glass shall be designed to be re-glazed from the exterior using original glass size and gaskets without modification to framing. Comply with manufacturer recommended re-glazing procedure.

n. Attachment details, including thickness of curtain wall components, designed to receive lightning protection system.

9. Submit insert/embed drawings including layout and enlarged details. Include detail and engineering calculations for field modifications due to location and/or omitted inserts/embeds.
10. Window System Operators for Operable Window Vent Systems: Show locations, mounting, and details for installing operator components and controls.

C. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.

1. Exposed Finishes: 12 in (300 mm) long sections of extrusions or formed shapes, 6 in (150 mm) squares of sheet or plate, each finish type and color.
2. Sealants and Gaskets: 12 in (304 mm) minimum length for sealant or gasket glazed joint, each type and color.
3. Joinery, including concealed welds.
4. Anchorage.
5. Expansion provisions.
6. Glazing, including sealants and gaskets, each type and color.
7. Flashing and drainage.

8. Include fabrication sample of any unusual condition.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified structural engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

C. Energy Performance Certificates: For glazed aluminum framing systems, accessories, and components.

1. Basis for Certification: Certified by manufacturer for energy performance ratings as determined in accordance with NFRC.

D. U-Value and Condensation Evaluation: Determine wall system U-Value and provide condensation evaluation using NFRC approved version of Lawrence Berkeley National Laboratory THERM software for simulations. Submit isothermal condensation results, including isothermal graphics, for temperature limits of wall system components.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Anchors and Fasteners: Tested and qualified for use in accordance with ICC-ES or other product approval acceptable to authorities having jurisdiction.

F. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

G. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1. Structural-Sealant Glazing: For structural-sealant glazing, include ASTM C 1401 recommendations for post-installation-phase, quality-control program.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope to this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope to this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope to this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

    a. Subcontractor Responsibility: Work included in this Technical Section shall be performed by a qualified single subcontractor solely responsible for engineering, fabrication and installation of the Work.

C. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

D. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements when indicated.

E. Structural-Sealant Glazing: Comply with ASTM C 1401 "Guide for Structural Sealant Glazing" for design and installation of glazed aluminum wall systems utilizing structural-sealant glazing.

1. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.
2. Comply with ASTM C 1135 Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will be in contact with sealants and for each condition.

1. Test a minimum five production-run samples each of metal, glazing, and other material.

    a. Include all adjacent materials with watertight seals to curtain wall systems.

2. Prepare samples using techniques and primers required for installed assemblies.
3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

1.9 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.10 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.
f. Owner's Building Enclosure Commissioning provider.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.

1) Review construction tolerances for structural frame and construction surveying requirements.

b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Protect materials according to manufacturer's written instructions.

B. Prevent damage to framing, glass and glazing materials from abrasion, soiling, contamination, wetting or condensation, temperature changes, direct exposure to sun, or other causes.

1. Use crating, stacking and storage procedures that prevent damage to finishes and gaskets.

1.12 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.13 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.14 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Thermal stresses transferring to building structure.
c. Glass breakage.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Deterioration of metals and other materials beyond normal weathering.
g. Water penetration through fixed glazing and framing areas.
h. Air infiltration exceeding performance requirements.
i. Failure of operating components.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

C. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Curtain Wall System; Structural Silicone Glazing, Four Sided - Unitized System:

a. Provide captured glass at the perimeter of the cutainwall whre is a butts to other materials.

### 2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

### 2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Failure includes the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Thermal stresses transferring to building structure.
c. Glass breakage.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Deterioration of metals and other materials beyond normal weathering.
g. Water penetration through fixed glazing and framing areas.
h. Air infiltration exceeding performance requirements.
i. Failure of operating units

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.
b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.

2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:

a. Design Displacement: As indicated on Drawings.
b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.
c. Connections shall permit movement in the plane of the panel for inter-story drift and shall be properly designed sliding type connections using slotted or over-sized holes, or connections permitting movement by bending of steel or other connections providing equivalent sliding and ductile capacity.

1) Connector bodies shall have sufficient ductility and rotational capacity to prevent fracture of concrete or brittle failure near welds.
2) Fasteners embedded in concrete shall be attached to reinforcing steel or otherwise terminated to effectively transfer forces to the reinforcing steel in accordance with applicable Building Code requirements.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Deflection of Framing Members: At design wind load in accordance with the Building Code.

1. Deflection Normal to Wall Plane: Edge deflection of individual glazing lites limited to 1/175 for glass edge lengths up to 13 feet 6 inches (4.1 m), and limited to 1/240 plus 1/4 inch (6.35 mm) for glass edge lengths greater than 13 feet 6 inches (4.1 m) and less than 40 feet (12 m), when designed in accordance with AAMA TIR A11-15 and tested in accordance with ASTM E 330/E330M-14.

a. Exceptions:

1) Where a sealant joint occurs between a framing member and a relatively stiff building element, framing member deflection not more than 1/2 of nominal joint width, or less if required by sealant manufacturer.

b. Span is defined as the distance between anchor center line.

2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 in (3 mm).

a. Operable Units (Doors or Windows): Provide a minimum 1/16 in (1.6 mm) clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 2L/175 where L is the cantilever length.

4. Deflection of Framing System Interior Trim: Center deflection of interior trim shall not exceed 1/4 in (6 mm) when subjected to a 250 pound (113 Kg) vertical concentrated load. No permanent deformation allowed when load is removed.

a. Window sill extension trim.
b. Slab edge covers.

F. Structural Test Performance: Test according to ASTM E 330/330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

G. Water Penetration under Static Pressure for Storefront System: Test in accordance with ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sf (480 Pa).

H. Water Penetration under Static Pressure for Curtain Wall and Window Wall Systems: Test in accordance with ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).

I. Water Penetration under Dynamic Pressure for Curtain Wall and Window Wall Systems: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).

J. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Provide drainage to exterior of wall for water entering at joints or glazing reveals, condensation occurring within assemblies, secondary water from adjacent wall systems and similar conditions.

a. Provide internal gutters and weep system to collect and drain water leakage and condensation to the exterior.

1) Stick framed curtain wall systems and punched windows shall have an isolated gutter cavity at each glass perimeter such that leakage is confined to and weeped from the opening where leakage originated.
2) Unitized curtain walls shall have continuous spliced gutters at horizontal stack joints with sealed end caps at termination conditions.
3) Window wall shall have a continuous gutter and weep holes at the glass sill and a continuous gutter at the glass head that drains directly to exterior or directs leakage from spandrel above to the window sill.

b. Provide continuous subsill below windows with interlocking mullions.
c. Coordinate gutter and weep systems with drainage provisions with adjacent construction.
d. Coordinate connection of drainage members at columns, spandrel beams and other areas with limited access.
e. The use of carbon steel components for gutter and drainage assemblies is prohibited; provide stainless steel or aluminum components.

K. Energy Performance: Certified or labeled by manufacturer for energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-Factor) - Fixed Vision Glazing and Framing Areas: U-factor as determined in accordance with NFRC 100.

a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.

2. Thermal Transmittance (U-Factor) - Fixed Spandrel Glazing, Metal Panels and Framing Areas: U-factor as determined in accordance with NFRC 100.

a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.

3. Solar Heat Gain Coefficient (SHGC) - Fixed Glazing and Framing Areas: Solar Heat Gain Coefficient as determined in accordance with NFRC 200.

a. Maximum SHGC: As indicated on Drawings, comply with building energy performance model for this project.

4. Air Leakage - Glazed Aluminum Wall and Storefront:

   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sf (0.30 L/s/sm) at a minimum static-air-pressure differential of 6.24 lbf/sf (300 Pa) when tested in accordance with ASTM E 283.

5. Condensation Resistance: Condensation resistance as determined in accordance with NFRC 500.

   a. Fixed Glazing and Framing Areas: No condensation allowed under design conditions indicated.

L. Building Maintenance Equipment: Engineer units supporting building maintenance equipment to resist pull-out and horizontal shear forces transmitted from equipment.

M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.

   a. Fabrication, assembly and erection procedures shall take into consideration the ambient temperature range at the time of each operation.

N. Structural-Sealant Joints:

1. Design reviewed and approved by structural-sealant manufacturer.

O. Structural-Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by glazed aluminum wall systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

P. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

## 2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 / B 209M.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.

3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
4. Structural Profiles: ASTM B 308 / B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Internal Reinforcement: Shapes and sizes to suit installation meeting delegated engineered performance requirements, as indicated on Shop Drawings.

1. Structural Shapes, Plates, and Bars: ASTM A 36 / A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008 / A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011 / A 1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

## 2.5 GLAZED ALUMINUM FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Structural Thermal Barriers: Provide thermally improved system in compliance with energy model and condensation performance requirements.
2. Field installation of four-sided structural glazing is not allowed.

    a. Where shop installation of four-sided structural glazing is not feasible, submit proposed field installation locations to Architect for review.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

1. Shims:

    a. Structural Connections: Series 300 Stainless Steel; ASTM A 36 or ASTM A 283 hot-dipped galvanized steel.

        1) Dynamic Connections: Molybdenum disulfied filled nylon lubricated pads or washers.

    b. Non-Structural Connections: U-shaped polystyrene.
    c. Static Non-Load Transfer Connections: Korolath high-impact polystyrene pads.

2. For connections where shim height is greater than twice the bolt diameter, provide steel or aluminum shims.

    a. Plastic shims are acceptable only in locations where shim height is less than twice the bolt diameter or fully bearing locations where there is no bending induced into the bolt anchor.

3. Mechanically restrain shims in dynamic connections to remain in place.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials. Domestically manufactured only.

1. Manufacturers and Products - Self Drilling, Self Tapping Screws:

    a. Elco; Dril-Flex Structural Self-Drilling Screws.
    b. Hilti; Kwik-Flex Structural Self-Drilling Screws.

2. Manufacturers and Products - Series 300 Stainless Steel Fasteners:

    a. Elco; Bi-Flex 300 SS with Stalgard.
    b. Elco; Alumi-Flex 302 SS with Stalgard.
    c. SFS; Bi-Met 300.

3. Use Series 300 Stainless Steel fasteners for joining framing members and fasteners located in wet areas including fasteners penetrating the waterline and covered with sealant.
4. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
5. Reinforce members as required to receive fastener threads.
6. Use concealed fasteners; exposed fasteners are not allowed.

    a. At locations where exposed fasteners are unavoidable and approved by Architect, use exposed fasteners with countersunk Phillips screw heads finished to match framing system.

7. Storefront: Furnish heavy duty aluminum sill pan with integral welded or fastened and structurally sealed end dams, typical.

D. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer. Domestically manufactured only.

1. Concrete and Masonry Inserts:

    a. Product Quality Standards: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 / A 123M or ASTM A 153 / A 153M requirements.
    b. Manufacturers:

        1) Halfen.
        2) Hilti.
        3) Jordahl.
        4) Unitstrut.

2. Post Installed Expansion Anchors:

    a. Product Quality Standards: Tested and qualified for use in accordance with ACI 355.2, ACI 318 and ICC-ES AC193 for cracked, uncracked and seismic concrete recognition.

        1) Material and Finish: Stainless steel ASTM F 593 Group 1 (Alloy 304/316), mechanically deposited ASTM B 695 or hot-dip zinc coating ASTM A 153 Class C. Thickness not less than 0.0002 inches.

b. Acceptable Manufacturers:

1) Dewalt.
2) Hilti.
3) ITW.
4) Simpson.

c. Not Acceptable: Chemical type anchors for overhead dead load connectors.

3. Threaded Concrete Anchors:

a. Product Quality Standards: Tested and qualified for use in accordance with ACI 355.2, ACI 318 and ICC-ES AC193 for cracked, uncracked and seismic concrete recognition.

1) Material and Finish: Carbon steel with corrosion resistant coating, not less than 1000 hours of salt spray resistance according to ASTM B 117; 300 Series Stainless Steel, non-magnetic.
2) Anchor Thickness: 3/8 inch minimum.

b. Acceptable Manufacturers:

1) Dewalt.
2) Elco.
3) Hilti.

c. Condition of Use: Shall not be used in overhead dead load connections supporting sustained load in tension.

E. Concealed Flashing: Dead-soft, 0.018 in (0.45 mm) thick stainless steel, ASTM A 240 / A 240M of type recommended by manufacturer.

F. Framing System Gaskets and Sealants: Refer to Division 08 Section “Glazing.

1. EPDM Gaskets: EPDM shall be isolated from direct contact with silicone; including but not limited to the secondary perimeter silicone seal of insulating glass units.

a. Provide silicone gaskets where gaskets are in contact with silicone sealant.

G. Glazed-in Aluminum Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated.

1. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.125 in (3.18 mm) thick minimum.
2. Exterior Finish: Matching framing system.

2.6 GLAZING

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section Glazing.

1. Glass Types: As scheduled or indicated in Design Selections.

B. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, non-migrating types compatible with sealants and suitable for joint movement and assembly performance requirements. Comply with Division 08 Section "Glazing".

1. Silicone Sealant Compatibility: When in direct contact with silicone sealants, gaskets, spacers and setting blocks shall be heat cured silicone rubber based material which is chemically compatible and with sufficient hardness for the purpose intended and approved in writing by the glazing and curtain wall manufacturers.

C. Glazing Sealants: As recommended by manufacturer for joint type.

1. Structural-Glazing Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural-sealant and approved by structural-sealant manufacturer for use in glazed aluminum wall assembly indicated.

a. Minimum Tensile Strength: 100 psi (690 kPa).
b. Modulus of Elasticity: As required by structural-sealant-glazed aluminum wall system design to meet performance requirements.
c. Manufacturers and Products: Subject to compliance with requirements, provide one of the following:

1) Dow; DOWSIL 983 Structural Glazing Sealant.
2) GE Silicones; SSG4400 Ultraglaze Sealant.
3) Tremco Incorporated; Proglaze SSG.

d. Color: Black, unless otherwise scheduled or indicated in Design Selections Summary.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 50, neutral-curing silicone formulation compatible with system components with which it comes in contact; and recommended by weatherseal-sealant and curtain-wall manufacturers for this use.

a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
b. Color: Black, unless otherwise scheduled or indicated in Design Selections Summary.

3. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

## 2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of glazed aluminum framing systems, as specified in Division 07 Section "Joint Sealants".

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils (0.762 mm) thickness per coat.

C. Perimeter Fire-Containment System for Curtain Wall Spandrel Conditions: Safing insulation and curtain wall insulation as specified in Division 07 Section "Fire-Resistive Joint Systems".

D. Thermal Insulating Materials: As specified in Division 07 Section Thermal Insulation.

E. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.

F. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.

G. Linings, Spacers and Sleeves: At dynamic or moving joints, provide type and materials recommended by manufacturer to provide a fully sealed penetration.

2.8 FABRICATION

A. Do not expose unfinished or cut edges to view.

B. Shop weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Welds shall be of adequate strength and durability, with jointing tight, flush, smooth and clean. Weld behind finished surfaces so as to cause no distortion and/or discoloration on the finished side. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

1. Field welding aluminum is not allowed.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that is sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing packets as recommended by glass manufacturer for thickness and type of glass indicated.

a. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural-sealant cures.

6. Fasteners, anchors, and connection devices that are concealed from view.
7. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum framing systems to exterior.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. For Factory-Assembled and Glazed Frame Units:

1. Rigidly secure non-movement joints.
2. Seal joints watertight unless otherwise indicated.
3. Factory-install glazing to comply with requirements in Division 08 Section "Glazing".

4. Structural-Sealant Units: Prepare surfaces that will contact structural-sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Concealed members may be mill finish, providing that they cannot be seen through the glass, do not contact any structural silicone or are not continually exposed to water immersion.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

E. Selections: As scheduled or as indicated in Design Selections.

2.10 ALUMINUM FINISHES

A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

D. Clear Anodic Finish at Interior Surfaces: AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 SOURCE QUALITY CONTROL FOR STRUCTURAL-SEALANT-GLAZED SYSTEMS

A. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

B. Structural-sealant-glazed system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

### 3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

1. Furnish inserts for setting in concrete forming, and similar work required to support glazed aluminum wall system.
2. Field measure and verify governing dimensions, including floor elevations, floor-to-floor heights, minimum clearance between wall system and structural frames and other permissible dimensional tolerances in building frame.

    a. Survey all embeds and floor elevations to confirm correct location above established benchmarks.

### 3.4 INSTALLATION OF GLAZED ALUMINUM FRAMING SYSTEMS

A. General:

1. Do not install damaged components.

2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure non-movement joints.
4. Install anchors with separators and isolators to prevent impediments to movement of joints.
5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum framing systems to exterior.

C. Set continuous sill members and flashing in full sealant bed and install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers. Maintain minimum clearance of 1 in (25 mm) between inside face of framing system and outside face of building structure.

E. Perimeter Fire-Containment System for Curtain Wall Spandrel Conditions: Clean debris from behind framing during erection and provide temporary closures to prevent accumulation of debris. Install spandrel insulation and firestopping securely anchored to prevent dislocation. Comply with requirements of Division 07 Section Fire-Resistive Joint Systems.

## 3.5 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

1. Plumb: 1/8 in per 10 ft (3 mm per 3 m); 1/4 in per 40 ft (6 mm per 12 m).
2. Level: 1/8 in per 10 ft (3 mm per 3 m); 1/4 in per 40 ft (6 mm per 12 m).
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 in (12 mm) wide, limit offset from true alignment to 1/16 in (1.5 mm).
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 in (12 to 25 mm) wide, limit offset from true alignment to 1/8 in (3 mm).
    c. Where surfaces are separated by reveal or protruding element of 1 in (25 mm) wide or more, limit offset from true alignment to 1/4 in (6 mm).

4. Location and Plane: Limit variation from plane to 1/8 in per 12 ft (3 mm per 3.6 m); 1/2 in (12 mm) over total length.

## 3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Special Inspections: Anchors and fasteners will be subject to testing and inspecting when applicable in accordance with the Building Code and current ICC-ESR.

D. Structural-Sealant Compatibility and Adhesion: Testing and inspecting of representative areas of structural-sealant-glazed curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with manufacturer and specified requirements.

1. Structural-Sealant Adhesion: Test structural-sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

a. Test a minimum of six (6) areas on each building facade.
b. Repair installation areas damaged by testing.

E. Glazed aluminum framing systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

## 3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as framing systems are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace framing systems panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

# SECTION 088000

# GLAZING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Glass, glazing, and supplementary items necessary for installation, including glass specified in other Sections where glazing requirements referenced to this Section.

1. Monolithic glass.
2. Laminated glass.
3. Insulating glass.
4. Decorative glazing.
5. Fire-protection-rated glazing.
6. Glazing sealants and glazing materials.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.

### 1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

### 1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.

B. Project Glazing Analysis: Prepared by manufacturer for primary glass or fabricator for fabricated glass units. Analyze each glass type and glazing condition for thermal, wind, impact and additional design loads indicated in glass performance requirements.

1. Provide glass products in the thickness and strengths required to meet or exceed the criteria based on project loads and in-service conditions.

C. Delegated Engineering – Structural Glass and Other Applications Exceeding Project Glazing Analysis: Contractor shall employ a qualified structural engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified structural engineer.

D. Delegated Engineering Professional Qualifications: Structural engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

E. Coordination of Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include details of each type of glazing in conjunction with the appropriate framing system; indicate type of glass, sizes, shapes, glazing material, and quantity.
2. Include details indicating glazing thickness, bite on glass, glass edge clearance, and depth of rabbet.

C. Glass Samples: For each type of glass product other than clear monolithic vision glass, 12 inches (300 mm) square.

D. Glazing Accessory Samples: For gaskets, sealants and colored spacers, each type and color, in 12-inch (300-mm) lengths.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
4. Certification: Qualified glazing contractor certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.8 MOCKUPS

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Provide glazing in mockups to match glazing systems required for Project, including glazing methods.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Insulating Glass Units: Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C),unless approved otherwise by manufacturer in writing.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate glazing channel dimensions.

1. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
2. Achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.12 WARRANTY

A. Manufacturer Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Laminated Glass: Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

2. Insulating Glass Units: Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

### 2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

### 2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.

C. Interior Glazing:

1. Maximum Lateral Deflection: For glass supported on all four edges or two edges, limit center-of-glass deflection to not more than 1/100 times the short-side length or 1/2 in (12 mm), whichever is less, at 10 lb/sq ft lateral load.
2. Differential Deflection: For glass installed to walking surfaces, deflection of adjacent unsupported edges shall not exceed glass thickness when subjected to 50 lbf/ft. (730 N/m) applied horizontally to one panel at any point up to 42 inches (1067 mm) above the adjacent walking surface.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by conditions including differential shading within individual glazing lites and temperatures.
4. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.

    a. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.

### 2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA/GANA Publications: Glazing Manual • and Laminated Glazing Reference Manual.

2. FGIA/IGMA Publication for Insulating Glass: IGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
3. FGIA/IGMA Publication Insulating Glazing Tolerances: IGMA TB-1200, "Guidelines for Insulating Glass Dimensional Tolerances."
4. NGA/GANA Publications: "Guidelines for the Appearance of Insulating Glass Unit Edges in Commercial Applications at the Time of Installation

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. Acceptable Products: Complying with CSPC 16 CFR 1201, Category II.

a. Submit label location and size for Owner approval prior to fabrication. Glass having labels in locations not pre-approved shall be removed and replaced with glass having labels in the correct location at no cost to Owner.

2. Products Not Permitted: Wired Glass.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1. Units shall be certified by IGCC to comply with ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. Insulating Glass Units: Acceptable products shall comply with the following:

1. ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units.
2. ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.

E. Glass Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Interior Glass Schedule: As indicated on Drawings, or as scheduled or as indicated in Design Selections.

a. Interior Lites: Not less than 1/4 in (6 mm) minimum thickness.

F. Glass Strength: Provide Kind HS heat-strengthened float glass or Kind FT fully tempered float glass as required to comply with Performance Requirements, unless otherwise indicated:

1. Provide Kind HS (Heat Strengthened) at exterior conditions and where recommended by manufacturer to comply with performance requirements.
2. Provide Kind FT (Fully Tempered) as indicated and where recommended by manufacturer to comply with performance requirements or required for safety glazing.
3. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with Performance Requirements.
4. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with Performance Requirements.
5. Where fully tempered float glass is indicated, provide fully tempered float glass.

a. Provide Kind FT fully tempered float glass where recommended by manufacturer to comply with safety glazing requirements.

## 2.5 GLASS PRODUCTS

A. Glass Manufacturers and Fabricators:

1. AGC Glass Co. North America, Inc.
2. Guardian Industries Corporation
3. Pilkington North America, Inc.
4. Vitro Architectural Glass (formerly PPG Industries, Inc.)
5. Saint Gobain.
6. Viracon.
7. Interpane.
8. Tecnoglass.
9. Oldcastle.

B. Clear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

C. Low-Iron Float Glass (Ultraclear): ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent.

1. Manufacturers and Products:

a. AGC Glass Co. North America, Inc.; Krystal Klear.
b. Guardian Industries Corp.; Ultrawhite.
c. Pilkington North America; Optiwhite.
d. Vitro Architectural Glass (PPG Industries, Inc.); Starphire.

D. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided otherwise.

E. Decorative Glazing: See Drawings for Interior Finish Schedule.

## 2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Comply with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral (PVB) interlayer or SGP Ionoplast interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than indicated and as needed to comply with requirements.

a. Minimum Thickness: 0.030 in (0.75 mm) unless otherwise indicated.
b. Heat Strengthened and Fully Tempered Glazing: 0.060 in (1.5 mm) minimum.

3. Interlayer Color: Clear unless otherwise indicated.
4. Typical Interlayer - Manufacturers and Products:

    a. DuPont; Butacite.
    b. Eastman Chemical Company; Saflex.
    c. Kuraray; SentryGlas.

5. Glass Railing / Windscreen Interlayer - Manufacturers and Products:

    a. Basis of Design: Kuraray America Inc.; SentryGlas Ionoplast.

## 2.7 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Insulating Glass Unit Thickness Tolerance: Minus 1/16 inch, plus 1/32 inch.

    a. Units Constructed with Patterned or Laminated Glass: Plus or minus 1/16 inch.

2. Sealing System: Dual seal, with polyisobutylene primary seal and silicone secondary seal in accordance with ASTM C 1249. Voids or skips in the primary seal are not allowed.

    a. Primary IGU Seal: Primary IGU sealant shall be fully wetted against glass, applied in a continuous, uninterrupted, properly dimensioned bead with no skips or voids around perimeter, each side of IGU.

        1) Primary Seal Width: 5/32-inch.
        2) Primary Seal Thickness: 1/16-inch minimum thickness after pressing IGU.
        3) Air Spacer Visibility: 3/32-inch maximum visible exposure beyond polyisobutylene primary seal.

    b. Secondary IGU Seal: Secondary IGU sealant shall be fully wetted against glass and spacer, applied in a continuous, uninterrupted, properly dimensioned bead, filling cavity with sealant completely.

        1) Secondary Seal Thickness: As determined by glass manufacturer; meeting minimum design width and depth requirements as determined by glass strength and deflections, plus 1/16-inch tolerance.
        2) Corners: IGU corners shall be completely filled with secondary sealant.

    c. Skips and Voids Between Primary and Secondary Sealant: Maximum of 2-inches long by 1/16-inch-wide discontinuity separated by at least 18-inches. Provide continuous contact between primary and secondary IGU sealant, cleanly tool secondary sealant prior to packing.
    d. Sealant Color: Black, unless otherwise scheduled or indicated in Design Selections.

3. Spacer: Provide a hermetically sealed and dehydrated space; lites shall be separated by a spacer with three bent corners and one keyed-soldered corner or four bent corners and one straight butyl injected zinc plated steel straight key joint.

a. Spacer Material and Color:

1) Spacer Material and Color: Aluminum with mill or clear anodic finish, unless otherwise scheduled or indicated in Design Selections.

4. Desiccant: Molecular sieve or silica gel, or blend of both.

2.8 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and complies with NFPA 80.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F (250 deg C) temperature-rise limitation; and fire-resistance rating in minutes.

C. Monolithic Fire-Protection-Rated Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) thickness; complying with 16 CFR 1201, Category II.

1. Manufacturers and Products:

a. Technical Glass Products; FireLite.
b. Safti First; SuperLite.
c. Schott North America, Inc.; Pyran Star.
d. Vetrotech; Keralite.

2. Basis of Design: Technical Glass Products; FireLite.

a. Locations - Safety Glazing not Required: Where indicated or scheduled for 20, 45, 60, and 90-minute ratings.

D. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.

1. Manufacturers and Products:

a. Technical Glass Products; FireLite Plus (Laminated).
b. Safti First; SuperLite (Laminated).
c. Schott North America, Inc.; Pyran Star (Laminated).
d. Vetrotech Saint-Gobain; Keralite (Laminated).

2. Basis of Design: Technical Glass Products; FireLite Plus.

a. Locations - Safety Glazing Required: Where indicated or scheduled for 20, 45-, 60-, 90-, and 120-minute ratings.

2.9 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. EPDM (peroxide cured) complying with ASTM C 864.
2. Silicone complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of EPDM, silicone, or thermoplastic polyolefin rubber, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal and compatible with sealants.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

a. Gasket Color: Black, unless otherwise scheduled or indicated in Design Selections. Gaskets concealed from view may be black.

C. Provide factory pre-molded, vulcanized or heat welded corners, for continuous, joint-free glazing material around sides of the glazing rabbet. Field-cut corners not allowed.

D. Provide gasket slightly longer than opening to be filled, as recommended by gasket manufacturer.

2.10 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Additional Movement Capability: Provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers and Products:

a. Dow; DOWSIL 795 Silicone Building Sealant.
b. GE Construction Sealants; Momentive Performance Materials Inc.GE Advanced Materials - Silicones; Silglaze II.
c. Pecora Corporation; 895.
d. Sika Corp.; Sikasil WS-295.

2. Color: As selected by Architect from manufacturer's full range of colors.

C. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

2.11 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone material with a Shore, Type A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Silicone blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Silicone material of hardness needed to limit glass lateral movement (side walking).
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.12 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

B. Butt Glazing: Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.13 DECORATIVE GLASS FABRICATION

A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.

B. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

C. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.4 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 in (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8 in (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

## 3.5 INSTALLATION OF DECORATIVE GLAZING

A. Set decorative glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

B. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces.

## 3.6 TAPE GLAZING FOR INTERIOR INSTALLATIONS

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

## 3.7 GASKET GLAZING (DRY)

A. Fabricate compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.8 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

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

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Glass Color Tolerances: Owner testing agency may perform onsite color measurements using spectrophotometer instrumentation to ensure compliance with Tolerances for Color Variation.

a. Onsite Developed Reference Target: Onsite developed reference target shall be the average measurement of not less than 75% of glass units of the same glass type per façade.

1) Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.

b. Testing agency will prepare survey report indicating locations not complying with specified tolerances.

3.10 CLEANING AND PROTECTION

A. Immediately after installation, remove non-permanent labels and clean surfaces.

B. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

C. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

1. Coordinate glass cleaning schedule with Owner's requirements.

3.11 GLASS TYPE SCHEDULE

A. Exterior Glass Schedule: (Note: Provide FT glass where required for safety glazing.)

1. GL-1V: Insulating Coated Glass - Vision

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with Guardian SNR50 Low E coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Warm edge Stainless Steel, Black spaces, Black sealant, 90% Argon.
d. Inboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated. Interlayer: 0.60 in PVB.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

2. GL-1S: Insulating Coated Glass, - Spandrel

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with Guardian SNR50 Low E coating on No. 2 surface.
c. Air Space: 3/4 in (19 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass with ceramic frit on the No. 4 surface, 100% coverage, color: Charcoal Gray.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise'

3. GL-2V: Insulating Coated Glass - Vision

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity =, 30% coverage).
c. Air Space: 3/4 in (19 mm); Warm Edge Stainless Steel, Black spacer, Black sealant, 90% Argon.
d. Inboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

4. GL-2S: Insulating Coated Glass, - Spandrel

a. Overall Thickness: 1.25 in. (32mm).

b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) minimum thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity =, 30% coverage).
c. Air Space: 3/4 in (19 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with ceramic frit on the No. 4 surface, 100% coverage, color: Charcoal Grey.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

5. GL-2V2: Insulating Laminated Coated Glass - Vision

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) minimum thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity =, 30% coverage).

c. Air Space: 1/2 in (12 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Two plies Ultraclear HS; 1/4 in (6 mm) thick glass; laminated. Interlayer: 0.60 in PVB.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

6. GL-3V: Insulating Ceramic Coated Glass - Vision

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity =, 30% coverage).
c. Air Space: 3/4 in (19 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

7. GL-3S: Insulating Ceramic Coated Glass - Spandrel

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity =, 30% coverage).
c. Air Space: 3/4 in (19 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with ceramic frit on the No. 4 surface, 100% coverage, color: Charcoal Grey.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

8. GL-6V: Insulating Ceramic Coated Glass - Vision

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity, 30% coverage).

c. Air Space: 1/2 in (12 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

9. GL-6S: Insulating Ceramic Coated Glass - Spandrel

a. Overall Thickness: 1.25 in. (32mm).
b. Outboard Lite: Ultraclear HS; 1/4 in (6 mm) thick glass with Guardian SNX70+ Low E coating on No. 2 surface and custom frit on No. 2 surface (50% opacity, 100% coverage).
c. Air Space: 3/4 in (19 mm); Warm Edge Stainless Steel Black spacer; Black sealant, 90% Argon.
d. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with ceramic frit on the No. 4 surface, 100% coverage, color Charcoal Gray.
e. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.

3.12 GLAZING SCHEDULE

A. Sealant and Tape Glazing:

1. Exterior door glass lites.

B. Compression Gasket Glazing:

1. Curtain and window walls
2. Fixed aluminum windows

END OF SECTION