SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Aluminum-framed storefront systems.

Aluminum-framed entrance door systems.

* + - 1. PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" paragraph below if Work of this Section is extensive or complex enough to justify a conference.

* + - * 1. Preinstallation Conference: Conduct conference at Project site.

<**Insert requirements**>.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

* + - * 1. Sustainable Design Submittals:
				2. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

Joinery, including concealed welds.

Anchorage.

Expansion provisions.

Glazing.

Flashing and drainage.

Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

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

Power requirements for each electrically operated door hardware.

Location and types of switches, signal device, conduit sizes, and number and size of wires.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs below for two-stage Samples.

* + - * 1. Samples for Initial Selection: For units with factory-applied color finishes.
				2. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

Retain "Fabrication Sample" paragraph below to verify details of assembly.

* + - * 1. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

Joinery, including concealed welds.

Anchorage.

Expansion provisions.

Glazing.

Flashing and drainage.

* + - * 1. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

Retain "Delegated-Design Submittal" paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
				2. Quality Control Submittals:

Retain "Preconstruction Laboratory Mockup Testing Submittals" paragraph below if specifying Project-specific preconstruction testing in "Preconstruction Testing" Article as Contractor's responsibility.

Preconstruction Laboratory Mockup Testing Submittals:

Testing Program: Developed specifically for Project.

Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.

Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by [**manufacturer and witnessed by a qualified testing agency**] [**a qualified testing agency**].

Retain "Quality-Control Program" paragraph below if Project includes two-sided structural glazing. ASTM C1401 recommends establishing a written quality-control program for fabrication, installation, and post-construction maintenance of structural-sealant-glazed storefronts.

Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.

Source quality-control reports.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

Field quality-control reports.

Sample Warranties: For special warranties.

* + - * 1. Contract Closeout Submittals

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

Retain "Maintenance Data for Structural Sealant" paragraph below if Project includes two-sided structural glazing.

Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

* + - 1. QUALITY ASSURANCE
				1. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Retain "Laboratory Mockup Testing Agency Qualifications" paragraph below if Project-specific preconstruction mockup testing is specified in "Preconstruction Testing" Article.

* + - * 1. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated [ **and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025**].
				2. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

Retain subparagraph below or revise to suit Project.

Do not change intended aesthetic effects, as judged solely by Director’s Representative, except with Director’s Representative's approval. If changes are proposed, submit comprehensive explanatory data to Director’s Representative for review.

Retain "Structural-Sealant Glazing" paragraph below if Project includes two-sided structural glazing.

* + - * 1. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.
			1. BENCHMARK

Mockups (off-site) may be required for large scale testing / envelope constructability required for specific project requirements. If Mockup testing is required, retain 1.6 Preconstruction Testing. Revise article below to suit.

* + - * 1. Build benchmark to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

Indicate portion of wall represented by benchmark on Drawings or draw benchmark as separate element. Coordinate requirements with those in other Sections, specifying glazing and cladding materials installed with aluminum-framed entrances and storefronts.

Build benchmark of typical wall area as shown on Drawings.

Retain first subparagraph below if subjecting mockup to field testing.

Testing shall be performed on benchmark according to requirements in "Field Quality Control" Article.

Retain first subparagraph below if benchmark are not only for establishing appearance factors.

Approval of benchmark does not constitute approval of deviations from the Contract Documents contained in benchmark unless Director’s Representative specifically approves such deviations in writing.

* + - 1. PRECONSTRUCTION TESTING

Retain this article for “Preconstruction Testing” for Mockup construction referenced above. Project-specific preconstruction testing of assemblies can be expensive but may be the best means of proving that performance requirements are met.

* + - * 1. Preconstruction Testing Service: [**Director’s Representative will engage] [Engage**] a qualified testing agency to perform preconstruction testing on laboratory mockups.

Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.

Usually indicate size and other details of preconstruction laboratory mockups on Drawings. ASTM E2099 includes recommendations for minimum sizes and configurations.

Size and Configuration: As indicated on Drawings.

Retain subparagraph below if required for Project.

Notify Director’s Representative [**seven] <Insert number**> days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.

Revise example test methods and sequence of tests in "Preconstruction Laboratory Mockup Testing" paragraph below to suit Project. Coordinate with performance requirements in "Performance /Requirements" Article. See AAMA 501 and ASTM E2099, and consult testing laboratories' default testing methods and sequences. Consult manufacturers and testing agencies for guidance on appropriate requirements for Project.

* + - * 1. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups according to requirements in "Performance Requirements" Article. Perform the following tests in the following order:

Structural: ASTM E330 at 50 percent of positive test load.

Air Leakage: ASTM E283.

Water Penetration under Static Pressure: ASTM E331.

Water Penetration under Dynamic Pressure: AAMA 501.1.

Structural: ASTM E330 at 100 percent of positive and negative test loads. Repeat the following:

Air Leakage: ASTM E283.

Water Penetration under Static Pressure: ASTM E331.

Thermal Cycling: According to AAMA 501.5. Repeat the following:

Air Leakage: ASTM E283.

Water Penetration under Static Pressure: ASTM E331.

Structural: ASTM E330 at 100 and 150 percent of positive and negative test loads. Repeat the following:

Air Leakage: ASTM E283.

Water Penetration under Static Pressure: ASTM E331.

Retain "Preconstruction Adhesion and Compatibility Testing" paragraph below for structural glazed systems. Adhesion and compatibility testing is essential and usually performed by sealant manufacturer.

Tests require many Samples, and some tests require four weeks to complete. If retaining, also retain "Preconstruction Laboratory Mockup Testing Submittals" paragraph in "Informational Submittals."

* + - * 1. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

Compatibility: Test materials or components using ASTM C1087.

Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.

Submit no fewer than [**eight] <Insert number**> pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

Retain subparagraph below if testing is not required.

Testing will not be required if data based on previous testing of current sealant products match those submitted.

* + - 1. WARRANTY

When warranties are required, verify with Director’s Representative’s that special warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

* + - * 1. Special Warranty: [**Manufacturer] [Installer**] agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

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

Structural failures, including, but not limited to, excessive deflection.

Noise or vibration created by wind and thermal and structural movements.

Delete option in first subparagraph below if retaining "Special Finish Warranty" paragraph.

Deterioration of metals [, **metal finishes**,] and other materials beyond normal weathering.

Water penetration through fixed glazing and framing areas.

Failure of operating components.

Verify available warranties and warranty periods for aluminum-framed entrances and storefronts.

Warranty Period: 10 years from date of Substantial Completion.

* + - * 1. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

Retain first subparagraph below for factory-painted finishes. Coordinate color fading and chalking limits with finishes retained in Part 2.

Deterioration includes, but is not limited to, the following:

Color fading more than 5 Delta E units when tested according to ASTM D2244.

Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Coordinate "Warranty Period" subparagraph below with "Aluminum Finishes" Article. AAMA 2604 is intended to represent five years of performance; AAMA 2605 is intended to represent 10 years of performance. Some manufacturers also offer a 20-year warranty. Verify available warranties and warranty periods for finishes.

Warranty Period: 20 years from date of Substantial Completion.

* + - * 1. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

Retain first subparagraph below for anodized finishes. Coordinate color fading and chalking limits with finishes retained in Part 2.

Deterioration includes, but is not limited to, the following:

Color fading more than 5 Delta E units when tested according to ASTM D 2244.

Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

Cracking, peeling, or chipping.

Coordinate "Warranty Period" subparagraph below with "Aluminum Finishes" Article. Five years is standard for Class I anodized finishes, although a few manufacturers offer a 10- or 20-year warranty. Class II anodized finishes often carry less than a five-year warranty. Verify available warranties and warranty periods for finishes.

Warranty Period: 10 years from date of Substantial Completion.

1. PRODUCTS
	* + 1. MANUFACTURERS
				1. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing [**spandrel panels] [venting windows**] and accessories, from single manufacturer.
			2. PERFORMANCE REQUIREMENTS
				1. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

Failure also includes the following:

Thermal stresses transferring to building structure.

Glass breakage.

Noise or vibration created by wind and thermal and structural movements.

Loosening or weakening of fasteners, attachments, and other components.

Failure of operating units.

* + - * 1. Structural Loads:

Usually indicate on Drawings design loads determined by Project's structural engineer. Verify requirements of authorities having jurisdiction.

Wind Loads: As indicated on Drawings.

Other Design Loads: [**As indicated on Drawings] <Insert loads**>.

* + - * 1. Deflection of Framing Members: At design wind pressure, as follows:

Based on Project conditions, more stringent deflection criteria than specified in "Deflection Normal to Wall Plane," "Deflection Parallel to Glazing Plane," and "Cantilever Deflection" subparagraphs below may be required. First option in "Deflection Normal to Wall Plane" subparagraph is based on BCNYS requirements for framing members supporting glass. Second option is based on AAMA TIR-A11 recommendations.

Deflection Normal to Wall Plane: Limited to [**edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite**] [1**/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches] <Insert deflection limit**> or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

First option in "Deflection Parallel to Glazing Plane" subparagraph below is based on typical deflection criteria for glass. Second option is based on GANA's "Glazing Manual."

Deflection Parallel to Glazing Plane: Limited to [**1/360 of clear span or 1/8 inch, whichever is smaller] [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 inch**].

Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

Retain "Cantilever Deflection" subparagraph below for parapets and similar components.

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

Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans of less than 11 feet 8-1/4 inches.

ASTM E330 test method evaluates structural performance of aluminum-framed entrances and storefronts and not structural performance of contiguous construction.

* + - * 1. Structural: Test according to ASTM E330 as follows:

When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.

When tested at [**150**] <**Insert number**> percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding [**0.2**] <**Insert number**> percent of span.

Minimum test duration according to ASTM E330 is 10 seconds, which is historically U.S. practice.

Test Durations: As required by design wind velocity, but not less than [**10**] <**Insert number**> seconds.

Retain "Water Penetration under Static Pressure" paragraph below for static-pressure method, which is most frequently specified. For water-penetration tests, AAMA 501 states that a static-air-pressure differential of 20 percent of wind-load design pressure provides satisfactory performance in most parts of the United States. Locations where high winds and heavy rains occur simultaneously require higher test-pressure differences. Both static and dynamic testing may be required or desired for certain designs, particularly those incorporating special water-drainage features, such as rain screen walls.

* + - * 1. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than [**6.24 lbf/sq. ft.**] [**10 lbf/sq. ft.**] [**15 lbf/sq. ft.**] <**Insert value**>.

Retain "Water Penetration under Dynamic Pressure" paragraph below if required for preconstruction laboratory mockup testing; most manufacturers do not include test data in product literature for dynamic-pressure testing. This test may be available in some areas for field quality-control testing; verify with qualified testing agency.

* + - * 1. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than [**6.24 lbf/sq. ft.**] [**10 lbf/sq. ft.**] [**15 lbf/sq. ft.**] <**Insert value**>.

AAMA 501.1's definition of water leakage allows up to 1/2 oz. of water to accumulate on an interior stop or stool integral to assembly in a 15-minute period.

Maximum Water Leakage: [**According to AAMA 501.1] [No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation**]. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

Retain "Seismic Performance" paragraph below for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7] <Insert requirement**>.

AAMA 501.6 in "Seismic Drift Causing Glass Fallout" subparagraph below is a dynamic racking test method focusing on seismic safety (glass fallout).

Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement[**and 1.5 times the design displacement**].

The ECCNYS and ASHRAE/IES 90.1 require that all fenestration be certified and labeled by manufacturer for energy performance for thermal transmittance (U-factor), Solar Heat-Gain Coefficient (SHGC), air leakage, and visible transmittance (VT). Energy performance for fenestration products is typically determined for the whole fenestration product or system, which includes the framing, glazing, and the spacer. Coordinate the values selected for energy performance with the glazing selections in Section 088000 "Glazing," and confirm that manufacturer can meet the specified energy performance and can provide certification and labeling. Verify requirements of authorities having jurisdiction.

* + - * 1. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

Options in subparagraphs below are examples only; revise values to suit climate zone of building envelope as defined by the ECCNYS. Testing for visible light transmittance (VT) is specified in Section 088000 "Glazing."

Thermal Transmittance (U-factor):

Fixed Glazing and Framing Areas: U-factor for the system of not more than [**0.41 Btu/sq. ft. x h x deg F] [0.45 Btu/sq. ft. x h x deg F] [0.57 Btu/sq. ft. x h x deg F] [0.69 Btu/sq. ft. x h x deg F] <Insert value**> as determined according to NFRC 100.

Entrance Doors: U-factor of not more than [**0.68 Btu/sq. ft. x h x deg F] [0.77 Btu/sq. ft. x h x deg F] [0.83 Btu/sq. ft. x h x deg F] [1.10 Btu/sq. ft. x h x deg F] <Insert value**> as determined according to NFRC 100.

Retain "Venting Windows" subparagraph below if required.

Venting Windows: Whole window U-factor of not more than [**0.37 Btu/sq. ft. x h x deg F**] [**0.43 Btu/sq. ft. x h x deg F**] [**0.45 Btu/sq. ft. x h x deg F**] [**0.60 Btu/sq. ft. x h x deg F**] [**0.65 Btu/sq. ft. x h x deg F**] <**Insert value**> as determined according to NFRC 100.

Solar Heat-Gain Coefficient (SHGC):

Fixed Glazing and Framing Areas: SHGC for the system of not more than [**0.26**] [**0.35**] [**0.40**] [**0.45**] <**Insert value**> as determined according to NFRC 200.

Entrance Doors: SHGC of not more than [**0.22**] [**0.25**] [**0.35**] [**0.40**] [**0.45**] <**Insert value**> as determined according to NFRC 200.

Retain "Venting Windows" subparagraph below if required.

Venting Windows: Whole window SHGC of not more than [**0.22**] [**0.27**] [**0.30**] [**0.40**] <**Insert value**> as determined according to NFRC 200.

Air Leakage:

Retain first option in "Fixed Glazing and Framing Areas" subparagraph below for maximum air-leakage rate based on ASHRAE/IES 90.1 requirements. Static-air-pressure differential of 1.57 lbf/sq. ft. in second option, equivalent to a 25-mph wind, is ASHRAE/IES 90.1 minimum, which is adequate for many buildings. Air-pressure differential in third option is equivalent to a 50-mph wind and is recommended for buildings in which greater control of air quality or humidity is required.

Fixed Glazing and Framing Areas: Air leakage for the system of not more than [**0.06 cfm/sq. ft.**] at a static-air-pressure differential of [**1.57 lbf/sq. ft.**] [**6.24 lbf/sq. ft.**] <**Insert value**> when tested according to ASTM E283.

Below is the maximum air-leakage rate based on ECCNYS and ASHRAE/IES 90.1 for glazed swinging entrance doors. Retain first subparagraph below if required.

Entrance Doors: Air leakage of not more than [**1.0 cfm/sq. ft.**] <**Insert value**> at a static-air-pressure differential of 1.57 lbf/sq. ft.

Retain "Venting Windows" subparagraph below if required.

Venting Windows: Whole window air leakage of not more than [**0.3 cfm/sq. ft.**] at a static-air-pressure differential of [**6.24 lbf/sq. ft.**] when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

Condensation Resistance Factor (CRF):

Fixed Glazing and Framing Areas: CRF for the system of not less than [**35**] [**55**] [**70**] <**Insert value**> as determined according to AAMA 1503.

Entrance Doors: CRF of not less than [**57**] [**63**] [**68**] <**Insert value**> as determined according to AAMA 1503.

Retain "Venting Windows" subparagraph below if required.

Venting Windows: Whole window CRF of not less than [**45] [52] [55] <Insert value**> as determined according to AAMA 1503.

Retain "Noise Reduction" paragraph below if required for Project.

* + - * 1. Noise Reduction: Test according to ASTM E90, with ratings determined by ASTM E1332, as follows.

Ratings in "Outdoor-Indoor Transmission Class" subparagraph below represent noise reductions based on a sound spectrum with frequencies weighted to correlate with transportation sources (aircraft takeoff, freeway, and railroad passby). The higher the OITC, the more effective the noise reduction.

Outdoor-Indoor Transmission Class: Minimum [**26**] [**30**] [**34**] <**Insert number**>.

Retain "Blast Resistance" paragraph below for aluminum-framed entrances and storefronts required to resist explosions. Verify requirements with Directory’s Representative and insert requirements for other blast hazard mitigation testing standards if required.

* + - * 1. Blast Resistance:

The ratings in "Hazard Rating" and "Performance Condition" subparagraphs below are based on the severity of fragments generated during an airblast test.

Hazard Rating: [**No Break] [No Hazard] [Minimal Hazard] [Very Low Hazard] [Low Hazard] [High Hazard**] according to ASTM F2912.

Performance Condition: [**1] [2] [3a] [3b] [4] [5]** according to GSA-TS01.

Retain one of first five paragraphs below for aluminum-framed entrances and storefronts required to resist bullets. Verify which manufacturers have tested aluminum-framed entrances and storefronts and can demonstrate compliance. UL 752 is the test most widely referenced by manufacturers.

Retaining first option in "Ballistics Resistance, UL 752" paragraph below, in addition to one of the level options, requires that products be UL listed with ongoing performance verification by Underwriters Laboratories.

* + - * 1. Ballistics Resistance, UL 752: **[Listed and labeled as] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [Level 6] [Level 7] [Level 8] [Level 9] [Level 10] [Level 1-SG] [Level 2-SG] [Level 3-SG] [Level 4-SG] [Level 5-SG] [Level 6-SG] [Level 7-SG] [Level 8-SG] [Level 9-SG] [Level 10-SG**] when tested according to UL 752.
				2. Ballistics Resistance, ASTM F1233: [**Class/Level HG1] [Class/Level HG2] [Class/Level HG3] [Class/Level HG4] [Class/Level SMG] [Class/Level R1] [Class/Level R2] [Class/Level R3] [Class/Level R4-AP] [Class/Level R5] [Class/Level SH1] [Class/Level SH2**] when tested according to ASTM F1233.
				3. Ballistics Resistance, HPW-TP-0500.03: [**A] [B] [C] [D] [E**] when tested according to HPW-TP-0500.03.
				4. Ballistics Resistance, SD-STD-01.01: [**R] [SH**] when tested according to SD-STD-01.01.
				5. Ballistics Resistance, NIJ STD-0108.01: [**Level I] [Level IIA] [Level II] [Level IIIA] [Level III] [Level IV**] when tested according to NIJ STD-0108.01.

Retain "Windborne-Debris Impact Resistance" paragraph below to suit Project. The BCNYS establishes criteria for buildings in hurricane-prone locations. In paragraph, "enhanced" option applies to essential facilities and has additional requirements. Verify requirements of authorities having jurisdiction. Verify which manufacturers have tested products and can demonstrate compliance.

* + - * 1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [**1] [2] [3] [4] for [basic] [enhanced**] protection.

Insert increased heights if different from those in "Large-Missile Test" and "Small-Missile Test" subparagraphs below. For enhanced protection, delete "Small-Missile Test" subparagraph.

Large-Missile Test: For glazing located within [**30 feet**] <**Insert dimension**> of grade.

Small-Missile Test: For glazing located between 30 feet and [**60 feet**] <**Insert dimension**> above grade.

* + - * 1. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

Differential values in "Temperature Change" subparagraph below (for aluminum in particular) are suitable for most of the United States.

Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

Retain "Thermal Cycling" subparagraph below if testing is required for Project. Standard systems are usually not tested according to AAMA 501.5. Manufacturers often rely on calculations and in-service performance to verify thermal-movement capabilities.

Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of [**180 deg F] <Insert temperature**>.

Low Exterior Ambient-Air Temperature: [**0 deg F] <Insert temperature**>.

Interior Ambient-Air Temperature: [**75 deg F] <Insert temperature**>.

Retain "Structural-Sealant Joints" paragraph below if Project includes two-sided structural glazing.

* + - * 1. Structural-Sealant Joints:

Retain subparagraph below if dead-load support by structural sealant is acceptable.

Designed to carry gravity loads of glazing.

Retain "Structural Sealant" paragraph below if Project includes two-sided structural glazing.

* + - * 1. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.

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.

* + - 1. STOREFRONT SYSTEMS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

EFCO Corporation.

Kawneer North America, an Arconic company.

Mapes Industries.

Oldcastle Building Envelope (OBE); CRH Americas.

Trulite Glass & Aluminum Solutions, LLC.

Tubelite Inc.

U.S. Aluminum; a brand of C.R. Laurence.

YKK AP America Inc.

Or equal.

* + - * 1. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Exterior Framing Construction: [**Thermally broken] [Thermally improved] [Nonthermal] <Insert description**>.

Interior Vestibule Framing Construction: [**Nonthermal] <Insert description**>.

Glazing System: [**Retained mechanically with gaskets on four sides] [Retained mechanically with gaskets on two sides and structural sealant on two sides**].

Glazing Plane: [**Front] <Insert location**>.

Finish: [**Clear anodic finish] [Color anodic finish] [Baked-enamel or powder-coat finish] [High-performance organic finish] [Superior-performance organic finish**].

Fabrication Method: Field-fabricated stick system.

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

Steel Reinforcement: As required by manufacturer.

* + - * 1. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
				2. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
				3. Insulated Spandrel Panels:

Retain one of two subparagraphs below if spandrel panels are required for Project.

Comply with Section 074213.19 "Insulated Metal Wall Panels."

Spandrel panels in subparagraph below are examples of available products. Revise to suit Project. See the Evaluations for additional information.

Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

Overall Panel Thickness: [**As indicated] [1 inch] <Insert thickness**>.

Exterior Skin: Aluminum.

Thickness: [**Manufacturer's standard for finish and texture indicated] <Insert thickness**>.

Finish: [**Match framing system] <Insert finish**>.

Texture: [**Smooth] [Embossed] <Insert texture**>.

Backing Sheet: [**1/8-inch- thick tempered hardboard] [0.157-inch- thick cement board] [0.125-inch- thick, corrugated, high-density polyethylene] <Insert material**>.

Interior Skin: Aluminum.

Thickness: [**Manufacturer's standard for finish and texture indicated] <Insert thickness**>.

Finish: [**Matching storefront framing] [Low-gloss, white baked enamel] [Mill finish] <Insert finish**>.

Texture: [**Smooth] [Embossed] <Insert texture**>.

Backing Sheet: [**1/8-inch-** thick tempered hardboard] [**0.157-inch-** thick cement board] [**1/2-inch-** thick gypsum board with proprietary fire-resistance-rated core] [**0.125-inch-** thick, corrugated, high-density polyethylene] <**Insert material**>.

Authorities having jurisdiction may restrict insulation materials based on their fire-test-response characteristics. Verify requirements of authorities having jurisdiction.

Thermal Insulation Core: Manufacturer's standard [**rigid, closed-cell, polyisocyanurate board] [extruded-polystyrene board] [expanded-perlite, mineral-insulation board] <Insert insulation**>.

Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: [**25**] <**Insert value**> or less.

Smoke-Developed Index: [**50**] [**450**] <**Insert value**> or less.

* + - * 1. Venting Windows:

Retain first subparagraph below and delete remainder of article if venting windows are specified with other windows.

As specified in Section 085113 "Aluminum Windows."

Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:

Window Type: [**Awning] [Casement] [As indicated on Drawings] <Insert type**>.

If retaining requirements for blast resistance and/or windborne-debris impact resistance in "Performance Requirements" Article, verify compliance of venting windows with manufacturer. Venting windows may not be rated for blast resistance or windborne-debris impact resistance, or only certain performance classes may be rated.

Minimum Performance Class: [**CW**] [**AW**] <**Insert class**>.

AAMA/WDMA/CSA 101/I.S.2/A440 establishes a gateway performance grade for windows to qualify for each performance class. The gateway performance grade is 30 for Class CW and 40 for Class AW. For a particular project, the minimum performance grade for windows is typically based on the design pressure.

Minimum Performance Grade: [**30**] [**40**] [**60**] [**70**] [**80**] [**90**] [**As indicated on Drawings**] <**Insert number**>.

Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:

Retain applicable hardware types from list below.

Cam handle locking system.

Multi-point locking system.

Pole-operated, cam handle locking system, where rail is more than 72 inches above floor.

Rotary operator.

Steel or bronze operating arms.

Retain "Limit Devices" subparagraph below if limit devices are required. They restrict sash opening for safety. Indicate locations of windows with limit devices on Drawings or in schedules, and coordinate with code requirements for windows for emergency escape and rescue.

Limit Devices: [Co**ncealed friction adjustor and adjustable stay bar] <Insert type**> limit devices designed to restrict sash opening.

Limit clear opening to [**4 inches**] for ventilation; with custodial key release.

Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:

Retain "Aluminum Wire Fabric," "Glass-Fiber Mesh Fabric," or "Fabric" subparagraph below.

Aluminum Wire Fabric: 18-by-18, 0.0445-inch-by-0.0445-inch; 18-by-16, 0.0445-inch-by-0.0515-inch; or 18-by-14, 0.0445-inch-by-0.0624-inch mesh of 0.013-inch- diameter, coated aluminum wire.

Glass-Fiber Mesh Fabric: 18-by-16 0.0445-inch-by-0.0515-inch or 18-by-14 0.0445-inch-by-0.0624-inch mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656.

Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.

Glazing: [**Same as adjacent aluminum-framed entrances and storefront glazing] <Insert glazing**>.

Finish: [**Match adjacent aluminum-framed entrances and storefront finish] <Insert finish**>.

* + - 1. ENTRANCE DOOR SYSTEMS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

EFCO Corporation.

Kawneer North America, an Arconic company.

Oldcastle Building Envelope (OBE); CRH Americas.

Trulite Glass & Aluminum Solutions, LLC.

Tubelite Inc.

U.S. Aluminum; a brand of C.R. Laurence.

YKK AP America Inc.

Or equal.

* + - * 1. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

Door Construction: [**1-3/4-inch** overall thickness, with minimum **0.125-inch-**] [**2-inch** overall thickness, with minimum **0.188-inch-**] [**2- to 2-1/4-inch** overall thickness, with minimum **0.125-inch-**] thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

Retain "Thermal Construction" subparagraph below if retaining last option in "Door Construction" subparagraph above.

Thermal Construction: [**High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior] <Insert description**>.

Coordinate entrance door design in "Door Design" subparagraph below with hardware requirements. Narrow-stile doors may not accommodate some exit devices.

Door Design: [As indicated] [Narrow stile; **2-1/8-inch** nominal width] [Medium stile; **3-1/2-inch** nominal width] [Wide stile; **5-inch** nominal width] <**Insert description**>.

Glazing Stops and Gaskets: [**Beveled] [Square] <Insert description**>, snap-on, extruded-aluminum stops and preformed gaskets.

Retain first subparagraph below if required. Glazing stops are typically removable from both sides.

Provide nonremovable glazing stops on outside of door.

Finish: Match adjacent storefront framing finish.

* + - 1. ENTRANCE DOOR HARDWARE

Before retaining hardware, verify accessible entrance, means-of-egress doorway, and other requirements of authorities having jurisdiction.

Delete "Entrance Door Hardware" paragraph below if all entrance door hardware is specified in this Section. See "Entrance Door Hardware" Article in the Evaluations for discussion of appropriate methods for specifying entrance door hardware.

* + - * 1. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
				2. General: Provide entrance door hardware and [**entrance door hardware sets indicated in door and frame schedule] [entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article**] for each entrance door, to comply with requirements in this Section.

Retain one of three options in "Entrance Door Hardware Sets" subparagraph below to coordinate with "Entrance Door Hardware Sets" Article.

Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and [named manufacturers' products] [products equivalent in function and comparable in quality to named products] [products complying with BHMA standard referenced].

Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

Opening-Force Requirements:

"Egress Doors" subparagraph below is based on requirements of both the BCNYS and NFPA 101 for means-of-egress doors. Option is a requirement of NFPA 101 only.

Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion [ **and not more than 15 lbf to open the door to its minimum required width**].

"Accessible Interior Doors" subparagraph below is based on ADA-ABA Accessibility Guidelines.

Accessible Interior Doors: Not more than 5 lbf to fully open door.

* + - * 1. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

Retain "Named Manufacturers' Products" or "References to BHMA Standards" subparagraph below.

Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.

Retain "References to BHMA Standards" subparagraph below for a nonproprietary specification based on referencing BHMA standards, with or without naming available manufacturers.

References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

If specifying entrance door hardware by named manufacturers' products, delete remaining paragraphs, and indicate entrance door hardware in "Entrance Door Hardware Sets" Article, including requirements for design, grade, function, finish, size, quantity and other distinctive qualities. If specifying entrance door hardware by reference to a BHMA standard or by describing characteristics, retain remaining paragraphs and insert specific type, function, finish and quantity requirements in "Entrance Door Hardware Sets" Article.

* + - * 1. Pivot Hinges: BHMA A156.4, Grade 1.

Retain "Offset-Pivot Hinges" subparagraph below only if quantities are not indicated in "Entrance Door Hardware Sets" Article. For offset pivots, an intermediate pivot is recommended for doors 60 inches to 90 inches in height. Each additional 30 inches of door height warrants another intermediate pivot.

Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

* + - * 1. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.

Exterior Hinges: [**Stainless steel, with stainless-steel pin] [Nonferrous] <Insert material**>.

Retain "Quantities" subparagraph below only if quantities are not indicated in "Entrance Door Hardware Sets" Article.

Quantities:

For doors up to [**87 inches**] high, provide three hinges per leaf.

For doors more than [**87 and up to 120 inches**] high, provide four hinges per leaf.

* + - * 1. Continuous-Gear Hinges: BHMA A156.26.
				2. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

Building codes prohibit manual flush bolts at means-of-egress doors.

* + - * 1. Manual Flush Bolts: BHMA A156.16, Grade 1.
				2. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
				3. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
				4. Cylinders:

Retain one of two subparagraphs below. First subparagraph allows for keying for aluminum-framed entrances to be coordinated with building keying system.

[**As specified in Section 087100 "Door Hardware**."]

BHMA A156.5, Grade 1.

Keying: [**No master**] [**Master**] key system. Permanently inscribe each key with a visual key control number and include notation [**"DO NOT DUPLICATE"**] [**to be furnished by Director’s Representative**].

* + - * 1. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
				2. Operating Trim: BHMA A156.6.
				3. Removable Mullions: BHMA A156.3 extruded aluminum.

When used with panic exit devices, provide [ **keyed**] removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

* + - * 1. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
				2. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.
				3. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
				4. Weather Stripping: Manufacturer's standard replaceable components.

Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.

Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

* + - * 1. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

"Thresholds" paragraph below is based on ADA-ABA Accessibility Guidelines requirements for egress doors.

* + - * 1. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

Retain "Finger Guards" paragraph below for entrance doors with center pivots.

* + - * 1. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.
			1. GLAZING
				1. Glazing: Comply with Section 088000 "Glazing."

Retain first option in "Glazing Gaskets" paragraph below for dry glazing system based on manufacturer's standard systems, or retain second option and specify gaskets in Section 088000 "Glazing." Silicone glazing gaskets are available in custom colors from some manufacturers.

* + - * 1. Glazing Gaskets: [**Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.] [Comply with Section 088000 "Glazing."]**

Retain first option in "Glazing Sealants" paragraph below for products based on manufacturer's standard systems, or retain second option and specify sealants for glazing systems in Section 088000 "Glazing."

* + - * 1. Glazing Sealants: [**As recommended by manufacturer.] [Comply with Section 088000 "Glazing."]**

Retain "Structural Glazing Sealants" and "Weatherseal Sealants" paragraphs below for two-sided structural-sealant-glazed storefront systems.

* + - * 1. Structural Glazing Sealants: ASTM C1184 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 storefront system indicated.

Color: [**Black] [Gray] [As selected by Director’s Representative from manufacturer's full range of colors] <Insert color**>.

Weatherseal sealants in "Weatherseal Sealants" paragraph below provide weather resistance for structural-glazed sealants. Delete paragraph if not required or where structural sealant is also weatherseal sealant.

* + - * 1. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

Color: Match structural sealant.

* + - 1. MATERIALS
				1. Sheet and Plate: ASTM B209.
				2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
				3. Extruded Structural Pipe and Tubes: ASTM B429.
				4. Structural Profiles: ASTM B308.

Retain "Steel Reinforcement" and "Steel Reinforcement Primer" paragraphs below for internal steel reinforcement of aluminum framing members; revise to suit Project.

* + - * 1. Steel Reinforcement:

Structural Shapes, Plates, and Bars: ASTM A36.

Cold-Rolled Sheet and Strip: ASTM A1008.

Hot-Rolled Sheet and Strip: ASTM A1011.

* + - * 1. Steel Reinforcement 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.
			1. ACCESSORIES

Retain first option in "Automatic Door Operators" paragraph below for automatic door operators furnished separately from doors and frames; retain second option for swinging doors and frames packaged with automatic door operators.

* + - * 1. Automatic Door Operators: [**Section 087113 "Automatic Door Operators."] [Section 084229.33 "Swinging Automatic Entrances**."]
				2. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

Reinforce members as required to receive fastener threads.

Retain subparagraph below for exposed fasteners if any.

Use exposed fasteners with countersunk Phillips screw heads [, **finished to match framing system][, fabricated from 300 series stainless steel**].

* + - * 1. Anchors: Three-way adjustable anchors with minimum adjustment of [**1 inch**] that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

Retain "Concrete and Masonry Inserts" subparagraph below if applicable, or revise to suit Project.

Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

* + - * 1. Concealed Flashing: [**Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials] [Dead-soft, 0.018-inch- thick stainless steel, complying with ASTM A240, of type recommended by manufacturer**].
				2. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

Rigid PVC Filler in paragraph below is used to improve installation of backer rod and perimeter sealant by providing support for backer rod. Retain if required.

* + - * 1. Rigid PVC Filler.
			1. FABRICATION
				1. Form or extrude aluminum shapes before finishing.

Retain first paragraph below for welding.

* + - * 1. 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.
				2. Fabricate components that, when assembled, have the following characteristics:

Profiles that are sharp, straight, and free of defects or deformations.

Accurately fitted joints with ends coped or mitered.

Physical and thermal isolation of glazing from framing members.

Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

Provisions for field replacement of glazing from [**exterior] [interior] [interior for vision glass and exterior for spandrel glazing or metal panels**].

Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

* + - * 1. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

Retain "Structural-Sealant-Glazed Framing Members" paragraph below if Project includes structural glazing.

* + - * 1. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

Retain "Storefront Framing" paragraph below if a particular assembly method is required.

* + - * 1. Storefront Framing: Fabricate components for assembly using [**shear-block system] [screw-spline system] [head-and-sill-receptor system with shear blocks at intermediate horizontal members] <Insert system**>.
				2. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

At interior and exterior doors, provide compression weather stripping at fixed stops.

* + - * 1. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.

At exterior doors, provide weather sweeps applied to door bottoms.

* + - * 1. 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.
				2. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
			1. ALUMINUM FINISHES

Retain finishes in paragraphs below to suit Project. If retaining more than one, indicate location of each on Drawings or by inserts. Aluminum-framing systems are available with dual finishes, allowing different interior and exterior color finishes. See "Aluminum Finishes" Article in the Evaluations for additional information.

Retain one of two options in "Clear Anodic Finish" paragraph below. Verify availability with manufacturers.

* + - * 1. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm] [AA-M12C22A31, Class II, 0.010 mm**] or thicker.

Retain one of two options in "Color Anodic Finish" paragraph below. Verify availability with manufacturers.

* + - * 1. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm] [AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

Options in "Color" subparagraph below are examples only and may vary in color range and availability among manufacturers.

Color: [**Light bronze] [Medium bronze] [Dark bronze] [Champagne] [Black] [Match Director’s Representative's sample] [As selected by Director’s Representative from full range of industry colors and color densities] <Insert color**>.

"Baked-Enamel or Powder-Coat Finish" paragraph below references AAMA standard for pigmented organic coating on aluminum extrusions and panels.

* + - * 1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

Color and Gloss: [**As indicated by manufacturer's designations] [Match Director’s Representative's sample] [As selected by Director’s Representative from manufacturer's full range] <Insert color and gloss**>.

Retain "High-Performance Organic Finish, Two-Coat PVDF"; "Superior-Performance Organic Finish, Three-Coat PVDF"; "Superior-Performance Organic Finish, Four-Coat PVDF"; "Superior-Performance Organic Finish, Single-Coat FEVE"; or "Superior-Performance Organic Finish, Two-Coat FEVE" paragraph below. If more than one is required, indicate location of each system on Drawings, in schedules, or by inserts. Coordinate finish system selected with special finish warranty period specified in "Warranty" Article.

In "High-Performance Organic Finish, Two-Coat PVDF" paragraph below, retain AAMA 2604 with 50 percent resin content by weight in color coat or AAMA 2605 with 70 percent resin content by weight in color coat for high-performance organic coatings on extrusions and panels. If specific products are required, name coating manufacturers and products.

* + - * 1. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with [**AAMA 2604] [AAMA 2605**] and containing not less than [**50] [70]** percent PVDF resin by weight in color coat.

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [ **for seacoast and severe environments**].

Color and Gloss: [**As indicated by manufacturer's designations] [Match Director’s Representative's sample] [As selected by Director’s Representative from manufacturer's full range] <Insert color and gloss**>.

* + - * 1. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].

Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Director’s Representative's sample**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color and gloss**>.

* + - * 1. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].

Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Director’s Representative's sample**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color and gloss**>.

"Superior-Performance Organic Finish, Single-Coat FEVE"" paragraph below is unsuitable for seacoast and severe environments.

* + - * 1. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Director’s Representative's sample**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color and gloss**>.

* + - * 1. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Director’s Representative's sample**] [**As selected by Director’s Representative from manufacturer's full range**] <**Insert color and gloss**>.

* + - 1. SOURCE QUALITY CONTROL

Retain this article if Project includes two-sided structural glazing.

* + - * 1. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION, GENERAL
				1. Comply with manufacturer's written instructions.
				2. Do not install damaged components.
				3. Fit joints to produce hairline joints free of burrs and distortion.
				4. Rigidly secure nonmovement joints.
				5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
				6. Seal perimeter and other joints watertight unless otherwise indicated.
				7. Metal Protection:

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 by installing nonconductive spacers.

Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

Coordinate first paragraph below with manufacturers' written recommendations.

* + - * 1. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
				2. Install joint filler behind sealant as recommended by sealant manufacturer.
				3. Install components plumb and true in alignment with established lines and grades.
			1. INSTALLATION OF OPERABLE UNITS

Retain this article for operable units.

* + - * 1. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
			1. INSTALLATION OF GLAZING
				1. Install glazing as specified in Section 088000 "Glazing."
			2. INSTALLATION OF STRUCTURAL GLAZING

Retain this article if Project includes two-sided structural glazing.

* + - * 1. 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.
				2. Set glazing into framing according to sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
				3. Set glazing with proper orientation so that coatings face exterior or interior as specified.
				4. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
				5. Apply structural sealant to completely fill cavity, according to sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
				6. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
				7. Allow structural sealant to cure according to manufacturer's written instructions.
				8. Clean and protect glass as indicated in Section 088000 "Glazing."
			1. INSTALLATION OF WEATHERSEAL SEALANT

Retain this article if Project includes two-sided structural glazing.

* + - * 1. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
				2. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.
			1. INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS
				1. Install entrance doors to produce smooth operation and tight fit at contact points.

Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

Indicate entrance door hardware mounting heights on Drawings, or insert them in "Field-Installed Entrance Door Hardware" subparagraph below.

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.

* + - 1. ERECTION TOLERANCES
				1. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

Erection tolerances in subparagraphs below are examples only that are based on various AAMA references. Coordinate with tolerances for support systems and revise to suit Project.

Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.

Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.

Alignment:

Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.

Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.

Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

* + - 1. FIELD QUALITY CONTROL

Retain this article for testing of aluminum-framed entrances and storefronts during installation.

* + - * 1. Testing Agency: [**Director’s Representative will engage] [Engage**] a qualified testing agency to perform tests and inspections.
				2. Field Quality-Control Testing: Perform the following test on [**representative areas of aluminum-framed entrances and storefronts] [mockups] <Insert requirements**>.

Inexpensive test in "Water-Spray Test" subparagraph below tests for deficiencies in workmanship only and is not representative of a wind-driven rain event.

Water-Spray Test: Before installation of interior finishes has begun, areas designated by Director’s Representative shall be tested according to AAMA 501.2 and shall not evidence water penetration.

Retain one of two subparagraphs below.

Perform a minimum of [**two**] [**three**] <**Insert number**> tests in areas as directed by Director’s Representative.

Perform tests in each test area as directed by Director’s Representative. Perform at least three tests, prior to [**10, 35, and 70 percent completion**] <**Insert requirements**>.

AAMA 503 allows a prescribed test pressure for air leakage, depending on the location and wind exposure of Project. Modify "Air Leakage" subparagraph below to use a prescribed test pressure.

Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

Retain one of first two subparagraphs below.

Perform a minimum of [**two**] [**three**] <**Insert number**> tests in areas as directed by Director’s Representative.

Perform tests in each test area as directed by Director’s Representative. Perform at least three tests, prior to [**10, 35, and 70 percent completion**] <**Insert requirements**>.

When specifying test pressure note that AAMA allows a one-third reduction in test pressures for field tests. 6.24 lbf/sq. ft. is industry standard minimum; however, AAMA 503 allows minimum test pressure of 4.18 lbf/sq. ft. Alternatively, AAMA 503 allows a prescribed test pressure for water penetration, depending on the location and wind exposure of the project. Modify "Water Penetration" subparagraph below to use a prescribed test pressure.

Water Penetration: ASTM E1105 at a minimum [**uniform**] [**and**] [**cyclic**] static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

Retain "Structural-Sealant Adhesion" paragraph below if Project includes two-sided structural glazing.

* + - * 1. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

Test a minimum of [**two**] [**four**] [**six**] <**Insert number**> areas on each building facade.

Repair installation areas damaged by testing.

* + - * 1. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.

END OF SECTION 084113