Manufacturer:

**Oldcastle BuildingEnvelope®**

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SECTION: 085553 SECURITY GLAZING (ARMORDEFEND™ STOREFRONT)

This guide specification has been prepared by **Oldcastle BuildingEnvelope®** in printed and electronic media as an aid to specifiers in preparing written construction documents for SECURITY GLAZING.

Edit entire master to suit project requirements. Modify or add items as necessary. Delete items which are not applicable. This section may include performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This section uses the term “Architect.” Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Editor notes are included as green boxes within the text of this section to assist the specifier in knowledgeable decision-making. Editor notes should be removed as you complete the document specific to your project needs.

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

Aluminum-framed storefront systems.

Security and forced-entry-resistant storefront systems.

* + - * 1. Related Requirements:

Editor Note: Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Editor Note: Retain first subparagraph below if preconstruction laboratory mockup testing is required and specified in Section 014339 instead of this Section.

Section 014339 "Mockups" for preconstruction laboratory mockup testing.

Section 084126 "All-Glass Entrances and Storefronts" for systems without aluminum support framing.

Section 081216 "Aluminum Frames" for interior aluminum framing.

* + - 1. **ALLOWANCES**

Editor Note: Retain paragraph below if testing is paid for by Contractor under an allowance.

* + - * 1. [**Preconstruction laboratory mockup**] [**source quality control**] [**and**] [**field quality control**] is part of testing and inspecting allowance.
			1. **PREINSTALLATION MEETINGS**

Editor Note: 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**].
			1. **ACTION SUBMITTALS**
				1. Product Data: For each type of product.

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

* + - * 1. 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.

Editor Note: 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.

Editor Note: 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 (300-mm) 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.

Editor Note: Retain "Delegated Design Submittal" Paragraph below if design services have been delegated to Contractor. See Section 014000 "Quality Requirements" for additional requirements.

* + - * 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.
			1. **INFORMATIONAL SUBMITTALS**

Editor Note: Retain "Mockup Testing Submittals" Paragraph below if specifying Project-specific preconstruction testing in "Preconstruction Testing" Article as Contractor's responsibility.

* + - * 1. 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 indicating changes made during preconstruction laboratory mockup testing.

Editor Note: Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data:

For Installer [**and laboratory mockup testing agency**] [**and field-testing agency**].

For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the [**jurisdiction**] [**state**] in which Project is located.

* + - * 1. 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.

* + - * 1. 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**].

Editor Note: 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.

* + - * 1. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
				2. Source quality-control reports.

Editor Note: Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranties: For special warranties.
			1. **CLOSEOUT SUBMITTALS**
				1. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

Editor Note: Retain "Maintenance Data for Structural Sealant" Paragraph below if Project includes two-sided structural glazing.

* + - * 1. 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**

Editor Note: If retaining "Installer Qualifications" Paragraph below, verify, with prospective installers, that they can comply with certification requirements referenced.

* + - * 1. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors[**and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program**].

Editor Note: Retain "Laboratory Mockup Testing Agency Qualifications" Paragraph below if Project-specific preconstruction mockup testing is specified in "Preconstruction Testing" Article. Delete if specifying preconstruction laboratory mockup testing in Section 014339 "Mockups."

* + - * 1. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with 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**].

Editor Note: Retain "Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 014000 "Quality Requirements."

* + - * 1. Testing Agency Qualifications: Qualified in accordance with 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**] and acceptable to Owner and Architect.
				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.

Editor Note: Retain subparagraph below or revise to suit Project.

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

Editor Note: 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. **MOCKUPS**
				1. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

Editor Note: Retain first subparagraph below for large-scale mockup. Indicate portion of wall represented by mockup on Drawings or draw mockup as separate element. Coordinate requirements with those in other Sections, specifying glazing and cladding materials installed with aluminum-framed entrances and storefronts.

Build mockup of typical wall area as indicated on Drawings.

Editor Note: Retain first subparagraph below if subjecting mockup to field testing.

Testing to be performed on mockups in accordance with requirements in "Field Quality Control" Article.

Editor Note: Retain first subparagraph below if mockups are not only for establishing appearance factors.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

Editor Note: Retain subparagraph below if the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

* + - 1. **PRECONSTRUCTION TESTING**

Editor Note: Project-specific preconstruction testing of assemblies can be expensive but may be the best means of proving that performance requirements are met. Retain this article for preconstruction laboratory mockup or preconstruction adhesive and compatibility testing. Preconstruction laboratory mockup testing may be deleted from this article and specified in Section 014339, if desired, while retaining preconstruction adhesive and compatibility testing.

Editor Note: Retain "Preconstruction Testing Service" Paragraph below, if required, or delete here if specifying preconstruction laboratory mockup testing in Section 014339 "Mockups."

* + - * 1. Preconstruction Testing Service: [**Owner 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.

Editor Note: 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.

Editor Note: Retain subparagraph below if required for Project.

Notify Architect [**insert number**] days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.

Editor Note: Retain "Preconstruction Laboratory Mockup Testing" Paragraph below, if required, or delete here if specifying preconstruction laboratory mockup testing in Section 014339 "Mockups."

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

Editor Note: Subparagraphs below list example test methods and sequence of tests based on AAMA 501 and ASTM E2099. Revise 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.

Structural, 50 Percent: ASTM E330/E330M 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/E330M 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: AAMA 501.5. Repeat the following:~~

~~Air Leakage: ASTM E283.~~

~~Water Penetration under Static Pressure: ASTM E331.~~

Structural, 100 Percent: ASTM E330/E330M at 100 of positive and negative test loads. Repeat the following:

Air Leakage: ASTM E283.

Water Penetration under Static Pressure: ASTM E331.

Water Penetration under Dynamic Pressure: AAMA 501.1.

Structural, 150 percent: ASTM E330/E330M at 150 percent of positive and negative test loads.

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

Editor Note: Tests require many Samples, and some tests require four weeks to complete. If retaining, also retain "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 **[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 use of specially formulated primers.

Editor Note: 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**

Editor Note: When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

* + - * 1. Special Material Warranty: 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.

Editor Note: 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.

Standard Warranty Period: [**Two**] years from date of manufacture and transferred to Owner on date of Substantial Completion; **[One]** year from date of Substantial Completion for manufacturer’s hardware

Extended Warranty period available upon request.

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

Editor Note: 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 in accordance with ASTM D2244.

Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

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

Standard Warranty Period: [**Two**] years from date of manufacture and transferred to Owner on date of Substantial Completion.

Extended Warranty period available upon request.

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

Editor Note: 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 in accordance with ASTM D 2244.

Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

Cracking, peeling, or chipping.

Standard Warranty Period: [**Two**] years from date of manufacture and transferred to Owner on date of Substantial Completion.

Extended Warranty period available upon request.

1. **PRODUCTS**
	* + 1. **PERFORMANCE REQUIREMENTS**

Editor Note: Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
				2. 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 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:

Editor Note: Usually, indicate on Drawings design loads determined by Project's structural engineer. Verify requirements of authorities having jurisdiction. See the Evaluations for additional information.

Wind Loads: As indicated on Drawings.

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

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

Editor Note: Based on Project conditions, more stringent deflection criteria than specified in "Deflection Normal to Wall Plane" and "Deflection Parallel to Glazing Plane" subparagraphs below may be required; see "Seismic Performance" Article in the Evaluations.

Deflection Normal to Wall Plane: Limited to [**L/180 of clear span**] [**1/175 of clear span for spans of up to 13 ft. 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 ft. 6 inches (4.1 m)**].

Editor Note: Deflection criteria in "Deflection Parallel to Glazing Plane" Subparagraph below is based on GANA's "Glazing Manual."

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 inch (3.2 mm)**].

Editor Note: Retain "Cantilever Deflection" Subparagraph below if required.

Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

Editor Note: ASTM E330/E330M test method evaluates structural performance of aluminum-framed entrances and storefronts and not structural performance of contiguous construction.

* + - * 1. Structural: Test in accordance with ASTM E330/E330M 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**] 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**] percent of span.

Editor Note: Minimum test duration in accordance with ASTM E330/E330M is 10 seconds, which is historically U.S. practice.

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

Editor Note: 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 in accordance with ASTM E331 as follows:

No evidence of water penetration through fixed glazing and framing areas, excluding entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than [**6.24 lbf/sq. ft. (300 Pa)**] [**10 lbf/sq. ft. (480 Pa)**]

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

Maximum Water Leakage: [**In accordance with 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.

Editor Note: The IECC 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:

Editor Note: Options in subparagraphs below are examples only; revise values to suit climate zone of building envelope as defined by the IECC. 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 [**0.32 Btu/sq. ft. x h x deg F (1.81 W/sq. m x K)**] determined in accordance with NFRC 100.

Solar Heat-Gain Coefficient (SHGC):

Fixed Glazing and Framing Areas: SHGC for the system of not more than [**0.20**] [**0.21**] [**0.26**] [**0.35**] [**0.40**] [**0.45**] as determined in accordance with NFRC 200.

Air Leakage:

Editor Note: Retain first option in "Fixed Glazing and Framing Areas" Subparagraph below for maximum air-leakage rate based on ASHRAE/IES 90.1; retain third option for static-air-pressure differential of 6.27 lbf/sq. ft. (300 Pa), which is equivalent to a 50 mph (80 km/h) wind; adequate for many buildings.

Fixed Glazing and Framing Areas: Air leakage for the system of not more than ~~[~~**~~0.10 cfm/sq. ft. (0.5 L/s per sq. m)~~**~~]~~ [**0.06 cfm/sq. ft. (0.30 L/s per sq. m)**] at a static-air-pressure differential of [**6.24 lbf/sq. ft. (300 Pa)**] when tested in accordance with ASTM E283.

Condensation Resistance Factor (CRF):

Fixed Glazing and Framing Areas: CRF for the system of not less than [**35**] [**55**] [**70**] as determined in accordance with AAMA 1503.

Editor Note: Retain "Security and Forced-Entry-Resistance" Paragraph below for OBE's "ArmorDefend™ Plus Storefront."

Editor Note: Retain first option below for OBE's "ArmorDefend™ Storefront with ArmorGarde" or "ArmorDefend™ Plus Storefront with ArmorGarde"; retain second option for "ArmorDefend™ Storefront with ArmorGarde Plus" or "ArmorDefend™ Plus Storefront with ArmorGarde Plus."

* + - * 1. Security and Forced-Entry-Resistance: Passes ASTM E2395, Performance Level 5 with Missile Level [**C**] [**D**] and ASTM F1233, Class 1; ASTM F588, Grade 40, forced entry.
				2. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

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

Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

Editor Note: Retain "Structural-Sealant Joints" Paragraph below if Project includes two-sided structural glazing.

* + - * 1. Structural-Sealant Joints:

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

Designed to carry gravity loads of glazing.

Editor Note: 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 occurs 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.

Editor Note: Retain “Basis-of-Design Product” Paragraph below for proprietary method specification. Add product attributes, performance characteristics, material standards, and descriptions as applicable. Do not use the phrase “or equal” or “approved equal”, or similar phrases. The use of such phrases will cause ambiguity in the specifications because of the different various interpretations among the different parties of the construction process and readers of the specifications. Such phrases require comprehensive and complete requirements (legal, procedural, regulatory, and responsibility) for determining “or equal.”

* + - 1. **Manufacturers**
				1. Basis-of-Design Product:

Subject to compliance with requirements, provide **Oldcastle BuildingEnvelope®**

**ARMORDEFEND****™ STOREFRONT**

Frame Profile: Mullions; [**2 by 4-1/2 inches (50.8 by 114.3 mm~~)~~**~~] [~~**~~2 by 6 inches (50.8 by 152.4 mm)~~**~~].~~

Editor Note: Retain Paragraph below for alternate manufacturers/products as specified in the contract documents. Coordinate below with bid documents, if any, and Division 1 alternates section. Consult with **Oldcastle BuildingEnvelope®** for recommendations on alternate manufacturers and products that meet the design criteria and project requirements. **Oldcastle BuildingEnvelope®** recommends that other manufacturers requesting approval to bid their product as an equal, must submit their request in writing 10 days prior to close of bidding.

* + - * 1. Subject to compliance with requirements, provide a comparable product by the following:

Manufacturer: (\_\_\_\_\_\_\_\_\_\_\_\_\_)

Series: (\_\_\_\_\_\_\_\_\_\_\_\_)

Frame Profile: (\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

* + - * 1. Substitutions: Refer to Substitutions Section for procedures and submission requirements.

Pre-Contract (Bidding Period) Substitutions: Submit written requests 10 days prior to bid date.

Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid curtain wall installation and construction delays.

Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.

Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum curtain walls for a period of not less than 10 years. (Company Name).

Test Reports: Submit test reports verifying compliance with each test requirement required by the project.

Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

* + - * 1. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.
				2. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Framing Profile: Mullions; [**as indicated**] [**2 by 4-1/2 inches (50.8 by 114.3 mm)**] [**~~2 by 6 inches (50.8 by 152.4 mm)~~**~~].~~

Exterior Framing Construction: Thermally broken.

Interior Vestibule Framing Construction: [**Nonthermal**] [**Thermally broken**].

Glazing System: Retained mechanically with gaskets on [**four sides**]

Glazing Plane: Center.

Glazing Loading: Exterior.

Glazing Thickness: **1 inch (25.4 mm)**.

Finish: [**Clear anodic**] [**Color anodic**] [**High-performance organic**] [**Superior-performance organic**].

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.
			1. **GLAZING**
				1. Glazing: Comply with Section 088000 "Glazing."
				2. Security Glazing: Comply with Section 088853 "Security Glazing."

Editor Note: Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

Basis-of-Design Product: Subject to compliance with requirements, provide **Oldcastle BuildingEnvelope®**; [**ArmorGarde™]** [**ArmorGarde™ Plus].**

Editor Note: Retain first option in "Timed Performance Rating" Subparagraph below for OBE's "ArmorGarde"; retain second option for "ArmorGarde Plus."

Timed Performance Rating: [**6 minutes 43 seconds**] [**13 minutes 8 seconds**] in accordance with ASTM F1233, Class 1.4, HG3, Test 5-aa-1.

Editor Note: 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."**]

Editor Note: 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."**]

Editor Note: Subparagraph below applies to LEED 2009 NC, CI, and CS; LEED v4; IgCC; ASHRAE 189.1; and Green Globes.

Sealant has a VOC content of 250 g/L or less.

Editor Note: 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 Architect from manufacturer's full range of colors**].

Editor Note: 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 (ASTM B209M).
				2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
				3. Structural Profiles: ASTM B308/B308M.

Editor Note: 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/A36M.

Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.

Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

* + - * 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 in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

Editor Note: Retain "Recycled Content of Aluminum Components" Paragraph below to specify recycled content if required. An alternative method of requiring recycled content is to retain requirement in Project's Division 01 sustainable design requirements Section that gives Contractor the option and responsibility to determine how recycled content requirements will be met.

* + - * 1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [**25**] [**50**] percent.
			1. **ACCESSORIES**
				1. 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.

Editor Note: 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 (25.4 mm)**] that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

Editor Note: 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/A123M or ASTM A153/A153M requirements.

* + - * 1. Concealed Flashing: [**Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials**] [**Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer**].
				2. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

Editor Note: 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.

Editor Note: 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.

Editor Note: 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.

Editor Note: 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**].
				2. After fabrication, clearly mark components to identify their locations in Project in **accordance with Shop Drawings.**
			1. **ALUMINUM FINISHES**

Editor Note: 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.

Editor Note: 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.

Editor Note: 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**] [**Black**] [**Match Architect's sample**] [**As selected by Architect from full range of industry colors and color densities**].

Editor Note: Retain "High-Performance Organic Finish, Two-Coat PVDF"; "Superior-Performance Organic Finish, Three-Coat PVDF"; or "Superior-Performance Organic Finish, Four-Coat PVDF" 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.

Editor Note: 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 Architect's sample**] [**As selected by Architect from manufacturer's full range**].

* + - * 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 Architect's sample**] [**As selected by Architect from manufacturer's full range**].

* + - * 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 Architect's sample**] [**As selected by Architect from manufacturer's full range**].

* + - 1. **SOURCE QUALITY CONTROL**

Editor Note: 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.

Editor Note: Coordinate first paragraph below with manufacturers' written instructions.

* + - * 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**

Editor Note: 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**

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

* + - * 1. Prepare surfaces that will contact structural sealant in accordance with 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 in accordance with 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, in accordance with 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 in accordance with manufacturer's written instructions.
				8. Clean and protect glass as indicated in Section 088000 "Glazing."
			1. **INSTALLATION OF WEATHERSEAL SEALANT**

Editor Note: 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, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
			1. **ERECTION TOLERANCES**
				1. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

Editor Note: 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 ft. (3.2 mm in 3 m); 1/4 inch in 40 ft. (6.35 mm in 12.2 m).

Level: 1/8 inch in 20 ft. (3.2 mm in 6 m); 1/4 inch in 40 ft. (6.35 mm in 12.2 m).

Alignment:

Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).

Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).

Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

Location: Limit variation from plane to 1/8 inch in 12 ft. (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

* + - 1. **FIELD QUALITY CONTROL**

Editor Note: Retain this article for testing of aluminum-framed entrances and storefronts during installation or for testing of field mockups.

* + - * 1. Testing Agency: [**Owner 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**].

Editor Note: 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 Architect are tested in accordance with AAMA 501.2 and do not evidence water penetration.

Editor Note: Retain one of two subparagraphs below.

Perform a minimum of [**insert number]** tests in areas as directed by Architect.

Perform tests in each test area as directed by Architect. Perform at least three tests, prior to [**10, 35, and 70 percent completion**].

Editor Note: AAMA 503 allows a prescribed test pressure for air leakage, depending on the location and wind exposure of Project. Revise "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. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

Editor Note: Retain one of first two subparagraphs below.

Perform a minimum of [**insert number]** tests in areas as directed by Architect.

Perform tests in each test area as directed by Architect. Perform at least three tests, prior to [**10, 35, and 70 percent completion**].

Editor Note: When specifying test pressure note that AAMA allows a one-third reduction in test pressures for field tests. 6.24 lbf/sq. ft. (300 Pa) is industry standard minimum; however, AAMA 503 allows minimum test pressure of 4.18 lbf/sq. ft. (200 Pa). Alternatively, AAMA 503 allows a prescribed test pressure for water penetration, depending on the location and wind exposure of Project. Revise "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. (300 Pa), and do not evidence water penetration.

Editor Note: Retain "Structural-Sealant Adhesion" Paragraph below if Project includes two-sided structural glazing.

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

Test a minimum of [**insert number]** areas on each building facade.

Repair installation areas damaged by testing.

Editor Note: See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

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

**END OF SECTION 084113**