

SECTION 08 56 53
BLAST RESISTANT WINDOWS AND STOREFRONTS

PART I - GENERAL

1.1 DESCRIPTION

The requirements of this section shall apply to all exterior windows, glazing, storefront windows and doors and other components required to make a complete assembly.

1.2 RELATED DOCUMENTS

- A. Glazing: Refer to VA Physical Security Design Manual for blast resistant design of fenestration and doors. Section 08 80 00, GLAZING.
- B. Aluminum Framed Entrances and Storefronts: Refer to VA Physical Security Design Manual for blast resistant design of fenestration and doors. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

1.3 SYSTEM PERFORMANCE

- A. General: Fabricate and install blast resistant windows and storefront entrances to achieve indicated levels of resistance as prescribed in the VA Physical Security Design Manual dated January 2015. Extend resistance to include glass, glazing, anchorages, mullions, interfaces with adjoining substrates, hardware, and other components required to produce a complete assembly.
 - 1. Blast Resistance: Provide units in accordance with requirements set forth in the VA Physical Security Design Manual dated January 2015. All requirements of the VA Physical Security Design Manual are in addition to the requirements of this specification.
 - 2. Normal resistances: Provide units capable of the following levels of performance for weather and environmental exposures:
 - a. Thermal Movement: Provide assembly capable of withstanding thermal movements resulting from ambient range of 150 deg. F (67 deg. C). Window wall temperature may be assumed to reach ambient temperature of 180 deg. F (82 deg. C).
 - b. Air infiltration: Maximum rate of 9.64 cu. in./min. per sq. in. (0.0017 cu. m/min per sq. m) of window area plus 52 cu. in./linear ft. (0.0028 cu./m per linear m) of operable sash joint for inward test pressure of 6.24 psf (298.8 Pa) per ASTM E 283.
 - c. Water penetration: No leakage for inward test pressure of 8 pounds (3.63 kg) force, per ASTM E 331.

1.4 SUBMITTALS

- A. General: For each blast resistant window and storefront assembly, submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
1. Product data for manufactured/fabricated metal window units and sub-frames. Include standard details and specifications for metals and alloys, fasteners, welding, applied finishes, hardware, and accessories. Include producer's detailed instructions for assembly, protection, installation, and maintenance.
 2. Manufacturer's standard color chart.
 3. Certification: letter from manufacturer indicating that products have been certified as meeting the blast resistance requirements specified in this Section.
 4. Shop drawings showing dimensioned details of metal window units and storefront entrances. Show application of intended glazing materials. Show typical window unit interior and exterior elevations at not less than $\frac{3}{4}"=1'-0"$ (1:20) scale. Indicate how window units, not necessarily including basic sub-frames, are to be subsequently removed/replaced; and how glazing unit removal/replacement is to be accomplished. After final modifications and corrections have been incorporated, submit drawings as AutoCAD files with .DWG extension:
 - a. Details: Show sections at $3"=1'-0"$ (1:5) scale of members indicating construction, size, and thickness of components, together with connections, fastenings, and means of separating dissimilar metals.
 - b. Indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.
 5. Calculations: Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the minimum requirements set forth in the 2015 VA Physical Security Design Manual. Calculations verifying the structural performance of each window

proposed for use, under the given loads, must be prepared and signed by a registered Professional Engineer. The window components and anchorage devices to the structure, as determined by the design analysis, must be reflected in the shop drawings. Calculations must clearly show window units, anchorages, and glazing withstand blast pressures and deflection limits outlined in 2015 VA Physical security design manual.

6. Test Report Requirements: Submit test reports for each type of window (including windows used in storefront assemblies) attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, minimum condensation resistance factor (CRF). For blast resistant windows results of airblast testing, whether by arena test or shocktube, must be included in a test report, providing information in accordance with ASTM F1642, as prepared by the independent testing agency performing the test. Test results must demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and meet requirements of 2015 VA Physical Security Design Manual.

1.5 QUALITY CONTROL

Provide products that meet the requirements of VA Physical Security Design Manual dated January 2015 and Unified Facilities Criteria for DOD minimum Antiterrorism Standards for Buildings UFC4-010-01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Manufacturer's directions and as required to prevent edge damage or other damage to assembly resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, and contact with chemical solvents.
- B. Deliver prefabricated units to Project as completely assembled units, ready for anchorage into supporting structure, and for interfacing with other work.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

- ASTM A36/A36M-08..... Standard Specification for Carbon Structural Steel
- ASTM A123/A123M-09..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A320/A320M-11..... Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service
- ASTM B221-08..... Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- ASTM E283-04..... Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- ASTM E331-00(R2009)..... Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- C. National Association of Architectural Metal Manufacturers (NAAMM)
AMP 500-06.....Metal Finishes Manual
- D. Underwriters Laboratories, Inc. (UL):
UL752-2011.....Bullet Resisting Equipment
- E. Unified Facilities Criteria (UFC):
4-010-01-2012.....DOD Minimum Antiterrorism Standards for Buildings
- F. VA Physical Security Design Manual, January 2015

PART 2 - PRODUCTS**2.1 MANUFACTURER/FABRICATOR**

Certified Units: Provide units and sub-frames which are manufactured/fabricated by firms which have produced identical units required for this Project and which have been certified to comply with requirements for levels of resistance to attack specified.

2.2 MATERIALS

- A. Steel Shapes/Plates/Bars: ASTM A 36, except where another designation is indicated.

- B. Stainless Steel: Provide formed members of AISI Type 304 stainless steel sheet, with No. 4 directional polish.
- C. Bolts and Fasteners: Provide AISI Type 300-series stainless steel screws, bolts, nuts, and washers; comply with ASTM A 320. Provide nonremovable type where accessible from attack side.
- D. Aluminum Extrusions/Bars: Provide members complying with ASTM B 221, alloy 6063-T5, -T6, or -T52, or alloy 6061-T6, for principal framing members, with 3/16 inch (4.76 mm) minimum thickness of walls; provide alloy 6063-T5, -T6, or -T52 for trim and stops which are not exposed to forced entry attack, of 1/16 inch (1.575 mm) minimum thickness.
- E. Window Cleaner's Bolts: Provide units of standard design as indicated, complying with applicable safety regulations, fabricated of nonmagnetic stainless steel.
- F. Glazing Materials: Refer to Section 08 80 00, GLAZING:

2.3 FABRICATION

- A. Unit Framing: Shop fabricate unit framing system of section profiles in metal as shown. Provide full-strength, mitered-and-welded corner joints. Provide framing units to achieve specified performances, but not less than metal thicknesses and dimensions shown. Comply with applicable AWS standards for welding, with exposed welds ground reasonably smooth. Provide welded-in-place reinforcements, including anchorage devices as shown. Fabricate metal glazing stops for removal, with mitered corners and countersunk screw attachment to frame.
 - 1. New Building: Each exterior frame system shall have inner frame, outer frame, and fasteners to connect them together. The outer frame shall be continuous steel frame embedded in exterior wall as concrete wall is constructed. The inner frame shall be preassembled with glazing and shall be bolted to outer frame. Both frames shall be supplied by one manufacturer.
 - 2. Existing Buildings: The frame shall be continuous steel frame anchored to existing wall with expansion anchors. If two frame system is used, both inner and outer frames shall be supplied by one manufacturer.
- B. Unit Anchorages: Fabricate metal anchorage system/devices as shown, and as required to achieve performance requirements.

- C. Unit Glazing: Install glazing sheets in frames at fabrication plant prior to delivery to project. See section 08 80 00 for laminated glass assemblies that meet the requirements of UFC4-010-01.

2.4 FINISHES

- A. General Finishing: Provide the following factory-applied finishes on the fabricated units of metal window framing and sub-framing, including hardware and accessories. Comply with NAAMM Metal Finishes Manual AMP 500-505-88 as applicable:
1. Stainless steel: Finish exposed stainless steel components of the work with AISI No. 4 directional polish, except retain manufacturer's standard mill finish on exposed fasteners and similar devices.
 2. Fabricated aluminum: Provide Class I clear anodized coating of 0.018 mm thickness; comply with Aluminum Association designation AA-M12C22A41.
 3. Fabricated aluminum: Provide Class I, color anodized coating of 0.008 inch (0.018 mm) thickness; comply with Aluminum Association designation AAM12C22A42/A44. Color to be selected from manufacturer's standard color line.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine prepared substrate openings to receive framed fenestration units of this Section. Check anchorages for location and coordination of face plans between walls and fenestration units. Check dimensions and clearances for sealant applications.
- B. Coat substrate surfaces of concrete, masonry, or steel where they will be in contact or close proximity with aluminum or stainless steel framing of fenestration units. Apply 1/32 inch (0.76 mm) coating of bituminous paint, confined to surfaces which will be concealed.

3.2 INSTALLATION

- A. Coordinate installation of window units in sub-frames with installation of expansion joint materials, isolators, joint fillers, spacer strips, tapes, gaskets, sealants, removable sub-frame stops, and other elements as indicated. Tighten bolts for maximum shear and tensile strength, for resisting forces indicated. Comply with Fabricator's instructions and recommendations.

- B. Place installation accessory items as shown and as required for unit installations, including flashings, shims, fillers, bedding materials, and anchorage accessories. Prepare openings for unit interfaces with other work.
- C. Install window units uniformly to lines and elevations indicated, plumb and level, true to plane of optical reflection. Comply with Fabricator's instructions for final assembly and installation. Install anchor bolts and devices as indicated, exercising care to shim and tighten against substrates without distorting or deflecting frames from intended lines. Provide uniform spaces around units for subsequent installation of joint sealer materials, which are not work of this Section, see Division 7 section for sealants.
- D. Anchorage: The window manufacturer is responsible to provide anchors appropriate for substrate to which window assembly is to be fastened.
 - 1. New Building window assembly installation: The window frame system shall consist of inner and outer frame. The outer frame shall be embedded in concrete wall as concrete is placed with sufficient anchorage (embedded studs) to meet performance requirements of this Section. The inner frame shall be anchored to outer frame with $\frac{1}{2}$ inch (13 mm) bolts having the following minimum requirements:
 - a. Yield strength: 130,000 psi (900 MPa)
 - b. Tensile strength: 150,000 psi (1033 MPa)
 - 2. Existing building window assembly installation: Structural frames shall have pre-drilled bolt holes at 12 inches (300 mm) o.c. maximum. The manufacturer shall verify substrates involved and supply fastening tools (e.g., drill, bit) required by their anchoring system. The anchor shall be acceptable for shock/short duration loading, and have potential for removal during life of building. The anchor shall also meet the following requirements:
 - a. Anchor diameter: $\frac{3}{8}$ inch (10 mm) minimum.
 - b. Embedment and edge distances shall be as certified for window, but not less than the following:
 - i. Embedment in concrete: $3\frac{1}{2}$ inch (90 mm).
 - ii. Embedment in solid masonry: 6 inches (150 mm).
 - iii. Edge distance: 3 inches (75 mm).
 - c. The minimum anchor strengths shall be as certified for window, but not less than:

- i. Yield strength: 130,000 psi (900 MPa)
 - ii. Tensile strength: 180,000 psi (1240 MPa)
- 3. Avoid cutting of rebar during concrete anchor installation.
- E. Remove protective covering from finished metal surfaces, and from exposed glass and plastic glazing sheets.
- F. Overcoat Painting: Refer to Division 9 section on painting for final overcoating on metal framing and trim members of fenestrations units; not work of this section.

3.3 CLEANING AND PROTECTION

- A. General: Upon completion of installation of metal windows, clean exposed surfaces of window units and sub-frames; comply with Fabricator's instructions. Remove excess and migrating joint sealing compounds, dirt, and foreign substances. Repair damaged areas of factory-applied finishes in accordance with Fabricator's instructions; comply with Project Director's requests. Continue maintenance of exposed finishes through remainder of construction period.
- B. Protection: Provide breakage protection promptly upon completion of fenestration installation. Install crossed streamers of cloth/plastic, adhered to unit framing exterior faces. Maintain through construction completion.
- C. Repair and Replacement: Touch up minor finish damage on metal surfaces where handling and installation have produced marred or abraded areas which can be readily corrected. Replace or refinish units where damage is of greater substance, as directed by Project Director.
- D. Glazing: Clean glazing in accordance with Section 08 80 00, GLAZING.

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