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SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.
- C. Sound rated doors as indicated in Door Schedule.
- D. Installation of hardware for doors provided under this Section.

1.2 RELATED WORK (Items not included in this Project manual are Available through the Construction Manager upon request.)

- A. Frames fabricated of structural steel: Section 05 50 00, Metal Fabrications.
- B. Door Hardware and sound seals for doors: Section 08 71 00, DOOR HARDWARE.
- C. Low Energy Power Assist Door Operators: Section 08 71 13.11.
- D. Glazing for interior hollow metal doors: Section 08 80 10 Interior Glazing.
- E. Glazing for exterior hollow metal doors: Section 08 88 53- Security Glazing.
- F. Colors, finishes, and textures: Section 09 06 00, Schedule for Finishes.
- G. Finish Painting: Section 09 91 00, Painting.
- H. Card readers and biometric devices: Section 28 13 11, Physical Access Control Systems.

1.3 TESTING

- A. An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. Manufacturers Literature and Data:
  - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements.
  - 2. Sound rated doors, including test report from Testing Laboratory.

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- C. Shop Drawings: Submit within 45 days after award. Show reinforcements, cut-outs, welds, anchorages and connections to adjacent construction, and provisions for hardware and other pertinent items.
1. Throat Size: Provide separate column on frame schedule for throat size which corresponds to the wall thickness in which the frame is located plus 1/8".
- D. Door Schedule:
1. Form: Subject to approval of Architect and separate from Hardware Schedule.
  2. Arrangement: Follow arrangement, door number sequence, and content of schedule on Contract Documents plus additional information necessary for submittal. Door schedule shall not be divided into separate schedules based on door features such as door type or door size.
  3. Provide field verified dimensions of existing openings for new hollow metal frames.
- E. Samples: Submit frame samples listed below not less than 12" leg on jamb and 8" leg on head sections; minimum 5 inches deep. Show proposed finishes, methods of construction, and joint tolerances.
1. Door Frame: Submit double rabbet door frame showing intersection of jamb and head.
  2. Submit for carbon steel units.
- F. Letter of Compliance: See "Certification" under "Manufacturer's Representative" under QUALITY ASSURANCE below. Submit on company letterhead prior to delivery of fabricated units to jobsite.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer/Fabricator:
1. Provide units produced by a firm with not less than 5 years of successful experience in fabrication of hollow metal work of type required for this project.
  2. Fabricator: Must be approved by Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual to fabricate fire-rated assemblies.
- B. Provide doors and frames complying with the following:
1. All Units: ANSI A 250.8.
  2. Labeled Units: Constructed, tested and approved by UL or other agency as approved by local building official in accordance with requirements of NFPA 252, UL 10C, or as required by Code.
- C. Regulatory Requirements:
1. Doors and frames to conform to applicable codes for fire ratings.
- D. Manufacturer's Representative:
1. Inspection: For fabrication not performed directly by manufacturer, inspect doors and frames for compliance with specifications and manufacturer's standards. Special attention to be directed to welded frames; see tolerances below.
- E. Contractor is responsible for deterring the correct door frame throat size.

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- F. Door openings in Existing Construction: Field measure existing openings and show existing measurements on shop drawings with corresponding door frame opening and door frame designation.

1.6 SHIPMENT

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame or other suitable method to prevent damage to welded joints.
- C. Packing:
1. Carton or crate to provide protection during transit and job storage.
  2. Tag or mark to numbered openings corresponding to approved schedules.
- D. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

1.7 STORAGE AND HANDLING

- A. Store doors and frames at the site under cover and as recommended by manufacturer. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide a minimum of 1/4" spaces between stacked doors and frames to promote air circulation. Replace damaged materials with new.
- B. Protect from rust and damage during storage and erection until completion.

1.8 APPLICABLE PUBLICATIONS (LATEST EDITION UNLESS OTHERWISE NOTED):

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
1. L-S-125B Screening, Insect, Nonmetallic
- C. Door and Hardware Institute (DHI):
1. A115 Series Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)
- D. Steel Door Institute (SDI):
1. 113-01 Thermal Transmittance of Steel Door and Frame Assemblies
  2. 128 Acoustical Performance for Steel Door and Frame Assemblies
  3. A250.6 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

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4. A250.8 Standard Steel Doors and Frames, SDI-100 Recommended Specifications for Standard Steel Doors and Frames
- E. American National Standards Institute (ANSI):
1. A123.1 Nomenclature for Standard Steel Doors and Steel Frames
- F. American Society for Testing and Materials (ASTM):
1. A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
2. A568/568 Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
3. A1008 Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
4. B209/209M Aluminum and Aluminum-Alloy Sheet and Plate
5. B221/221M Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
6. E90 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
7. E283 Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Difference Across this Specification
8. E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
9. E1886 Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
10. E1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
11. D1621 Compressive Properties of Rigid Cellular Plastics
12. D3656 Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns
13. E1886 Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
14. E1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
- G. The National Association Architectural Metal Manufacturers (NAAMM):
1. Metal Finishes Manual (1988 Edition)
- H. National Fire Protection Association (NFPA):
1. 80 Fire Doors and Fire Windows
2. 105 Installation of Smoke-Control Door Assemblies
3. 252 Fire Tests for Door Assemblies
- I. Underwriters Laboratories, Inc. (UL):
1. Fire Resistance Directory

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- 2. 10C-98 Positive Pressure Fire Tests for Door Assemblies.
  - J. Intertek Testing Services (ITS):
    - 1. Certifications Listings...Latest Edition
  - K. Factory Mutual System (FM):
    - 1. Approval Guide

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS FOR EXTERIOR OPENINGS

- A. Delegated Design: Design hollow metal doors and frames, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Hurricane-Resistance Test Performance: Provide exterior hollow metal door and frame assemblies including door hardware and insulated side light panels with an assemblies that pass large missile-impact tests and cyclic-pressure tests according to testing requirements of authorities having jurisdiction, but not less than the following:
  - 1. Impact Resistance: Hollow metal door and frame assemblies including door hardware must satisfy the criteria for protection from windborne debris. The assemblies must have passed the large missile impact test (which equates to Missile Level D specified in ASTM E 1996. The assemblies may be installed at any height on the structure as long as the design pressure rating for the assemblies is not exceeded.
  - 2. Perform applicable impact tests for wind-borne debris and exposure to cyclic pressure differentials in accordance with the testing standards ASTM 1886 and ASTM 1996 Wind Zone 3, and Missile Level "D".
  - 3. Wind Loads: As specified in Section 01 83 16.13 - Exterior Wind Enclosure Requirements.
  - 4. The hollow metal door and frame assemble, including door hardware, shall not need to be protected by any other impact protective system to meet the above requirements.
  - 5. Importance Factor: See Structural Drawings.
  - 6. Glazing: Meet or exceed requirements of Section 08 88 53, Security Glazing.

### 2.2 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 302 or 304; finish, NAAMM Number 4
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.
- D. Galvanized Finish: ASTM A 653 with minimum G60 or A60 zinc-coating.

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- E. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
  - F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
  - G. Aluminum Sheet: ASTM B209/209M.
  - H. Aluminum, Extruded: ASTM B221/221M.
  - I. Prime Paint: Paint that meets or exceeds the requirements of A250.8, SDI.
  - J. Glazing: Section 08 80 10 – Interior Glazing.
  - K. Fill: For repairs or closing gaps; weld or body putty; manufacturer's standard. Sealant or caulk not acceptable.
  - L. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.
  - M. Thermal Insulation: Manufacturer's standard thermal insulation. See "Exterior Doors" below for minimum R value of door. Plastic foam type insulation to be based on an aged R value of not greater than 5.6.
  - N. Sound Insulation: Manufacturer's standard acoustic insulation.
  - O. Door Silencers: Standard resilient cushions for drilled application provided under Section 08 71 00. Preparation for silencers required under this Section.
  - P. Junction Boxes Secured to Hollow Metal Frames: Furnished by Section 08 71 00 and Division 26. Welding of boxes to frame required by this section.

## 2.3 FABRICATION, GENERAL

### A. GENERAL:

- 1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Prepare doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 1-3/4 inches, unless otherwise shown.
  - 2. Close top edge of exterior doors flush and seal to prevent water intrusion.
  - 3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
  - 4. Hot-Dip Zinc-Coated and Factory-Primed Finish: Fabricate exterior hollow metal door and frame assemblies and interior door and frame assemblies scheduled as galvanized; from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8.
  - 5. Fabricate doors and frames square, true to line without warp, twist or other deformations.
- B. Grades: Doors and frames to comply with the following levels per ANSI A250.8 with gages not less than specified under "Gages" below.

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1. Interior:
    - a. Door Leaf Widths up to 3'-4":
      - 1) Doors: Level 1, Standard Duty.
      - 2) Frames: Level 2.
    - b. Door Leaf Widths Over 3'-4" and Frames for Double Doors:
      - 1) Doors: Level 2, Heavy Duty.
      - 2) Frames: Level 2.
    - c. Stairwell Doors:
      - 1) Doors: Level 2, Heavy Duty.
      - 2) Frames: Level 2.
    - d. Stile and Rail Doors: Level 2, Heavy Duty
      - 1) Frames: Level 2.
    - e. Where Noted: Level 4.
  2. Exterior:
    - a. Doors: Level 3, Extra Heavy Duty.
    - b. Frames: Level 4.
  3. Fixed Glass Frames: Level 3, Extra Heavy Duty, minimum.
- C. Gages: See "Grades" above.
1. Doors:
    - a. Face Sheets:
      - 1) Level 1: 20 gage (0.8 mm, 0.032 inch, minimum).
      - 2) Level 2: 18 gage (1.0 mm, 0.042 inch, minimum).
      - 3) Level 3: 16 gage (1.3 mm, 0.053 inch, minimum).
      - 4) Level 4: 14 gage (1.7 mm, 0.067 inch, minimum).
    - b. End Channels: Minimum 18-gage (1.0 mm, 0.042 inch, minimum).
    - c. Face Stiffeners: Minimum 22-gage (0.0299 inch, minimum).
    - d. Labeled Doors: Gages as approved by Underwriters' Laboratories for required label.
  2. Frames: Provide heavier gage when optional under ANSI A250.8.
    - a. Level 1: Not permitted.
    - b. Level 2: 16 gage (1.3 mm, 0.053 inch, minimum).
    - c. Level 3: 16 gage (1.3 mm, 0.053 inch, minimum).
    - d. Level 4: 14 gage (1.7 mm, 0.067 inch).
    - e. Gages of labeled frames as approved by Underwriters' Laboratories for required label.
- D. Cores: Types as listed below by alpha designations.
1. Kraft honeycomb.
  2. Polyurethane.
  3. Polystyrene.
  4. Unitized steel grid.
  5. Mineral fiberboard.
  6. Vertical steel stiffners.

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- E. Standard Duty Doors: SDI A250.8, Level 1, Model 2 of size and design shown. Use for interior locations only. Do not use for stairwell doors.
- F. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f for interior doors; and types b, c, e, or f for exterior doors.
- G. Extra Heavy Duty Doors: SDI A250.8, Level 3, Model 2 of size and design shown. Core construction Core construction types d or f for interior doors; and types b, c, e, or f for exterior doors. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation, unless required otherwise for fire rated application. Use for stairwell doors.
- H. Smoke Doors:
1. Close top and vertical edges flush.
  2. Provide seamless vertical edges.
  3. Apply Steel astragal to the meeting stile at the active leaf of pair of doors or double egress doors.
  4. Provide clearance at head, jamb and sill as specified in NFPA 80.
- I. Fire Rated Doors (Labeled):
1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
  2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
  3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
  4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230° C (450° F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.
- J. Custom Metal Hollow Doors:
1. Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages and finish shall be as specified for standard steel doors.
- K. Sound Rated Doors:
1. SDI 114, except as specified otherwise.
  2. Sound Transmission Class minimum of 45 when tested in accordance with ASTM E90.
  3. Doors complete with integral spring type automatic door bottom seal and with integral continuous gaskets on the frames. Applied spring type automatic door bottom seal and applied continuous gaskets for the frames for doors that are not sound rated but sealed for flanking noises are specified in Section 08 71 00, DOOR HARDWARE.
  4. Fabricate vision panels to receive double glazing where shown.
- L. Door panels; consist of two sheets of 1 mm (0.042 inch) thick steel with a resilient separator, nominally 9 mm (3/8 inch) thick, interlocked into the stiles and rails.



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M. Door Edges:

1. Closers: Top and bottom edges closed with continuous recessed steel channel, spot weld to faces. Exterior doors to receive additional flush closing channels on top and bottom with welded and filled seams; verify requirements with finish hardware specified elsewhere. Interior doors to receive flush metal or vinyl closer at tops for housekeeping purposes.
2. Bevel: Shape lock and hinge edges as follows:
  - a. Single Acting Doors: 1/8" bevel in 2".
  - b. Double Acting Doors: 2-1/8" radius.

## N. Exterior Doors:

1. Insulated Doors: All exterior doors are required to be insulated except where precluded by fire-resistance requirements; fill core voids with insulation. R value of door to be not less than 8.0 using R values of aged insulation; see "Thermal Insulation" under MATERIALS in Part 2 above.
  - a. Provide insulated sidelight panels, at exterior locations, where glazing is not shown for door sidelight on drawings. Insulated sidelight panel shall meet requirements of adjacent door construction.
2. Rain Hoods: Provide rain hoods at heads of exterior doors not under canopy. Fabricate to profile as detailed from 16 gage galvanized steel, full width of door frame. Weld to frame and seal to prevent water infiltration.

RFI 7082: See RFI for Cut Sheet of Rain Hood.

## 2.4 METAL FRAMES

## A. General:

1. SDI A250.8, types and styles as shown or scheduled.
2. Throat Openings: Provide as required to accommodate wall construction. Size = Wall Thickness + 1/8 inch - 1/16 inch.
3. Frames in Gypsum Board Walls: Provide a drywall frame profile similar to "MU" type unit by Steelcraft and it shall include a minimum 5/16" backbend parallel to face on the return leg. This profile required regardless if not shown on drawings.
4. Frames for labeled fire rated doors and windows.
  - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
  - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
5. Frames for doors specified to have automatic door operators: Minimum 1.7 mm (0.067 inch) thick.
6. Knocked-down frames are not acceptable.
7. Provide face welded type frames unless otherwise indicated. Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth. Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded

## B. Reinforcement and Covers:

1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. SDI A250.6 for, SDI A250.6 for, Hardware reinforcing on doors and frames

3. Provide reinforcing plates as required by Table 4 of ANSI A 250.8 or greater if required for proper performance.
4. Provide mortar guards securely fastened to back of hardware reinforcements.
5. Where concealed door closers are installed within the head of the door frames, prepare frames for closers and provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.
6. Provide reinforcement for closers whether or not closers are listed in hardware schedule, including channel stiffeners in transom panels.

C. Terminated Stops: SDI A250.8. NOT REQUIRED - Per RFI 06629

D. Glazed Openings and Panel Opening:

1. Integral stop on exterior, corridor, or secure side of door.
2. Design rabbet width and depth to receive glazing material or panel shown or specified.

E. Frame Anchors:

1. Floor anchors:

- a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
- b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts.
- c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
- d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (2 inches) on center.

2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
  - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
  - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
- d. Anchors for stud partitions: Weld to frame type. Provide tabs for securing anchor to the sides of the studs.
- e. Anchors for frames set in prepared openings:
  - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
  - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.

- 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
  - f. Anchors for observation windows and other continuous frames set in stud partitions.
    - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
    - 2) Anchors spaced 600 mm (24 inches) on centers maximum.
  - g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.
- F. Mortar Boxes: Provide mortar guards, minimum 26 gage steel at all hardware mortises on frames. Items include, but not limited to, the following:
- 1. Security Switches: See Division 26.
  - 2. Electric Locks.
  - 3. Strikes.
  - 4. Hinges.

- G. Gasketed Frames: For smoke rated openings.
- 1. Provide gasketed frames with integral frame kerf and fire rated door gasket.
  - 2. Gasket to form a smoke seal meeting requirements of NFPA 105 and be concealed from view when door is closed.
  - 3. Gasket is installed after field painting and in lieu of door silencers.
  - 4. Gasketed frames may or may not be detailed on drawings; regardless, provide as specified.

GASKETED FRAME NOT REQUIRED WHERE AT DOORS WITH  
A HDW SET REQUIRING SELF ADHESIVE SEALS (RFI 06228)

## 2.5 TOLERANCES

- A. Meet or exceed requirements of SDI A250.8. .
- B. Frame Joint Gap: Between unwelded portions of head and jamb joints: Plus 0.0109 inch maximum.
- C. Glazing Stop Gap: Between butted ends of applied glazing stops: Plus 0.0156 inch maximum.
- D. Patient room doors shall meet or exceed requirements specified for fire rated applications in SDI A250.8.

## 2.6 SHOP FINISH

- A. Typical: After repairs are complete, chemically-treat for bond. Paint all surfaces with rust inhibiting primer system that complies with requirements of SDI A250.8.; leave ready to receive finish painting specified elsewhere.

## 2.7 SPECIAL FEATURES

- A. Labeled Doors and Frames:
  - 1. See QUALITY ASSURANCE in Part 1 above.

2. If doors or frames specified or designated by the Architect to be fire-rated cannot qualify for appropriate labeling because of design, hardware or any other reason, modify such features as required for required labeling and obtain Architect's approval of required modifications before commencing fabrication of unit.
  3. Where rated doors are scheduled, coordinate doors and frames with specified hardware to furnish a complete fire assembly.
  4. Label Location for Continuous Hinges: Labels shall be visible after installation of hardware. Labels shall be concealed when door is in closed position.
  5. Doors: Locate on latch side.
  6. Frames: Locate on head in plane of door.
  7. Note gypsum grout required as shown and specified.
- B. Astragals: Provide as required for fire resistance. Advise hardware supplier and Resident Engineer of all nonscheduled astragals.
- C. Vision Panels: Provide trimmed openings for glass panels of the sizes and locations shown and scheduled for designated doors. Provide with removable stops conforming to requirements specified under "FRAMES" above. Openings for fire rated doors not to exceed limitations of the required label. Glazing provided under another Division 8. Fasteners for stops shall be on the non-secure side of door.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Hollow Metal Frames: Comply with or exceed ANSI/SDI A250.11 and DHI A115.1G.
1. At fire rated applications install frames according to NFPA 80.
  2. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
  3. Install door silencers in frames before grouting.
- B. Plumb, align and brace frames securely until permanent anchors are set.
1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  3. Protect frame from accidental abuse.
  4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
  5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- C. Floor Anchors:
1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts.
  2. Power actuated drive pins may be used to secure frame anchors to concrete floors.
- D. Jamb Anchors:

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1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
  2. Coat frame back with a bituminous coating prior to grout filling in masonry walls.
    - a. Coating shall be applied outside of the building so as to not impact LEED or VOC requirements.
  3. Coat frame back with a bituminous coating prior grout filling frames indicated to be grouted.
    - a. Coating shall be applied outside of the building so as to not impact VOC requirements.
  4. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
  5. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers.
- E. Install anchors for labeled fire rated doors to provide rating as required.
- F. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
- G. Frames for Sound Rated Doors: Coordinate **to line** frames for sound rated doors with insulation.
- H. Glazing: Comply with installation requirements in Section 08 80 10 –Interior Glazing and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### 3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

#### A. Doors:

1. General: Hang doors in accordance with clearances specified in SDI/DOOR A250.8 and as follows:
  - a. Typical: DHI Installation Guide for Doors and Hardware; and within clearances specified below. Shim as necessary.
    - 1) Non-Fire-Rated Standard Steel Doors:
      - a) Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      - b) Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      - c) Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
      - d) Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
    - 2) Fire Rated Applications: NFPA 80.
    - 3) Smoke-Control Doors: Install doors according to NFPA 105.

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2. Where doors have been prefinished before hanging, exercise care to protect finishes from damage during hanging. Protect doors from construction damage.
- B. Hardware: Install hardware for doors provided under this Section as specified in Section 08 71 00, DOOR HARDWARE and in accordance with applicable portions of DHI A115.
- 3.3 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Demonstration: Upon completion of hanging, demonstrate that doors operate freely without binding and will latch properly when closed with moderate pressure.

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SECTION 08 14 00  
INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies prefinished, prefit, interior solid-core flush doors, and interior solid-core flush doors.
- B. Doors with Type D WD-1 wood veneer shall have a factory applied stain and transparent finish.
- C. Hollow core doors not permitted.
- D. Section includes fire rated doors, sound retardant doors, and smoke doors.
- E. Install hardware for doors provided under this Section.
- F. Work Specified Elsewhere, but provided under this Section:
  - 1. Sound seals for acoustically rated doors: Section 08 71 00 - Door Hardware.

1.2 RELATED WORK

- A. Metal door frames: Section 08 11 13, Hollow Metal Doors and Frames.
- B. Interior aluminum storefront type framing: 08 41 26 – Interior Aluminum-Framed Storefronts.
- C. Door hardware including hardware location (height): Section 08 71 00, Door Hardware.
- D. Low Energy Power Assist Door Operators: Section 08 71 13.11.
- E. Installation of doors and hardware: Section 08 11 13, Hollow Metal Doors and Frames, Section 08 14 00, Wood Doors, or Section 08 71 00, Door Hardware.
- F. Glazing: Section 08 80 10, Interior Glazing.
- G. Finish: Section 09 06 00, Schedule for Finishes.
- H. Intrusion alarm: Section 28 16 11, Intrusion Detection System

1.3 COORDINATION

- A. Coordination: See "Hardware Fasteners Coordination" under SUBMITTALS; furnish data to Section 08 71 00 – Door Hardware.

1.4 DEFINITIONS

- A. Hot Press Construction: Doors manufactured by the hot-press method, bonding faces, crossbands, and core together in a single operation. Doors are individually pressed, one door

at a time. Equipment provides uniform pressure over entire door surface and heat cures all glue lines independent of environmental conditions using Type 1 glue.

- B. Cold Press Construction: Doors manufactured by the cold-press method, bonding pre-manufactured skins, of any ply, to core. Doors are pressed in stacks of multiple doors. Equipment may or may not provide uniform pressure over entire door and glue lines of skin to core is time cured and dependent of environmental conditions using Type 2 glue. Skins may be manufactured using either hot or cold press methods and range from 2 to 4 plies.
- C. STC: Sound Transmission Class.
- D. See "Hardware Fasteners Coordination" under SUBMITTALS; furnish data to Section 08 71 00 - Door Hardware.

#### 1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. Glazing: Provide submittal in compliance with Section 08 80 10 Interior Glazing. Fire rated glazing for the interior of the building shall be by the same manufacturer through out the building. Construction Manager shall coordinate with other trade contractors.
- C. Sample Warranty: Submit with shop drawings in accordance with Section 01 33 25.
- D. Samples:
  - 1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
  - 2. Veneer sample 8 inch by 11 inch by 1/4 inch showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample..
  - 3. Louvers: Sample corner of louver blade and frame sections, 150 mm (6 inches) x 150 mm (6 inches) long, for each material specified.
    - a. Color Samples: 4 inch square color samples of louver color.
  - 4. Frames for light openings, 12 inches long, for each material, type, and finish required.
  - 5. Fire Rated Lite: At Architect's request provide samples of glazed lite opening with the type of fire rated glass required in a 90 minute door and a lite of 1296 square inches. Sample shall be a minimum of 24" square x 1-3/4" thick corner of door with a 10" x 10" lite and wood moldings required for fire rated glass to meet UL requirements. Finish on door shall match approved factory finish. Provide sample for each factory finish.
- E. Shop Drawings:
  - 1. Show every door in project and schedule location in building.
  - 2. Indicate type, grade, finish and size; blocking, include detail of glazing louvers sound gasketing and pertinent details.
  - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.
  - 4. Arrangement: Follow arrangement and content of schedule on Contract Documents plus additional information necessary for submittal. Door schedule shall not be divided into separate schedules based on door features such as door type or door size.
- F. Manufacturer's Literature and Data:



1. Sound rated doors, including test report indicating STC rating per ASTM E90 from test laboratory.
2. Labeled fire rated doors showing conformance with NFPA 80.
3. Butt Hinge Screws: Advise proposed pilot hole size for hinge screws; obtain approval before drilling or drill for screw size as directed by Section 08 71 00 - Door Hardware. Provide minimum #12 screws unless otherwise tested and approved.

G. Laboratory Test Results:

1. Screw holding capacity test report in accordance with WDMA T.M.10.
2. Split resistance test report in accordance with WDMA T.M.5.
3. Cycle/Slam test report in accordance with WDMA T.M.7.
4. Hinge-Loading test report in accordance with WDMA T.M.8.

H. LEED Submittals:

1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that flush wood doors comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body.
  - a. Include statement indicating cost for each certified wood product.
2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated and WDMA I.S.1-A, "Architectural Wood Flush Doors." In case of conflict, provide the more stringent requirement.
  1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  2. Labels: Provide metal labels with raised or incised markings

1.7 WARRANTY

- A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:
  1. For interior doors, manufacturer's warranty for lifetime of original installation.
  2. Specified STC RATING for sound retardant rated door assembly in place.

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1.8 DELIVERY AND STORAGE

- A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.
- B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.
- C. Label package for door opening where used.

## 1.9 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. Window and Door Manufacturers Association (WDMA):
  - 1. I.S.1A Architectural Wood Flush Doors
  - 2. I.S.4 Industry Specification for Preservative Treatment for Millwork
  - 3. I.S.6A Architectural Wood Stile and Rail Doors
  - 4. T.M.5 Split Resistance Test Method
  - 5. T.M.6 Adhesive (Glue Bond) Durability Test Method
  - 6. T.M.7 Cycle-Slam Test Method
  - 7. T.M.8 Hinge Loading Test Method
  - 8. T.M.10 Screwholding Test Method
- C. National Fire Protection Association (NFPA):
  - 1. 80 Protection of Buildings from Exterior Fire
  - 2. 252 Fire Tests of Door Assemblies
- D. ASTM International (ASTM):
  - 1. D 143 Method of Testing Small Clear Specimens of Timber.
  - 2. E90 Laboratory Measurements of Airborne Sound Transmission Loss.
  - 3. E413 Classification for Rating Sound Insulation
- E. Underwriters Laboratories Inc. (UL):
  - 10C Positive Pressure Fire Tests for Door Assemblies.
- F. Forest Stewardship Council (FSC)
  - 1. FSC STD-01-001 FSC Principles and Criteria for Forest Stewardship.

## PART 2 - PRODUCTS

## 2.1 WOOD DOOR CONSTRUCTION - GENERAL

- A. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
- B. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.

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- C. Give exposed wood parts of exterior doors a water-repellent preservative treatment in accordance with WDMA I.S.4.
- D. Glazing: Provide glazing for lites in doors in compliance with Section 08 80 10 Interior Glazing.
- E. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- F. Certified Wood: Fabricate doors produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- G. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- H. Edge Machining: Bevel lock and hinge edges 1/8 inch in 2 inches on all single acting doors. Bevel edges of double acting doors to rounded edges. Provide reverse bevel on meeting edge of inactive leaf of pairs of doors, except where exit devices are specified.
- I. Wood Beads for Light Openings in Wood Doors: Provide wood beads as follows unless otherwise indicated.
1. Wood Species: Same species and finish as door faces.
  2. Profile:
    - a. Typical: Flush rectangular beads.
      - 1) Size and Appearance: The size and profile of the wood bead and wood-veneered beads shall be consistent for all doors; except for fire doors with a rating greater than 90 minutes.
    - b. Fire Rated Doors with Fire Rating Greater than 90 minute: Manufacturer's standard shape.
  3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
  4. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
  5. Fire Rated Doors with Fire Rating Greater than 90 minute: Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-(1.2-mm-) thick, cold-rolled steel sheet; and approved for use in doors of fire-protection rating indicated. Provide the following factory finish:
    - a. At Doors with Transparent Finish: Factory primed for finish painting by Section 09 91 00 - Painting..
    - b. At Doors with Transparent Finish: Powder-coated or baked enamel finish to match color and gloss level of factory applied paint on face of door.
- J. Doors shall be constructed to allow the edge of glazed opening to be within 5-1/2 inches of the vertical edge and top edge of the door, where a glazing is indicated or required for the door. At full view opening the 5-1/2" dimension may increase to 6 inches.
- K. Edges:
1. Fire-Rated Doors: Provide integral concealed intumescent strip for doors required to comply with positive pressure tests under UL 10C or UBC 7-2. Surface-applied gasketing on frame not acceptable except for smoke seal.

2. Solid Core Edge Bands: Edges to be minimum 2 pieces of hardwood, laminated to 1-3/8" minimum thickness. Bond edges to core with waterproof glue.
  - a. Doors with Transparent Finish: Finish edges of stiles in solid wood to match face veneer. Face veneer shall lap solid wood edge in accordance with AWI 9.1.18.3 for Type A or D Edges.
  - b. Doors with Opaque Finish:
    - 1) Typical: Finish edges of stiles (lock and hinge) in specified polymer impact-resistant material; edging flush with door faces and attached with two serrated legs inserted into slots.
    - 2) Doors with Fire rating Greater than 20 Minutes: Finish edges of stiles in tight grain hardwood. Face veneer shall lap solid wood edge in accordance with AWI 9.1.18.3 for Type A or D Edges. Fill edge grain and sand smooth prior to finishing.

L. Louvers: Size as shown.

## 2.2 FLUSH DOORS

### A. Veneered-Faced Doors for Transparent Finish:

1. In accordance with WDMA I.S.1-A.
2. Veneer: Match D WD-1 specified in Section 06 40 00 – Architectural Woodwork.
3. Grade: Custom (Grade A faces).
4. Match between Veneer Leaves: Match D WD-1.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Core: As specified below.
7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press. Cold press construction not permitted; see DEFINITIONS in Part 1 above.
8. Adhesives: WDMA TM-6:
  - a. Doors exposed to Unconditioned Space: Type I.
  - b. Doors within Conditioned Space: Type II.
9. One species throughout the project unless scheduled or otherwise shown. See Door Schedule and Finish Schedule.

### B. Cores: Doors shall have a solid core:

1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.
  - a. Particleboard core is not permitted at doors indicated to receive glazing or exit device or doors exposed to unconditioned spaces.
  - b. Blocking: Provide wood blocking in particleboard-core doors as follows:
    - 1) Top Rail: 5-inch (125-mm) x continuous.
    - 2) Lock Blocks: Minimum 5" wide x 18" high.
    - 3) Exit Device: Minimum 5" wide x 18" high at each stile.
      - a) Bottom of double doors, lock side only, for attachment of vertical rod: 5" wide x 10" high.
2. Structural-Composite-Lumber-Core Doors:
  - a. Structural Composite Lumber: WDMA I.S.10.
    - 1) Screw Withdrawal, Face: 700 lbf.
    - 2) Screw Withdrawal, Edge: 400 lbf

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3. Mineral-Core Doors: Use only where required to obtain fire rating greater than 45 minutes.
    - a. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
    - b. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
      - 1) Top Rail: 5-inch (125-mm) x continuous.
      - 2) Lock Blocks: Minimum 4-1/2" wide x 10" high.
        - a) Both sides for attachment of exit devices.
        - b) Bottom of double doors, lock side only, for attachment of vertical rod.
      - 3) 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
      - 4) 5-inch (125-mm) x continuous midrail blocking, in doors indicated to have armor plates.
    - c. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

C. Fire rated wood doors:

1. Fire Performance Rating:
  - a. "B" label, 1-1/2 hours.
  - b. "C" label, 3/4 hour.
  - c. "D" label, 20 minute.
2. Labels: See QUALITY ASSURANCE
3. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:
  - a. Hinge Loading: WDMA T.M.8. Average of 10 test samples for Extra Heavy Duty doors.
    - 1) Direct Screw Withdrawal: Not less than 700 lbs.
  - b. Direct screw withdrawal: WDMA T.M.10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.
  - c. Cycle Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with WDMA T.M.7.
4. Additional Hardware Reinforcement:
  - a. Provide fire rated doors with hardware reinforcement blocking.
  - b. Size of lock blocks as required to secure hardware specified.
  - c. Top, bottom and intermediate rail blocks shall measure not less than 125 mm (five inches) minimum by full core width.
  - d. Reinforcement blocking in compliance with manufacturer's labeling requirements.
  - e. Mineral material similar to core is not acceptable.
5. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.
6. Special Features: Where doors are noted with an hourly fire-resistant rating, provide doors constructed, tested and approved by UL or other agency as approved by local building official in accordance with requirements of UL 10C. If any door specified or designated by the Architect to be fire-rated cannot qualify for appropriate labeling because of design, hardware or any other reason, modify such features as required for

required labeling and obtain Architect's approval of required modifications before commencing fabrication of unit. Where rated doors are scheduled, coordinate doors and frames with specified hardware to furnish a complete fire assembly. Fire dampers in door louvers to be UL listed for rating equal to that required for door assembly.

- a. Stiles for Mineral Core Doors: Provide with improved type stiles meeting the following requirements when tested with #12 wood screws.
  - 1) Split Resistance: Not less than 950 lbs. when tested in accordance with ASTM D143.

D. Smoke Barrier Doors:

- 1. For glazed openings use steel frames approved for use in labeled doors.
- 2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

E. Sound Rated Doors:

- 1. Fabricated as specified for flush wood doors with additional construction requirements to meet specified sound transmission class (STC).
- 2. STC Rating of the door assembly in place when tested in accordance with ASTM E90 by an independent nationally recognized acoustical testing laboratory not less than 31 and as specified in PERFORMANCE REQUIREMENTS.
- 3. Accessories:
  - a. Frame Gaskets: Continuous closed cell sponge neoprene with stop adjusters.
  - b. Automatic Door Bottom Seal:
    - 1) Steel spring operated, closed cell sponge neoprene metal mounted removable in extruded aluminum housing with a medium matte 0.1 mm (4.0 mil) thick clear Anodized finish.
    - 2) Concealed or Surface Mounted.

2.3 PREFINISH, PREFIT

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Drill pilot holes for hinges; verify screw size of proposed hinge manufacturer with Section 08 71 00 - Door Hardware; see "Coordination" under SUMMARY in Part 1 above.
- C. Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
  - 1. Fabricate door with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

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- D. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 10, Interior Glazing.
  3. Louvers: Factory install louvers in prepared openings.

## 2.4 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory, unless indicated otherwise.
- C. Transparent Finish: Provide transparent Finish in conformance with Section 06 40 00 - Architectural Woodwork.
1. Grade: Custom
  2. Appearance: Match color, texture, and sheen specified in Section 09 06 00 SCHEDULE FOR FINISHES for WDPL-1, and Architect's Sample.
- D. Opaque Finish:
1. Grade: Custom.
  2. Finish: WDMA OP-4 conversion varnish or OP-6 catalyzed polyurethane.
  3. Color: Match color, texture, and sheen specified in Section 09 06 00 SCHEDULE FOR FINISHES.
- E. Doors shall be individually packaged for delivery in opaque, moisture proof, polyethylene wrapping

## 2.5 IDENTIFICATION MARK:

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Accompanied by either of the following additional requirements:
1. An identification mark or a separate certification including name of inspection organization.
  2. Identification of standards for door, including glue type.
  3. Identification of veneer and quality certification.
  4. Identification of preservative treatment for stile and rail doors.

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## 2.6 TOLERANCES

- A. Doors shall be considered defective if they exceed any of the following tolerances:
1. Size: Thickness + 1/16", length + 1/16", standard widths + 1/16".
  2. Squareness: Diagonal measurement difference shall not exceed 1/8".
  3. Factory Hardware Preparation: Plus 1/32" on hinge preparation cut-outs. A plus 1/32", minus 0", on lock front preparation cut outs.
  4. Stile, rail and core show-through (telegraphing) shall not be considered a defect unless the face of the door varies from a true plane in excess of 1/100" in any 3" span.
  5. Warp:
    - a. 1/2 inch away from stop of a properly installed frame at any point or sufficient warp to prevent proper operation of hardware.
    - b. 1/4 inch in the plane of the door itself measured by placing a straight edge on the concave face and determining the maximum distance from straight edge to door face.
- B. Prefitting: Prefit swinging doors within plus or minus 1/32 inch to standard clearance allowance of 1/8 inch at top and each side and 1/2 inch at bottom, except where thresholds, undercuts, or other deviations from standard fit are noted. Prefit pairs of doors to 3/32 inch clearance at meeting stiles.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 DOOR PREPARATION

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
  2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
- C. Provide cutouts for special details required and specified.



- D. Route doors for hardware using templates and location heights specified in Section, 08 71 00, DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness undercut where shown.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.
- I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

### 3.3 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

- A. Installation of Doors: Hang doors scheduled on drawings in locations indicated.
  - 1. Where doors have been prefinished before hanging, exercise care to protect finishes from damage during hanging.
  - 2. Install doors in accordance with AWI 9 for Premium Grade, NFPA 80, and manufacturer's recommendations.
  - 3. Hanging: Hang doors to clearances specified for "Prefitting" under TOLERANCES in Part 2 above, unless specifically noted for "undercuts" or other deviations in fit.
    - a. Verify clearance required for carpeting and make no job site cuts unless approved.
    - b. Except where undercuts of designated size are required, no additional bottom cut needed where finish flooring reduces specified clearance as long as door swings freely and does not contact flooring.
- B. Hardware: Install hardware for doors provided under this Section as specified in Section 08 71 00, DOOR HARDWARE and in accordance with applicable portions of DHI A115.
- C. Demonstration: Upon completion of hanging, demonstrate that doors operate freely without binding and will latch properly when closed with moderate pressure.

### 3.4 DOOR PROTECTION

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.
- B. Provide protective covering over knobs and handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by Resident Engineer.

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**SECTION 08 31 13**  
**ACCESS DOORS AND FRAMES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Section Includes: Access doors in walls, partitions or ceilings included under General Contract work. Doors are:
  - 1. Furnished and installed by General Trades where directed by mechanical/electrical trades and approved by Architect.
  - 2. Required for access to mechanical/electrical equipment and devices which are otherwise not accessible due to permanent General Trades work.
- B. Coordinate requirements with Divisions 21 through 28 for location.
- C. Single Source: Access doors must be from single manufacturer to maintain continuity of appearance. Access doors in individual rooms or areas must match in appearance for their application; e.g. all ceiling panels match and all wall panels match.

**1.2 RELATED WORK**

- A. Section 01 31 14: Mechanical & Electrical Coordination Drawings
- B. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
- C. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Access doors in acoustical ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.
- E. Other Access Doors:
  - 1. Section 09 54 23 - Metal Ceilings.
- F. Access doors located in construction not provided by General Trades Contractor, i.e. ducts, air-handling equipment; these doors provided under applicable Division 23 & 26 trades
- G. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS; Section 23 37 00, AIR OUTLETS AND INLETS.

**1.3 DEFINITIONS**

- A. See DEFINITIONS in Section 09 29 00 - Gypsum Board.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Access doors, each type, showing construction, location and installation details. Show details of units; indicate materials, gages, finishes, sizes, adjacent substrates

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methods of attachment, and fire rating where applicable. Indicate types of locking devices.

- B. Manufacturer's Literature and Data: Access doors, each type.

1.5 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
1. A1008 Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS):
1. D1.3 Structural Welding Code Sheet Steel
- D. National Fire Protection Association (NFPA):
1. 80 Fire Doors and Windows
- E. The National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500 Series Metal Finishes Manual
- F. Underwriters Laboratories, Inc. (UL):
1. Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

- A. Fabricate components to be straight, square, flat and in same plane where required.
1. Slightly round exposed edges and without burrs, snags and sharp edges.
  2. Exposed welds continuous and ground smooth.
  3. Weld in accordance with AWS D1.3.
- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

2.2 ACCESS DOORS, FIRE RATED

- A. Unless indicated otherwise, provide as follows:
1. Frame type compatible with wall construction.
  2. Minimum fire resistance ratings as required for opening protectives by the Building Code.
  3. 24" x 24" size, unless indicated otherwise.

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- B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for openings in fire rated construction.
1. Access door shall have appropriate UL label, or other nationally recognized laboratory label, permanently attached on side not visible to public.
- C. Door Panel: Form of 0.9 mm (0.0359 inch) thick steel sheet, insulated sandwich type construction.
- D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
1. Weld exposed joints in flange and grind smooth.
  2. Access Panel in Concrete and Masonry: Provide frame flange at perimeter. .
  3. Access Panel in Gypsum Board Walls and Ceilings: Provide 1" drywall bead flange, that conceals fasteners, and designed to be tapped and spackled, and provide smooth appearance.
  4. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.
- E. Automatic Closing Device: Provide automatic closing device for door.
- F. Hinge: Continuous steel hinge with steel pin.
- G. Lock:
1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
  2. Provide latch release device operable from inside of door. Mortise case in door.

### 2.3 ACCESS DOORS, FLUSH PANEL

- A. Door Panel:
1. Form of 1.9 mm (0.0747 inch) thick steel 1.5 mm (0.0598 inch) thick steel sheet.
  2. Reinforce to maintain flat surface.
- B. Frame:
1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed.
  2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
  3. Weld exposed joints in flange and grind smooth.
  4. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.
- C. Hinge:
1. Concealed spring hinge to allow panel to open 175 degrees.
  2. Provide removable hinge pin to allow removal of panel from frame.
- D. Lock:

1. Flush, screwdriver operated cam lock.
2. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.

## 2.4 ACCESS DOOR, RECESSED DOOR PANEL

### A. Door Panel:

1. Form of 1.2 mm (0.0478 inch) thick steel sheet to form a 25 mm (one inch) deep recessed pan to accommodate the installation of acoustical units, acoustical plaster, gypsum board, or other materials where shown in walls and ceiling.
2. Reinforce as required to prevent sagging.
3. Finish face of access door shall be coplanar with adjacent finish wall surface.

### B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing. Concealed Metal Frame.
  - a. Frame Flange:
    - 1) Gypsum Board: Drywall bead that is designed to be tapped and spackled, and provide smooth appearance.
    - 2) Plaster:  $\frac{3}{4}$ " plaster guard with 3" wide expanded metal lath for plaster engagement at edge of door.
    - 3) Acoustical Tile Insert: Extend sides of frame to protect edge of acoustical units when panel is in open position.
2. Provide shims, bushings, clips and other devices necessary for installation.
3. Fasteners: Concealed from view.

### C. Hinge: Continuous steel hinge with steel pin or concealed hinge.

### D. Lock:

1. Flush screwdriver operated cam lock.
2. Provide sleeve of plastic or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.
3. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.

## 2.5 FINISH

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

## 2.6 SIZE

- A. Minimum 600 mm (24 inches) square door unless otherwise shown.

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**PART 3 - EXECUTION****3.1 LOCATION**

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use fire rated doors in fire rated partitions and ceilings.
- C. Use flush panels in partitions and gypsum board or plaster ceilings in spaces exposed to public view; except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.
- D. Use recessed panel access doors in spaces exposed to public view; except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

**3.2 INSTALLATION, GENERAL**

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.
- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.
- D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

**3.3 ANCHORAGE**

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.
- C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

**3.4 ADJUSTMENT**

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

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SECTION 08 33 23  
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes:
1. Overhead Coiling Doors.
  2. Coiling doors are electrically operated unless noted otherwise.
  3. Controls.

1.2 RELATED WORK

- A. Exposed finish on metal surfaces: Section 05 05 13, Shop Applied Coatings for Metal
- B. Lock cylinders for cylindrical locks: Section 08 71 00, DOOR HARDWARE.
- C. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Field painting: Section 09 91 00, PAINTING.
- E. Electric devices and wiring: DIVISION 26, ELECTRICAL.
- F. Magnetic Lock: Division 28.

1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS

- A. Coiling doors shall be products of manufacturers regularly engaged in manufacturing items of type specified.
- B. Install items under direct supervision of manufacturer's representative or trained personnel.

1.4 DESIGN REQUIREMENTS

- A. Coiling doors shall be spring counter balanced, overhead coiling type, inside face mounted with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- B. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
1. All rolling doors shall be designed to a standard maximum of 25 cycles per day and an overall maximum of 50,000 operating cycles for the life of the door.
- C. All motor operators shall have manual emergency mechanical operators.

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## 1.5 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design Exterior overhead Coiling Doors, including comprehensive engineering analysis by a qualified Professional Engineer, using performance requirements and design requirements indicated.
- B. Structural Design: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
  - 1. Wind Loads: See Section 01 83 16.13 - Exterior Wind Enclosure Requirements, but not less than 55 pounds per square foot positive and negative wind pressure.
  - 2. Importance Factor: See Structural Drawings.
  - 3. Exposure Category: See Structural Drawings.
  - 4. Safety Factor: 1.5.
- C. Exterior doors, hardware, and anchors shall be designed to withstand a horizontal or wind pressure, indicated above, of door area without damage.
- D. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- E. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

## 1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Engineer's Seal/Signature: Shop drawings and associated calculations required for structural design shall bear seal and signature of curtain wall manufacturer's Professional Engineer. See Professional Engineer under Quality Assurance below, and "Structural Calculations" below.
- C. Shop Drawings:
  - 1. Each type of door showing details of construction, accessories and hardware, electrical and mechanical items, supporting brackets for motors, location, and ratings of motors, and safety devices.
  - 2. Show locations for activation devices (key controls, push buttons).
  - 3. Wiring diagrams for motors and controls, including wiring diagram for door, showing electrical interlock of motor with manually operated dead lock, electrical rough-in. Submittal is for information only, and will not be reviewed or approved.
- D. Delegated-Design Submittal: For exterior overhead coiling doors, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Summary of forces and loads on walls and jambs.
- E. Manufacturer's Literature and Data:
  - 1. Brochures or catalog cuts, each type door.
  - 2. Manufacturer's installation procedures and instructions.
  - 3. Maintenance instructions and parts lists.



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F. Certificates:

1. Attesting door's, anchors and hardware will withstand the horizontal loads specified.

## 1.7 QUALITY ASSURANCE

- A. Work shall be performed by Contractor specializing in this type of work and having experience on similar installations under like conditions, and trained and approved by over.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- C. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
  1. Obtain operators and controls from overhead coiling door manufacturer.
- D. All electrical work in accordance with the National Electrical Code.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Louisiana and who has a minimum of 10 years experience in providing engineering services of the kind indicated.
- F. Each door shall have a permanent metal label on interior side of door indicating the maximum positive and negative wind pressure, in pounds per square foot, it is designed to withstand. Door shall be in conformance with Performance Requirements and Design Requirements for the wind pressures stated on label.

## 1.8 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):
  1. A36/A36M-05 Structural Steel
  2. A653/A653M-07 Steel Sheet, Zinc-Coated (Galvanized) Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  3. B209/209M-06 Aluminum and Aluminum-Alloy Sheet and Plate
  4. B221/B221M-06 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- C. National Electrical Manufacturers Association (NEMA):
  1. ICS 1-00(R2005) Industrial Control and Systems General Requirements
  2. ICS 2-00(R2005) Industrial Control, and Systems, Controllers, Contactors, and Overload Relays
  3. ICS 6-93 (R2006) Industrial Control and Systems Enclosures
  4. MG 1-06 Motors and Generators
  5. ST 20-92 (RI997) Dry-Type Transformers for General Applications
- D. Master Painters Institute (MPI):
  1. MPI #35 Exterior Bituminous Coating

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E. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500 Series Metal Finishes Manual
2. 2603-02 Pigmented Organic Coatings on Aluminum Extrusions and Panels; Voluntary Specification, Performance Requirements and Test Procedures for.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Steel: A653 for forming operation. ASTM A36 for structural sections.
- B. Bituminous Coating: MPI No. 35.

2.2 FABRICATION

- A. Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Form of interlocking slats of galvanized steel of shapes standard with the manufacturer, except that slats for exterior doors shall be flat type.
    - a. Galvanized steel, G90 coating exterior (G60 interior), Structural Quality Grade C, as per ASTM A 653/ A 653 M.
  2. Thickness of slats shall be as required to resist loads specified except not less than the following:
    - a. For doors less than 15 feet wide: 0.0299 inch.
    - b. For doors from 15 feet 1 inch to 21 feet wide: 0.0359 inch.
    - c. For doors wider than 21 feet 1 inch: 0.0478 inch.
  3. Exterior doors: Provide outer slat as described above with an inner slat of not less than 0.040 inch. Fill slats of doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
- B. Endlocks and Windlocks:
1. Manufacturer's stock design of galvanized malleable iron or galvanized steel or stamped cadmium steel for doors.
  2. The ends of each slat for exterior doors and interior doors shall have endlocks.
  3. Doors shall have windlocks at ends of at least every sixth slat. Windlocks shall prevent curtain from leaving guide because of deflection from wind pressure or other forces.
- C. Bottom Bar:
1. Two angles of equal weight, one on each side, standard extruded aluminum members not less than 0.125 inches thick.
  2. Bottom bar designed to receive weather-stripping and safety device, and be securely fastened to bottom of curtain.

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D. Barrel and Spring Counterbalance:

1. Curtain shall coil on a barrel supported at end of opening on brackets and be balanced by helical springs.
2. Barrel fabricated of steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain, to limit deflection with curtain rolled up, not to exceed 1 in 0.03 inch per foot of span.
  - a. Door Tube Diameter: Not less than 6 inches.
  - b. Shutter Tube Diameter: Not less than 4 inches.
3. Close ends of barrel with cast iron plugs, machined to fit the opening.
4. Within the barrel, install an oil-tempered, helical, counter balancing steel spring, capable of producing sufficient torque to assure easy operation of coiling doors from any position.
5. At least 80 percent of door's weight shall be counter balanced at any position.
6. Spring-tension shall be adjustable from outside of bracket without removing the hood or motor operator.

E. Brackets:

1. Steel plate designed to form end closure and support for hood and the end of the barrel assembly.
2. End of barrel or shaft shall screw into bracket hubs fabricated of cast iron or steel.
3. Equip bracket hubs or barrel plugs with pre-lubricated ball bearings, shielded or sealed.

F. Hoods:

1. Steel galvanized, 0.0239 inch thick
2. Aluminum, not less than 0.040 inch thick
3. Form hood to fit contour of end brackets.
4. Reinforce at top and bottom edges with rolled beads, rods or angles. Hoods more than 12 feet in length shall have intermediate supporting brackets.
5. Fasten to brackets with screws or bolts and provide for attachment to wall with bolts.
6. At exterior doors provide weather baffle at the lintel or inside the hood to minimize seepage of air through the hood enclosure.

G. Guides:

1. Manufacturer's standard formed sections or angles of steel.
  - a. Steel sections not less than 5 mm (3/16 inch) thick.
2. Form a channel pocket of sufficient depth to retain the curtain in place under the horizontal pressure specified, and prevent ends of curtain from slipping out of guide slots.
3. Top sections flared for smooth entry of curtain to vertical sections that will facilitate entry of curtain.
4. Provide stops to limit curtain travel above top of guides.
5. Provide guide of aluminum with replaceable wear strips to prevent metal to metal contact.
6. Mounting brackets shall provide closure between guides and jambs.

H. Weather-stripping:

1. Motor Operated Doors: Bottom bar safety device shall be a combination compressible seal and safety device as specified in paragraph, ELECTRIC MOTOR OPERATORS.
2. At exterior doors provide replaceable sweep type continuous vinyl or neoprene weather seals on guides and across head on exterior to seal against wind infiltration.

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I. Locking:

1. Cylinder locks shall receive standard screw in cylinders furnished under Section, 08 71 00 - Door Hardware.
2. For motor operated doors, provide manufacturer's standard cylinder dead lock type locking device on the inside, key operated from both sides, interlocked with motor to prevent motor from operating when locks are activated.

J. Support tubes:

1. Material and Fabrication: Steel or aluminum tubes as specified in Section 05 50 00 - Metal Fabrications, of sizes recommended size by manufacturer and meet performance requirements. Tube shall span from floor to structure above; and connect to structure above with clip angle designed to allow 3/4" deflection of structure.
2. Steel at Exterior Wall: Provide Steel which shall be hot dipped galvanized finish.

2.3 ELECTRIC MOTOR OPERATORS

A. Provide operators complete with electric motor, machine cut reduction gears, steel chain and sprockets, magnetic brake, overload protection, brackets, push button controls, limit switches, magnetic reversing contactor, and other accessories necessary for proper operation including emergency manual operator.

B. Design:

1. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency manual operators.
2. Make provision for emergency manual operation of door by chain-gear mechanism.
3. Arrange the emergency manual operating mechanism so that it may be immediately put into and out of operation from the floor with an electrical or mechanical device, which will disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged, and its use shall not affect the timing of the limit switches, in case of electrical failure.
4. Provide interlock with motor to prevent motor from operating when manual locks are activated.

C. Motors:

1. Motors shall conform to NEMA MG1, suitable for operation on current of the characteristics indicated, and shall operate at not more than 3600 rpm. Single-phase motors shall not have commutation or more than one starting contact. Motor enclosures shall be the drip proof type of NEMA TENV type.
2. Motors shall be high starting torque, reversible type, of sufficient horsepower and torque output to move the door in either direction from any position, and produce a door travel speed of not less than 0.66 foot or more than 1 foot per second, without exceeding the rated capacity.

D. Controls:

1. The control equipment shall conform to NEMA ICS 1 and 2.
2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that Contractor enclosures may be Type 1.
3. Remote control switches shall be at least 1500 mm (5 feet) above the floor line, and located so that the operator will have complete visibility of the door at all times.

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4. Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload protection, solenoid operated brake, limit switches, and remote control switches at locations designated by the Resident Engineer.
  5. Use key activated switches on exterior requiring constant pressure to operate.
  6. Use three-button type, push button switch on interior, unless noted to be key activated, with the buttons marked, OPEN, CLOSE, and STOP.
    - a. The OPEN and STOP buttons shall be of the type requiring only momentary pressure to operate. The CLOSE button shall be of the type requiring constant pressure to maintain the closing motion of the door. When the door is in motion, and the STOP button is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door may then be operated in either direction by the OPEN or CLOSE buttons.
    - b. Push buttons shall be full-guarded to prevent accidental operation.
  7. Provide limit switches to automatically stop the doors at their fully open and closed positions. Positions of the limit switches shall be readily adjustable.
  8. Safety device:
    - a. The bottom bar of power-operated doors shall have a fail safe safety device that will immediately stop and reverse the door in its closing travel upon contact with an obstruction in the door opening, or upon failure of the device, or any component of the device, or any component of the control system, and cause the door to return to its full open position. The door closing circuit shall be electrically locked out, and the door shall be operable manually until the failure or damage has been corrected.
    - b. Safety device shall not be used as a limit switch.
    - c. Safety device connecting cable to motor shall be flexible "Type SO" cable and spring loaded automatic take up reel or equivalent device, as required for proper operation of the doors.
  9. Transformer:
    - a. Provide a control transformer in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.
    - b. The transformer shall conform to NEMA ST20.
  10. Electrical components shall conform to NFPA 70. Electrical materials, equipment, and devices for installation in hazardous locations as defined by NFPA 70 shall be specifically approved by Underwriters Laboratories for the particular chemical group and the class and division of hazardous location involved.

## 2.4 FINISHES

### A. Steel:

1. Clean surfaces of steel free from scale, rust, oil and grease, and then apply a light colored shop prime paint after fabrication.
2. Non-galvanized steel: Treat to assure maximum paint adherence, and apply corrosion inhibitive primer.
3. Galvanized steel: Apply a phosphate treatment and a corrosion inhibitive primer compatible with finish coat.
4. Baked-Enamel or Powder-Coated Finish:

- a. Color:
- 1) Exterior: Custom Color as selected by Architect, see Section 09 06 00, SCHEDULE FOR FINISHES.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install doors in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories accurately.
- C. Securely attach guides to adjoining construction with not less than 9 mm (3/8 inch) diameter bolts, near each end and spaced not over 600 mm (24 inches) apart.
- D. Locate control switches where shown. If not shown locate control switches where designated by Resident Engineer.
- E. Install all electric devices and wiring as specified in DIVISION 26 ELECTRICAL and DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

#### 3.2 REPAIR

- A. Repair prime painted zinc-coated surfaces and bare zinc-coated surfaces that are damaged by the application of galvanizing repair compound. Spot prime all damaged shop prime painted surfaces including repaired prime painted zinc-coated surfaces.
- B. Coiling Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

#### 3.3 PROTECTION

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze or other metals not compatible with aluminum by one of the following:
  1. Paint the dissimilar metal with a prime coat of zinc-Molybdate or other suitable primer, followed by two coats of aluminum paint.
  2. Place an approved caulking compound, or a non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster or other masonry materials with a coat of bituminous paint.
- C. Paint aluminum in contact with wood or other absorptive materials, which may repeatedly become wet, with a coat of bituminous paint or two coats of aluminum paint.

## 3.4 INSPECTION

- A. Upon completion, doors shall be weathertight and doors shall be free from warp, twist, or distortion.

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SECTION 08 41 13  
INTERIOR ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies aluminum storefront work for interior applications including all components to make a complete assembly.
1. Delegated Design.
  2. Glass and Glazing for glazed framing systems provided under this Section.
  3. Sealant work associated with systems provided under this Section
  4. Engineering design, shop drawings, calculations, testing.
  5. Supports, bracing, reinforcing, and anchorage not shown on Structural Drawings, but required to meet performance requirements and for structural integrity of completed work.

1.2 RELATED WORK

- A. Metal Finishes: Section 05 05 13, Shop-Applied Coatings for Metal.
- B. Firestopping: Section 07 84 00.
- C. Glass and Glazing: Sections 08 80 10, Interior Glazing, and 08 88 53, Security Glazing.
- D. Finish Appearance including texture and color: Section 09 06 00, Schedule for Finishes.
- E. Fire Suppression Systems: Appropriate Division 21 Section(s).
1. Prior to Shop Drawing submission, obtain information from Fire Suppression System Trade Contractor necessary for proper coordination of sprinkler pipe covers with sprinkler piping and heads.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples.
- B. Engineer's Seal/Signature: Shop drawings and associated calculations required for structural design shall bear seal and signature of framing manufacturer's Professional Engineer. See Professional Engineer under QUALITY ASSURANCE below, and "Structural Calculations" below.
- C. Structural Calculations: Submit triplicate copies of structural calculations made by or for glazed framing manufacturer in connection with design and detailing of the glazed framing work, including connections and attachments. Submittals may or may not be returned, and will not bear stamp of approval. Base calculations on worst case conditions for all allowable variations, tolerances, and connections. Calculations shall be performed by or under direct supervision of



manufacturer's Professional Engineer. . Calculations shall be sealed and signed, and shall include:

1. Direction and magnitude of thermal expansion; direction and magnitude of applicable building and seismic movements.
2. Structural forces imposed on the building structure under all conditions of construction and loading, as specified.
3. Section property computations for framing members.

D. Shop Drawings: 1/2 full scale; show construction, anchorage, reinforcement, and installation details.

1. Show coordination of sprinkler pipe cover with fire suppression system components based on information obtained from Fire Suppression System Trade Contractor. Describe installation sequence.

E. Manufacturer's Literature and Data.

F. Samples:

1. Two samples of each surface finish type, material, and color required showing maximum shade range.
2. Three samples of the following framing member corner conditions; 12 inches long each way minimum; include glass of any kind except match required thickness.
  - a. Capture glazing-to-capture glazing.
  - b. Capture glazing-to-structural glazing.
3. Three samples of sprinkler pipe cover; include one horizontal support and bottom closure condition; 12 inches long minimum.

G. Manufacturer's Certificates:

1. Stating that aluminum has been given specified thickness of anodizing.
2. Indicating manufacturer's qualifications specified.

#### 1.4 QUALITY ASSURANCE

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.
- C. Professional Engineer Qualifications: A professional engineer legally qualified to practice in State of Louisiana with at least 10 years of experience in similar systems in providing engineering services of kind required.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.

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- C. Protect from damage from handling, weather and construction operations before, during and after installation.

#### 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications may be referenced in the text by the basic designation only. Follow latest editions unless otherwise indicated.
- B. American National Standards Institute (ANSI):
1. Z97.1 Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test
- C. American Society for Testing and Materials (ASTM):
1. B209 Aluminum and Aluminum-Alloy Sheet and Plate
  2. B221 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  3. E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  4. E331 Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
  5. F468 Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  6. F593 Stainless Steel Bolts, Hex Cap Screws, and Studs
- D. American Architectural Manufacturer's Association (AAMA):
1. 2604 High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS):
1. D1.2 Structural Welding Code - Aluminum
- F. Consumer Product Safety Commission (CPSC):
1. 16 CFR 1201 Architectural Glazing Standards and Related Material
- G. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500 Series Metal Finishes Manual

#### 1.7 PERFORMANCE REQUIREMENTS

- A. Shapes and thickness of framing members, including mullions, shall be sufficient to withstand a design wind load of not less than 1.4 kilopascals (30 pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.

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- B. Air Infiltration: When tested in accordance with ASTM E283, air infiltration shall not exceed 2.63 x 10-50 cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.
  - C. Water Penetration: When tested in accordance with ASTM E331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.
  - D. Sprinkler pipe covers shall visually conceal the fire suppression system but in no way impinge upon or deter the function or acceptability of the fire suppression system to the Authorities Having Jurisdiction.
  - E. Glazing shall meet requirements of the following:
    - 1. CPSC16 CFR, Part 1201.
    - 2. ANSI Z97.1.

#### 1.8 DESIGN REQUIREMENTS

- A. Aesthetic Design: Work shall meet the aesthetic design intent indicated on the drawings and specified herein including, but not limited to, the following:
  - 1. System Type: Unitized; externally glazed; perimeter members and intermediate mullions.
  - 2. Framing profiles and dimensions including framing width and depth.
    - a. Provide reinforcement concealed within framing if and as required to meet performance requirements.
  - 3. Provide the following glazing methods where indicated:
    - a. Mechanically captured with retainers and caps.
    - b. Structurally glazed (butt glazed).
- B. Structural:
  - 1. General Support:
    - a. Edge of slab supported.
    - b. Gravity attachment at top.
    - c. One story high.
  - 2. All eccentricity taken by storefront framing and not transferred to anchors or building structure.
  - 3. Movement and Loads: See PERFORMANCE REQUIREMENTS above.
- C. Contractor has sole responsible for engineering design of the systems meeting the design and performance criteria.
- D. See "Engineer's Seal/Signature" under SUBMITTALS in PART 1.
- E. Accessories: See COVERS AND TRIM in PART 2 below.

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PART 2 - PRODUCTS

## 2.1 MATERIALS

## A. Aluminum: ASTM B209 and B221.

1. Alloy 6063 temper T5 typical.
2. Alloy 6061 temper T6 for extruded structural members.
3. For color anodized finish, use aluminum alloy as required to produce specified color.

## B. Fasteners:

1. Aluminum: ASTM F468, Alloy 2024.
2. Stainless Steel: ASTM F593, Alloy Groups 1, 2, and 3.

## C. Glass and Glazing: Comply with Section 08 80 10, Interior Glazing, and manufacturer's recommendations.

## D. Other: As required for a complete installation.

## 2.2 FABRICATION

## A. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.

## B. Accurately form metal parts and accurately fit and rigidly assemble joints except those joints designed to accommodate movement. Seal joints to prevent leakage of air. Joints to be hairline or better.

## C. Exposed Break Metal: Fabricate work true to detail with sharp, clean profiles, straight and free from defects, dents, marks, indentations, waves, or flaws of any nature impairing strength or appearance, fitted with proper joints and intersections, and with the specified finishes.

## D. Make welds in aluminum in accordance with the recommended practice AWS D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no visible evidence, including distortion or discoloration, on the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.

## E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to ensure proper assembly in the field.

## F. Provide framing with removable stops to allow replacement of glass.

## 2.3 PROTECTION OF ALUMINUM

## A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following. Materials shall comply with Section 01 81 13, Sustainable Design Requirements.

1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.

2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

## 2.4 FRAMING

- A. Fabricate framing for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Use concealed screws, bolts, and other fasteners.

## 2.5 COVERS AND TRIM

- A. General: Provide break metal covers, closures, reveals, trim and other related work as indicated or necessary for a complete installation:
  1. Fabricate from 1.5 mm (0.0625 inch) thick sheet aluminum of longest available lengths.
  2. Use concealed fasteners.
  3. Provide aluminum stiffener and other supporting members shown or as required to maintain the integrity of the components.
  4. Metal Finishes:
    - a. Exposed Surfaces: Match storefront framing.
    - b. All Surfaces of the Sprinkler Pipe Cover System: Match storefront framing.
    - c. Other Surfaces: Manufacturer's standard corrosion-resistant system.
- B. Sprinkler Pipe Cover System: Provide aluminum sprinkler pipe enclosure system including covers (caps), pipe plate guides, and semi-concealed supports (1/4 inch thick minimum) extending through the storefront system and anchored to structural steel tubes. Close bottom of covers.
- C. Fire Safing Integral with Storefront System: As indicated on Drawings; comply with Section 07 84 00, Firestopping.

## 2.6 FINISHES

- A. All: Comply with Section 05 05 13, Shop-Applied Coatings for Metal.
- B. Exposed Surfaces: As indicated in Section 09 06 00, Schedule for Finishes.
- C. Concealed Surfaces: Manufacturer's standard finishes meeting the requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Prior to installation of framing system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive framing work included herein.

1. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this Section is to be performed to verify that work may properly commence.
- B. Acts of omissions by other parties that may modify the Warranty shall be brought to the Resident Engineer's and Architect's attention, in writing, within 7 days of initial awareness.
- C. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor-to-floor heights, minimum clearances between framing and structural frames, and other permissible dimensional tolerances in building frame.
- D. Proceed only after satisfactory conditions are established. Starting Work indicates installer's acceptance of conditions.

### 3.2 INSTALLATION

- A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (8 feet), non-accumulative, is maximum permissible for plumb, level, warp, bow, and alignment.
- B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.
- C. Where work is installed within masonry or concrete openings, place no parts other than built-in anchors and provision for operating devices located in the floor, until after the masonry or concrete work is completed.
- D. Coordinate installation with adjacent work including work of Division 21, Fire Suppression.

### 3.3 ADJUSTING

- A. After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

### 3.4 PROTECTION, CLEANING, AND REPAIRING

- A. Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

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SECTION 08 41 26  
INTERIOR ALL-GLASS ENTRANCES AND STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Laminated glass door units.
2. Sidelights.
3. Transoms.

B. Products Installed but not Furnished Under this Section:

1. Lock cylinder: Section 08 71 00.

C. Work Specified Elsewhere, but provided under This Section:

1. Door hardware for doors specified in this Section: Section 08 71 00 - Door Hardware.

D. Related Sections:

1. Sealants: Section 07 92 00 - Joint Sealants.
2. Glass and Glazing: Section 08 80 10, Interior Glazing.
3. Door Hardware: Section 08 71 00.
4. Electronic safety and Security: Division 28.

1.2 REFERENCES (Latest edition unless otherwise noted.)

A. Uniform Federal Accessibility Standards (UFAS).

B. International Code Council/American National Standard (ICC/ANSI):

1. A 117.1 Accessible and Usable Buildings and Facilities.

C. National Association of Architectural Metal Manufacturers (NAAMM):

1. Metal Finishes Manual.

1.3 DESIGN REQUIREMENTS DESCRIPTION

- A. The Drawings show aesthetic design intent. Products provided must conform to design intent shown and PERFORMANCE REQUIREMENTS specified.

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#### 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: All-glass systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: All-glass systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
  - 1. Wind Pressure: 20 pounds per square foot.
  - 2. Deflection Limits: Deflection normal to glazing plane is limited to 1/350.
- C. Delegated Design: Design all-glass systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

#### 1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Prepared by Interior All-Glass Entrances and Storefront system manufacturer. Shop Drawings shall be signed and sealed by a qualified professional engineer, responsible for their preparation, and include the manufacturer's name and trademark on each shop drawing. Include complete elevations of all systems; details and methods of anchorage; details of construction; finishes; methods of assembly; location and installation of hardware and reinforcement for same; size, shape and thickness of materials; joints and connections; details of joining with other work.
- C. Samples: Exposed metal facing or framing materials showing proposed finish, clearly identified as to type of finish.
  - 1. Samples of extrusions shall be minimum 12" long.
  - 2. Materials installed shall be within range of approved samples.
- D. Door Hardware: Provide Submittals for door hardware provide by this Section, in conformance with Section 08 71 00, Door Hardware.
- E. Manufacturer's Certification: See "Manufacturer's Certifications" under QUALITY ASSURANCE below. Submit manufacturer's certification of the Interior All-Glass Entrances and Storefront System.
- F. Product Data: Furnish manufacturer's written data including fabrication, finishing, hardware, accessories and other components of work. Substantiate that products meet or exceed performance requirements specified herein.
- G. Maintenance Data: Furnish written instructions to Owner describing recommended materials and methods for proper maintenance.
  - 1. Provide adjusting wrenches and other tools necessary for door adjustment and maintenance.
  - 2. Tag tools for positive identification and deliver to Owner prior to acceptance of work.



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- H. Silicone Sealants: Provide Shop Drawings, Product Data, and Samples in compliance with Section 07 92 00, Joint Sealants.
  - I. Glazing Sealants: Provide Shop Drawings, Product Data, and Samples in compliance with Section 08 80 10, Interior Glazing.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer: Provide units produced by a firm with not less than five (5) years of successful experience in fabrication of all glass entrances of type required for this project.
- B. Coordinate installation of all-glass entrances with work of other trades. Provide installation templates, inserts, and anchorage devices so as to avoid delays in other work.
- C. Installer Qualifications: Manufacturer's authorized representative who is factory-trained and approved for installation of units required for this Project.
- D. Engineering Responsibility: Prepare data for all-glass systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- E. Source Limitations: Obtain all-glass systems from single source from single manufacturer.
- F. Accessible All-Glass Entrance Doors: Comply with applicable provisions in UFAS.
- G. Manufacturer's Certifications: See SUBMITTALS above.
  - 1. Design Certification Submit material manufacturer's certification that he has reviewed the design specifications and that his materials, and door hardware provided by this Section, are appropriate for the conditions shown on drawings.
- H. Preinstallation Conference: Conduct conference at Project site.

#### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Pack and brace doors carefully. No damaged assemblies will be accepted.
- B. Store materials at job site so as to prevent damage to members or assemblies, and protect from corrosion or deterioration.
- C. Protect exposed surfaces against damage by staining, abrasion or other injury.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer and installer agree to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty to provide full labor and materials as required to restore system to meet requirements of specification and restore or replace defective materials without cost to Owner.
  - 1. Failures include, but are not limited to, the following:

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- a. Structural failures including excessive deflection.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - c. Failure of operating components.
  2. Warranty Period: ten years from date of Substantial Completion, including glazing.
- B. Defective Work:
1. Promptly undertake corrective action upon receipt of written notice from the Owner of defective work discovered during the warranty period.
  2. Pay for exploratory work necessary to determine the cause of the defect.
  3. Corrective work required shall extend the warranty period for that portion of the Work for an additional five years.

## PART 2 - PRODUCT

### 2.1 MANUFACTURERS

- A. 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:
1. Virginia Glass.
    - a. Type "P".
  2. Blumcraft of Pittsburgh.

### 2.2 MATERIALS

- A. General: Provide sheet metals selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, stains, discoloration or other imperfections.
- B. Exposed Metal:
1. Stainless steel, typical.
- C. Stainless Steel:
1. Type: Austenitic grades, AISI Type as follows:
    - a. Interior: 304.
  2. Sheet, Plate, and Flat Bars: ASTM A666.
  3. Bars and Shapes: ASTM A276.
  4. Plate or Sheet: ASTM A167.
  5. Shapes: ASTM A276.
  6. Tubing: ASTM A269, seamless steel tubing.
  7. Pipe: ASTM A312, seamless steel pipe.
  8. Castings: ASTM A743, iron-chromium-nickel alloy.
- D. Aluminum:

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1. Extruded Shapes: ASTM B221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5.
  2. Sheet: ASTM B209.
- E. Rails: Top and bottom, solid extruded aluminum, rectangular profile. Cover all exposed surfaces with stainless steel cladding.
1. Sizes: See drawings.
    - a. Bottom Rail at Doors: Comply with requirements of UFAS.
- F. Steel Supports: Manufacturer's standard, mild steel.
- G. Anchorages and Fastenings: Manufacturer's standard, concealed except where otherwise indicated. Finish heads of exposed fasteners to match adjacent metal surfaces. Do not use exposed fasteners except where approved by Architect.
- H. Glass: Provide clear fully tempered glass in compliance with Section 08 80 10, Interior Glazing.
1. Minimum Thickness: 1/2".
  2. Glass shall be certified by the Safety Glazing Certification Council in compliance with: ANSI Z97.1.
    - a. CPSC 16 CFR Part 1201 Category II.
  3. Exposed Edges: Machine ground and flat polished.
  4. Butt Edges: Flat ground.
  5. Corner Edges: Lap-joint corners with exposed edges polished.
- I. Sealants: Products per Section 07 92 00 – Sealants, except glazing sealant, and meeting the following requirements.
1. Non-Moving Joints Within Entrance Assembly: Low or medium modulus silicone.
  2. Moving Joints Between Components:
    - a. Perimeter Joints Not Involving Glazing: Provided under Division 7.
    - b. Other Joints within System: High range type; i.e.: low modulus silicones, all as approved by manufacturer as being suitable for application and compatible with seals of insulated glazing units where applicable.
  3. Glazing Sealant: Provide in compliance with Section 08 80 10, Interior Glazing.
- J. Door Hardware: Provide door hardware in conformance with Section 08 71 00, Door Hardware, Door Schedule, and drawings.
1. Thresholds: No threshold permitted at interior to interior conditions.
- K. Miscellaneous Materials: Provide all incidental accessory materials, tools, methods and equipment required for fabrication and installation of All-Glass Entrances and Storefront as indicated on drawings, and not furnished by other sections.

## 2.3 FABRICATION

- A. Fabricate all-glass entrance units to sizes and configuration shown with members closely fitted to joints, reinforced and mechanically joined or welded as required. Dress welds flush and finish to match adjacent surfaces. Countersink heads of exposed fasteners, if any.
- B. Finish:

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1. Stainless Steel: NAAMM #4 Satin finish, typical all exposed metal.
  2. Aluminum: Baked enamel, custom color as selected by Architect to match adjacent ceiling finish.
- C. Fabricate using all glass assembly with continuous rails top and bottom.
- D. Glass: Fabricate edges in accordance with requirements of Section 08 80 10, Glazing, and as follows:
1. Exposed edges of doors penciled (satin radiused).
  2. Sidelights, transoms, and exposed edges other than doors: Edges radiused per manufacturer's recommendations.
  3. Edges housed in frame: Per manufacturer's recommendations.
  4. Exposed Edges: Machine ground and flat polished.
  5. Corner Edges: Lap-joint corners with exposed edges polished.
- E. Match details, materials, and finishes of sidelights with glass door components, unless otherwise indicated.
- F. Provide framing with removable stops to allow replacement of glass.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install glass in accordance with Section 08 80 10 and manufacturer's printed instructions and recommendations, unless otherwise indicated.
- B. Provide concealed overhead steel framing as required to brace assembly to structure.
- C. Cut and trim framing during installation with the approval of manufacturer and in accordance with his instructions.
- D. Sealant:
1. Conform to sealant manufacturer's recommendations for cleaning, priming and installation.
  2. Joints between system metal and adjacent substrates to be sealed under Division 7.
  3. All joints within system and all glazing joints to be sealed under this Section.
- E. Restore finish and remove and replace members as directed where cutting and trimming has impaired strength or appearance.
- F. Do not install members which are warped, bowed, deformed, or otherwise damaged or defaced to such extent as to impair strength or appearance. Remove and replace members, as directed, which have been damaged during installation.
- G. Set units level, plumb, and true to line, with uniform joints. Support on metal shims and secure in place by bolting to clip angles and supports anchored to supporting structure.

- H. Paint concealed contact surfaces of dissimilar materials, including metal in contact with concrete work, with a heavy coating of bituminous paint, or provide other separation as recommended by manufacturer.
- I. Adjust doors and hardware to operate smoothly and function properly.

### 3.2 CLEANING AND PROTECTION

- A. After installation, clean all-glass entrances and other contiguous components following procedure recommended by manufacturer.

END OF SECTION

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**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS****PART 1 - GENERAL****1.1 DESCRIPTION****A. Section Includes:**

1. Delegated Design.
2. Coordination of curtain wall anchor with structural steel and poured in place concrete work provided in EWP-5.
3. Glazed Aluminum Curtain Walls includes all fixed exterior glazed framing systems installed vertically as part of the building enclosure system. The curtain wall system is specified for its superior performance requirements, and is used for glazed curtain wall, ribbon window, punched window, storefront and other vertical fixed frame glazing type applications.
4. Windows installed at metal-clad and precast wall assemblies are included in this section.
5. All non-operable glazed framing systems are included in this section.
6. Exterior aluminum doors are included curtain wall system.
7. Aluminum framed swing doors Glass and Glazing for glazed framing systems provided by this Section.
8. Thermal insulation with backpan behind all opaque spandrel glass panels in curtain wall.
9. Insulated metal panels at opaque metal panel locations
10. MSP-01, aluminum plates glazed into curtain wall. Typically occurring at MEP penetrations in curtain wall.
11. Metal flashing with end dams.
12. Extruded aluminum mullion extensions.
13. Extruded aluminum window sill extensions adjacent to curtain wall.
14. Sealant work associated with systems.
15. Engineering design, shop drawings, calculations, testing.
16. Firestopping between edge of slab, edge of rated roofs, and curtain wall cladding conditions.
17. Expansion joint covers in curtain wall.
18. Metal trim and exterior column enclosures,
19. Supports, bracing, reinforcing, and anchorage for above systems not shown on Structural Drawings, but required to meet performance requirements and for structural integrity of completed work.
  - a. 3 dimensional adjustable curtain wall anchoring.
20. Mockups: See Section 01 43 39, Mockups.
21. Thermal simulation of curtain wall with adjacent floor and wall systems.
22. Internal system junction boxes to doors and conduit meeting requirements of Division 26. Junction boxes secured to aluminum frame for final connections by Division 26 and 28. Doors shall have internal conduits for wiring of door hardware.
23. Coordination of electrically operated hardware devices.
24. Provide preformed extruded silicone sheet at perimeter of curtain wall and door units.
25. Support framing for exterior linear wood grilles shown to be cantilevered from cantilevered from the glazed curtain wall framing.

**B. Products Furnished but not Installed Under this Section:**

1. Embedded items in Precast Architectural Concrete for the support of the Glazed Aluminum Curtain Walls. Furnish to Section 03 45 00 - Precast Architectural Concrete.

**C. Products Provided but not specified Under this Section:**

1. Glazing in doors and curtain wall, as specified in Section 08 88 53 - Security Glazing.

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2. Door hardware for aluminum doors, see Section 08 71 00 - Door Hardware, except as follows:
    - a. Permanent key and cylinder shall be provided by Section 08 71 00 - Door Hardware in future bid package.
    - b. Temporary Construction key and cylinder shall be provided by Construction manager or trade contractor designated by Construction Manager.
  3. Power door operators for doors provided by this Section: Section 08 71 13.11, Low Energy, Power Assist Door Operators.
  4. Expansion Joint Covers: 07 95 13 - Expansion Joint Cover Assemblies.
  5. Work of this Section shall comply with Section 08 44 13.30 - Life Safety Blast Requirements for Glazed Aluminum Curtain Wall System.
  6. Work of this Section shall comply with Section 08 71 13.50 - Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.
- D. Alternate: See Section 01 23 00 - Alternates for description of work under this Section affected by alternates.
- E. Electric Coordination:
1. Coordinate with Section 08 71 00 - Door Hardware.
  2. Electrical Devices provided under This Section: See "Section Includes" above.
  3. Voltages and Operation Requirements:
    - a. Operator: 120 VAC.
    - b. Actuating Devices: 24 VAC.
    - c. Verify all voltages with Division 26 after EWP-3 is bid and awarded.
- 1.2 RELATED WORK (Items not included in this Project Manual are available through Construction Manager upon request)
- A. Requirements of Division 1 Sections apply to this Section.
  - B. Summary of Work including Interior HVAC Design Data: Section 01 11 10 - Summary of Work.
  - C. MockUps: Section 01 43 39.
  - D. Testing Laboratory Services: Section 01 45 29.
  - E. Exterior Wind Enclosure Requirements: Section 01 83 16.13.
  - F. Division 03 Section "Cast-in-Place Concrete" for tolerances of the supporting structure which curtain wall must align with or to which it will be attached.
  - G. Division 03 Section "Precast Architectural Concrete" for tolerances of the supporting structure which curtain wall must align with or to which it will be attached.
  - H. Division 05 Section "Structural Steel Framing" for tolerances for the adjacent steel structure with which curtain wall must align with or to which it will be attached.
  - I. Division 05 Section "Cold Formed Metal Framing": Cold formed metal framing assemblies that interface with curtain wall work.
  - J. Facility Exterior Enclosure Commissioning: Section 07 08 00.
  - K. Flashing and Sheet Metal: Section 07 60 00.
  - L. Firestopping at edge of slab: Section 07 84 00 - Firestopping

- M. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain-wall systems and for sealants to the extent not specified in this Section.
- N. Expansion joint covers for building enclosure: Section 07 95 13 - Expansion Joint Cover Assemblies.
- O. Glazed Aluminum Curtain Walls for Dixie: Section 08 44 13.3.
- P. Hardware: Section 08 71 00, Door Hardware.
- Q. Power Door Operators: Section 08 71 13.11, Low Energy Power Assist Door Operators.
- R. Exterior glazing: Section 08 88 53 - Security Glazing.
- S. Color texture and finish: Section 09 06 00, Schedule for Finishes.
- T. Division 26 - Electrical.
- U. Division 28 - Electronic Safety and Security

### 1.3 DEFINITIONS

- A. "Preformed Extruded Silicone Sheet", "Preformed Extruded Silicone Joint Sealant" are interchangeable terms for purposes of this Section.
- B. "Sealant", "Joint Sealer", "Calk", "Caulk", "Calking", and "Caulking" are interchangeable terms for purposes of this Section.
- C. "Glazed aluminum curtain wall", "curtain wall", "curtainwall" and "glazed framing system" are interchangeable terms for purposes of this Section.
- D. For purposes of this section with Section 08 44 13.30 and Section 08 44 13.50 the word "window" is interchangeable with the word "curtain wall".

### 1.4 BLAST REQUIREMENTS

- A. Blast Requirements:
  - 1. Life Safety Structures: As specified in Section 08 44 13.30 - Life Safety Blast Requirements for Glazed Aluminum Curtain Wall System
  - 2. Mission Critical Structures: As specified in Section 08 44 13.50 - Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.

### 1.5 DESIGN REQUIREMENTS DESCRIPTION

- A. The Drawings show aesthetic design intent. Products provided must conform to design intent shown and performance levels specified. The drawings and specifications are complementary regarding the aesthetic design intent.
  - 1. Framing Systems:
    - a. Typical: Four-sided horizontal and vertical structural glazing.
      - 1) Provide horizontal and vertical caps where indicated on drawings.
- B. Products provided under this Section shall meet or exceed BLAST REQUIREMENTS specified above.



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- C. Structural Support:
1. Unitized System: Typical all locations except Building 07 (Central Energy Plant).
    - a. Edge of slab supported.
    - b. Gravity attachment at top.
    - c. One story high.
    - d. Punched Windows in Precast Concrete: Jamb anchored as indicated on drawings. Punched windows may be stick built or unitized at contractor's option.
- 1.6 The connection of the curtain wall to the building occurs approximately 2" outside the edge of slab, and the building structure is designed for this level of eccentric load from the curtain wall; any additional eccentric load created by the curtain wall system shall be carried by the curtain wall system.
1. Movement and Loads: See "Deflection of Framing Members" and "Thermal Movements" under PERFORMANCE REQUIREMENTS below.
- B. Contractor is solely responsible for engineering design of the systems following the below listed architectural design criteria and performance criteria specified under PERFORMANCE REQUIREMENTS.
- C. See "Engineer's Seal/Signature" under SUBMITTALS below.
- D. Glazing System:
1. Typical: Externally glazed.
- E. Exposed Break Metal: Fabricate Work true to detail with sharp, clean profiles, straight and free from defects, dents, marks, indentations, waves, or flaws of any nature impairing strength or appearance, fitted with proper joints and intersections, and with the specified finishes.
1. Welding.
    - a. Do all welding in accordance with recommendations of the American Welding Society.
    - b. Do welds behind finished surfaces to minimize distortion and discoloration on finished side. Remove weld splatter and welding oxides on finished surfaces by descaling or grinding.
    - c. No field welding will be allowed.
- F. Size Requirements:
1. Width (Sight Line): Horizontal and vertical member width shall be the same within each system. Field and perimeter member widths as shown on drawings.
  2. Depth: Horizontal and vertical member depth to be as required for specified loading and for sill as shown on drawings, but without affecting the building structure or intended tolerances.
  3. Provide reinforcement concealed within curtain wall system, as required to meet PERFORMANCE REQUIREMENTS.
- G. Field Installed Sealant Joints:
1. Bonding Surface: Provide water tight metal return the full depth of vertical and horizontal mullions, including glazing pocket, to allow for dual stage sealant joints within the full depth of the aluminum mullion extrusion; except metal caps at exterior side of glass are not required to be water tight.
    - a. Set preformed extruded silicone sheet into glazing pocket to allow transition to AWB in adjacent construction, and as shown on drawings.
  2. Typical Size: 5/8 inch wide unless specifically accepted by Architect or required to accommodate calculated movement with low modulus sealant. See details on drawings and sealant matrix on drawings for other sealant joint sizes.

- H. Design Modifications: Make design modifications of work shown only as necessary to meet performance requirements and coordinate the work. Maintain the general exterior design concept without altering spacing, profiles, or alignments shown.
- I. Transition to adjacent AWB: Provide continuous Preformed Extruded Silicone Sheet sealed into glazing pocket of curtain wall system and overlapping AWB in adjacent wall system. Preformed Extruded Silicone Sheet shall lap over AWB, 2 inches minimum lap. See details on drawings.
- J. Design supports for curtain wall supported by structural steel with Intumescent fireproofing to allow Intumescent fireproofing to expand during a fire and maintain the required fire resistant rating of the structural member.
- K. Door openings shall meet ADA requirements.

#### 1.7 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design curtain wall, including comprehensive engineering analysis by a qualified Professional Engineer, using performance requirements, blast requirements, and design criteria indicated.
- B. Provide glazed aluminum curtain wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:
  - 1. Structural loads, including wind, blast, and seismic.
  - 2. Thermal movements.
  - 3. Movements of supporting structure indicated on Drawings and specified in Related Sections including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 4. Dimensional tolerances of building frame and other adjacent construction.
  - 5. Failure includes, but not limited to, the following:
    - a. Deflection exceeding specified limits.
    - b. Thermal stresses transferred to building structure.
    - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
    - d. Noise or vibration created by wind and thermal and structural movements.
    - e. Loosening or weakening of fasteners, attachments, and other components.
    - f. Sealant failure.
    - g. Gasketing failure.
    - h. Water penetration.
    - i. Air leakage exceeding specified limits.
- C. The curtain wall systems and interface details between the curtain wall systems and adjacent envelope components shall be designed utilizing rainscreen principles.
  - 1. Two distinct lines of protection against water ingress shall be provided, with the interior line of protection providing the primary air barrier of the system.
    - a. The air seal shall extend from the curtain wall frame to the appropriate air and water barrier of the adjacent system.
    - b. The exterior weather seal or flashing shall extend from the exterior of the curtain wall system to the exterior cladding or similar water shedding surface of the adjacent construction.
  - 2. Provide weeps to allow drainage to the exterior of water, which enters the space between the interior and exterior seals. Where feasible, provide drainage to the exterior at horizontal mullions below each glazing unit. Unless otherwise indicated or approved by the Architect, drainage paths shall be concealed or similarly protected from direct exposure to wind driven rain.

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D. Structural Design:

1. Wind Loads: See Section 01 83 16.13 - Exterior Wind Enclosure Requirements.
2. Seismic Loads: See Structural drawings
3. Importance Factor: See Structural Drawings.
4. Exposure Category: See Structural Drawings.
5. Blast Loads: See drawings and "BLAST REQUIREMENTS" above.
6. Structural-Test Performance: Provide glazed aluminum curtain wall systems tested according to ASTM E 330 as follows:
  - a. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
  - b. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  - c. Test Duration: As required by design wind velocity but not less than 10 seconds.
7. Deflection of Framing Members:
  - a. Deflection Normal to Wall Plane: Limited to 1/180.
  - b. Deflection Parallel to Glazing Plane: Limited to an amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch when carrying full loads, and the clearance between the member and an operable window or door shall be minimum 1/16 inch.
  - c. Cantilever Deflection: Where framing members overhang an anchor point, limited to 2 times the length of cantilevered member, divided by 180.
8. Windborne-Debris Impact Resistance: The glazed openings to meet requirements of the p. 1609.1.2 of the Chapter 16 of the International Building Code (IBC) 2006 as follows:
  - a. Top of openings within 30 feet from Grade: Large Missile Test, Level D.
  - b. Bottom of openings more than 30 feet from Grade: Small Missile Test.
  - c. Test specimens for small and large missile test shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
  - d. Perform applicable impact tests for wind-borne debris in accordance with the testing standards ASTM E1886 and ASTM E1996 for Wind Zone 4 and Enhanced Protection level (Essential Facilities), Missile Level "D".
9. Interstory Drift (seismic or wind): The maximum movement in all directions as measured between points in a plumb line between floors subjected to the maximum wind or seismic loads. Provide curtain wall systems that accommodate the following displacement between adjacent floor levels:
  - a. Elastic Displacement (base event): 1/2 inch.
    - 1) After being subjected to elastic displacement limit, no permanent damage or deformation shall occur and the curtain wall shall meet all performance criteria indicated in this specification without repairs.
    - 2) Test procedure shall be in accordance with AAMA 501.4
  - b. Inelastic Displacement (maximum considered event): 3/4-inch.
    - 1) After being subjected to inelastic displacement limit, gaskets and sealant may fail and frame deformation may occur, but no component may fall from the building.
    - 2) Test procedure shall be in accordance with AAMA 501.4.
  - c. Glass installed in the curtain wall shall meet the glass fallout requirements of ASCE-7 to accommodate seismic displacement without glass fallout.
10. Vertical Floor Deflection:
  - a. Curtain wall system shall be designed to accommodate vertical floor deflection equal to 3/8 inch downward at all locations.
11. Erection Tolerance:
  - a. Curtain wall system shall be designed to accommodate erection tolerances of supporting and adjacent construction as specified in related sections.

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12. Eccentric Loads: Eccentricity to be taken by the curtain wall framing and not be transferred to the anchor / structure.
- E. Air Infiltration and Exfiltration:
1. Curtain wall: Maximum air infiltration and exfiltration leakage rate shall be 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure differential of 6.24 lbf/sq. ft.
  2. Aluminum framed doors: When closed and locked, maximum air infiltration and exfiltration leakage rate shall be 0.30 cfm/sq. ft. when tested according to ASTM E 283 at a static-air-pressure differential of 6.24 lbf/sq. ft.
  3. The above Air Infiltration and Exfiltration requirements do not apply to CW-6.
- F. Water Leakage Resistance:
1. Water Penetration Under Static Pressure:
    - a. Curtain wall: No evidence of water penetration when tested according to ASTM E 331 for 15 minute duration at a minimum differential static pressure of 15 lbf/sq. ft. positive wind load.
    - b. Aluminum framed doors: When closed and locked, no evidence of water penetration when tested according to ASTM E 331 for 15 minute duration at a minimum differential static pressure of 15 lbf/sq. ft. positive wind load.
  2. Water Penetration Under Dynamic Pressure:
    - a. Curtain wall: No evidence of water leakage when tested according to AAMA 501.1 for 15 minute duration under dynamic pressure equal to not less than 15 lbf/sq. ft. positive wind load pressure.
    - b. Aluminum framed doors: No evidence of water leakage when tested according to AAMA 501.1 for 15 minute duration under dynamic pressure equal to not less than 15 lbf/sq. ft. positive wind load pressure.
  3. Water penetration shall be defined as the appearance of any water on the interior side of any part of the glazed wall assembly, including the interface locations with adjacent envelope systems, that is not contained and drained back to the exterior, or that can cause damage to adjacent materials or finishes. Water fully contained in drained flashings, gutters, and sills is not considered water penetration.
  4. The above Water Leakage Resistance requirements do not apply to CW-6.
- G. Thermal Movements: Provide glazed aluminum curtain wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
  2. Test Performance: No buckling, stress on glass, glazing-edge seal failure, sealant failure, excess stress on curtain wall framing, anchors and fasteners, or reduction of performance when tested according to AAMA 501.5.
    - a. Test High Exterior Ambient Air Temperature: The greater of 120 deg F or that which produces an exterior metal surface temperature of 180 deg F
    - b. Test Low Exterior Ambient Air Temperature: 0 deg F.
    - c. Test Interior Ambient Air Temperature: 75 deg F.
- H. Energy Performance:
1. Thermal Transmission:
    - a. Curtain wall: The curtain wall, including vision glass and metal framing, shall have an average thermal transmittance U-factor not more than 0.5 BTU/ft<sup>2</sup>/°F when tested in accordance with AAMA 1503.1.
    - b. Spandrel Thermal Resistance: Opaque and spandrel panels shall have average effective thermal value of at least :
      - 1) R-value: Not less than 13.

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- c. Aluminum framed doors: When tested in accordance with AAMA 1503, the conductive thermal transmittance (U-Factor) shall not be more than 0.49 BTU/hr/sf/F.
    - 2. Thermal breaks and separation:
      - a. Curtain wall system framing to incorporate thermal break separating framing components exposed to interior and exterior environments.
    - 3. Condensation Resistance:
      - a. Curtain wall: the condensation-resistance factor (CRF) shall be no less than 60 for the frame and glass, when tested according to AAMA 1503.
      - b. Aluminum framed doors: the condensation resistance factor (CRF) shall not be less than 55 frame, 60 glass, when tested according to AAMA 1503.
    - 4. Comply with "Thermal Simulation" under QUALITY ASSURANCE below.
    - 5. The above Energy Performance requirements do not apply to CW-6.
  - I. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by curtain wall systems without failing adhesively or cohesively. Provide sealant that fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.
    - 1. Safety Factor: 4.
  - J. Condensation Requirements:
    - 1. Exterior Glazed Framing: Provide manufacturer's thermally broken construction which has been tested or simulated, to provide an assembly or assemblies which will not allow condensation to occur on the interior side of framing or glass under winter design conditions and conditions of installation shown on drawings
      - a. See STRUCTURAL DESIGN DATA and HVAC DESIGN DATA under Section 01 11 10– Summary of Work for winter design conditions.
      - b. Humidity may vary with type of spaces listed under Section 01 11 10.
    - 2. Interior Glazed Framing: No requirements.
    - 3. The above Condensation Requirements do not apply to CW-6.
  - K. Glass Statistical Factor (Safety Factor): Glass thicknesses when shown on the drawings are for convenience of detailing only and are to be confirmed by the Contractor and/or glass manufacturer. All glass for the size openings shown will be provided in thicknesses such that the probability of breakage at the design wind pressure will not exceed 8 lights per 1000 lights (S.F. = 2.5). Glass manufacturer to provide, on request, substantiating glass breakage data if such data is not otherwise available as manufacturer's published data.
  - L. Surface-Burning Characteristics of Interior Materials:
    - 1. Flame-Spread Index: 25 or less, ASTM E84.
    - 2. Smoke-Developed Index: 450 or less, ASTM E84.
  - M. Comply with requirements of Section 01 43 39 – Mockups. If requirements conflict with requirements stated in this Section, comply with the more stringent condition.
- 1.8 SUBMITTALS
- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
  - B. Engineer's Seal/Signature: Shop drawings and associated calculations required for structural design shall bear seal and signature of curtain wall manufacturer's Professional Engineer. See Professional Engineer under QUALITY ASSURANCE below, and "Structural Calculations" below.

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- C. Shop Drawings: Prepared by curtain wall system manufacturer. Information contained in Shop Drawings shall include, but not necessarily be limited to the following:
1. Each shop drawing sheet shall include manufacturer's name and trademark.
  2. Plans, elevations and sections at a scale as large as practical. Provide references to detail numbers on the Architectural Drawings and references to the Specifications section and paragraph numbers to identify material types and finishes
  3. Key to metal thickness, types, and metal finishes.
  4. Key to glass types, thickness, and attributes.
  5. Details of field connections and anchorages and their relationship to the work of other building trades. Include transition details of curtain wall system to adjacent construction. See Anchorage Drawings, below.
  6. Three dimensional details to illustrate four-way joint details.
  7. Details showing concealed reinforcement.
  8. Drainage paths, weeps, flashings and baffles.
  9. Details of sealing methods, dimensions, and materials; gaskets, and product joinery.
  10. Glazing details and methods.
  11. Type of construction including joinery, fasteners and welds, anchorage assemblies and components, fabrication tolerances for the Work of this Section and the adjoining related work, and layout of inserts.
  12. Continuous line of air tightness for the system, including at interfaces with adjacent construction.
  13. Details of adjoining work to ensure coordination of this Work and work of other Sections.
  14. Shimming Depths: For each type of anchorage to structure, show maximum allowable depths of shims permitted for normal conditions. Show details for shim depths exceeding normal conditions and their limits. Design custom anchorages as needed to meet field conditions.
  15. Adjustability: Show details of anchors indicating range of adjustment and accommodation of tolerances of adjoining work.
  16. Movement Capability: Show details of joints which accommodate vertical movement including stack joints. Indicate range of movement.
  17. Do not proceed with fabrication until Shop Drawings have been reviewed and approved by Architect.
  18. Anchorage Drawings:
    - a. Show embed types and layouts, anchorage locations, types and sizes of anchors, and proposed methods of attachment to structure.
    - b. Show details of anchors. Include range of adjustment for each anchor type and bolt size, including those perpendicular to face of building.
    - c. Describe all materials including shimming devices.
    - d. Indicate all reactions or loads-imposed-on structure imposed on structure under maximum design load conditions for Engineer to review.
    - e. Shimming Depths: For each type of anchorage to structure, show maximum allowable depths of shims permitted for normal conditions. Show details for shim depths exceeding normal conditions.
  19. Minimum scale of details 3" = 1'-0".
- D. Structural Calculations: Submit triplicate copies of structural calculations made by or for curtain wall manufacturer in connection with design and detailing of the curtain wall work, including connections and attachments. Submittals may or may not be returned, and will not bear stamp of approval. Base calculations on worst case conditions for all allowable variations, tolerances and connections. Perform calculations under direct supervision of manufacturer's Professional Engineer. Calculations shall be sealed and signed, and shall include
1. Direction and magnitude of thermal expansion; direction and magnitude of applicable building and seismic movements.
  2. Structural forces imposed on the building structure under all conditions of construction and loading, as specified.
  3. Section property computations for framing members.

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- E. Door Hardware Provided By This Section: Provide SUBMITTALS in conformance with Section 08 71 00 - Door Hardware.
- F. Glass and Glazing Provided by This Section: Provide SUBMITTALS in conformance with Section 08 88 53 - Security Glazing.
- G. SUBMITTALS required for this Sections shall be submitted complete and concurrently with Blast Submittals. Partial submittals are not acceptable.
1. Blast Submittals: SUBMITTALS as specified in:
    - a. Section 08 44 13.30 - Life Safety Blast Requirements for Glazed Aluminum Curtain Wall System
    - b. Section 08 44 13.50 - Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.
- H. Thermal Simulation report(s).
- I. Installation Instructions.
- J. QA/QC procedures.
- K. Shop QA/QC reports.
- L. Sample Warranties, per Section 01 33 25 – Warranties.
- M. Laboratory Test Reports: Submit duplicate copies of certified test reports on the performance of curtain wall system and components based on testing to specified requirements by AAMA accredited laboratory or other qualified laboratory.
- N. Maintenance Data: Submit detailed procedures for periodic inspection, maintenance and cleaning of applicable elements.
1. Include relevant information related to interior components, such as installation of blinds or similar finishes, or procedures that may impact the performance or warranty of the curtain wall or glazing components.
- O. Schedules: Provide the following:
1. Detailed schedule for sealants and related items such as primers and back-up material; designation of areas and locations for all types of sealants, primer and back-up materials used in each case; methods of application, special instructions, and specification data sheets. Cross-reference scheduled items with Shop Drawings.
  2. Schedule of tapes, gaskets, separators, and related items including the designation of areas and specific locations; materials used; special instructions; specification data sheets, and related information. Cross-reference scheduled items with Shop Drawings.
  3. Schedule of fasteners, connectors, and related items, such as washers and spacers including the designation of areas and specific locations; materials used; special instructions; specification data sheets, and related information. Cross-reference scheduled items with Shop Drawings.
  4. Detailed instructions for the installation of glass. Include sequence of installation and method of installation for materials including the glass, glazing gaskets, setting blocks, jamb blocks and related items; location of specific items such as the setting blocks and jamb blocks; any special instructions that may be required. Include instructions related to replacement of glazing units.
- P. Provide detailed instructions for removal and reinstallation of curtain wall access panels for sizes and locations indicated on drawings.

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- Q. Pre-Construction Adhesion Tests: See QUALITY ASSURANCE below. Submit results in format which allows comparison with manufacturer's published values.
- R. Samples:
1. Submit samples of each type and color of finish required by this Section. Include two (2) or more samples in each set, showing near-limits of variations (if any) in color and texture of finish.
  2. Window Rail: 12" sections of extrusion plus connection detail assembled.
  3. Metal Panels: 18" x 18" of each type.
  4. Sample Assemblies: After approval of the above listed samples is obtained, submit one each sample of assemblies listed below. Fabricate samples within the guidelines set forth under FABRICATION in PART 2 and show proposed construction methods, joinery, materials, and be prefinished. Sample may be reduced in size but show full size details.
    - a. Cut-Away Assembly (Typical of 2): Nominal 36" x 36". Beginning with a four-lite with vertical and horizontal mullions centered in sample, cut assembly at 45 degrees at approximately 3 inches above center to expose framing profiles and internal attachments and glazing details. Fabricate insulated glass units to match framing (1 square and 2 cut units). Sample construction available for inspection at Architect's office.
      - 1) 4-Sided Structural Glazing Assembly: Submit "Cut-Away Assembly" for 4-sided structural glazing.
    - b. Metal Panels: Nominal 36" x 36" with 4 equal size panels; show framing, backup construction and joints.
  5. Door corner section, 18 x 18 inches, of each door type specified, showing vertical and top hinge edges, door closer reinforcement, and internal reinforcement, of bottom corner of door, with glazing and glass stops.
- S. Samples for Color Verification:
1. Mullions: Submit samples of each type and color of finish required by this Section, on 12" sections of extrusions or formed shapes and on 12" squares of sheet/plate. Include two (2) or more samples in each set, showing near-limits of variations (if any) in color and texture of finish.
  2. Glass: as specified in Division 8 Section "Glazing".
  3. Sealant (cured strips): duplicate samples, minimum 6 inches long, in each color proposed for use in exposed finish conditions.
  4. Gaskets: duplicate samples, minimum 6 inches long, in each color proposed for use in exposed finish conditions.
  5. Column Enclosure Panel: 12 inches wide by 12 inches high with return on corner of full depth.
- T. Fabricator Qualification Certificate: Signed by curtain wall system manufacturer certifying that the manufacturer has approved, authorized, or licensed the fabrication facility to fabricate the manufacturer's curtain wall system, and that the facility is capable of producing the work herein specifically for this Project. Certificate is not required if curtain wall systems are fabricated by product manufacturer.
- U. Installer Qualification Certificate: Signed by curtain wall system manufacturer certifying that installer is approved, authorized, or licensed by manufacturer to install curtain wall system. Certificate is not required if curtain wall systems are installed by product manufacturer.
- V. Manufacturer's Field Reports:
1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during the course of curtain wall installation. Indicate results of field testing of mockup, and any directions given to Contractor for corrective action.



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- W. Certificate of Compliance: Fabricator shall provide certification of compliance after completion of fabrication in conformance with "QUALITY ASSURANCE".
    - 1. Stating that aluminum has been given specified thickness of anodizing.
  - X. Provide documentation to show that fabricator meets requirements of "APPROVED FABRICATOR" in conformance with "QUALITY ASSURANCE".
  - Y. LEED Submittals:
    - 1. Product Data for Credit IEQ 4.3: For sealers, documentation including printed statement of VOC content.
    - 2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
  - Z. Sealants: Provide submittal in conformance with Section 07 92 00 - Joint Sealants for sealant products provided by this Section.
  - AA. Finish and Maintenance Data: Provide written instructions for the following as required under Section 01 78 23 - Operation and Maintenance Manuals:
    - 1. Finishes. List each type of coating and the names of products receiving that type of coating.
    - 2. Maintenance: Recommended materials and methods for proper maintenance of work for each type of coating provided under this Section.

#### 1.9 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide each curtain wall system from one source.
- B. Manufacturer Qualifications: Manufacturer shall specialize in designing and manufacturing the types of metal, glass and glazing accessories specified in this section, with a minimum of 10 years of documented successful experience of similar project size and type, and have the facilities capable of meeting all requirements of the Contract Documents as a single-source responsibility and warranty. Manufacturer shall fabricate and design the Glazed Aluminum Curtain system. Manufacturer's Professional Engineer shall design the curtain wall system.
- C. Installer Qualifications:
  - 1. Curtain Wall: A qualified firm that is certified by curtain wall system manufacturer to install manufacturer's product and that is specifically experienced with a minimum of 10 years experience in similar glazed wall systems for similar project size and type.
  - 2. Firestopping: Specialty contractor as specified under Section 07 84 00 - Firestopping. Refer to Section 07 84 00 for training and approval requirements.
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Louisiana and who has a minimum of 10 years experience in similar glazed wall systems in providing engineering services of the kind indicated.
- E. Qualified Blast Consultant: Provide in conformance with Section 08 44 13.50 Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.
- F. Welding:
  - 1. Perform welding by skilled and qualified mechanics licensed where required in accordance with local governing regulations.
  - 2. Perform welding in conformance with AWS Structural Welding Code D1.1 for steel and D1.2 for aluminum.
- G. Pre-construction Sealant Test Reports:

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1. Compatibility and adhesion test reports from sealant manufacturer indicating that the glazing materials were tested for compatibility and adhesion with glazing sealant. Include the following:
    - a. Sealant manufacturer's interpretation of test results relative to the sealant performance and recommendations for primers and substrate preparation needed for adhesion.
    - b. Certification from the sealant manufacturer that any structural silicone sealants and accessories comply with the Contract Documents and are recommended by the sealant manufacturer for the use intended, and that the samples tested for adhesion comply with the manufacturers requirements for structural glazing.
    - c. Cost of testing to be borne by Contractor.
  - H. Label: Provide metal label on frame to show compliance with building code and specifications. Label to meet requirements of authority having jurisdiction. Locate label where directed by Architect.
  - I. Manufacturer shall afford the Architect, Resident Engineer, and their authorized agents full access to plant, shop (excluding paint facility), and assembly point to view and inspect the processes and methods employed in the fabrication, assembly, and finishing of the curtain wall.
  - J. Fabricator shall meet requirements of "APPROVED FABRICATOR" as defined in Section 1702 of the 2006 International Building Code.
  - K. At completion of fabrication submit a certificate of compliance, in conformance with Section 1704.2.2 of 2006 IBC; to the building official, Contracting Officer, and Architect stating that the work was performed in compliance with approved construction documents and shop drawings.
  - L. Thermal Simulation: Perform 2-D Finite Element Thermal Simulation Models of the curtain wall system with a temperature between minimum 32°F and 150°F. Thermal models shall include fenestration, glazing, spacers, and adjacent construction and represent each project-specific condition.
    1. Provide thermal model outputs showing temperatures of glass, framing, and surrounding conditions through a 2-D cross section for each condition modeled.
    2. Analyze model output for dew point temperatures and report conditions under which dew point temperatures are reached.
    3. Internal Design Conditions: See HVAC DESIGN DATA under Section 01 11 10 Summary of Work for conditioned spaces.
    4. Surfaces that fall below the ASHRAE identified dew point for the condition shall be considered non-compliant.
  - M. Mockups: Before production or installation of curtain wall systems, provide mock-ups for aesthetic review and determination of final design and to confirm performance. Build mockups as directed, using all components as shown and specified in accordance with final shop drawings. The mockup is an Aesthetic Mockup and Testing Mockup.
    1. Aesthetic Mockup: Provide glass, metal, texture and workmanship to be expected in completed work. See Section 01 43 39, Mockups. Approval of aesthetic mock-up required before design of testing mock-up can proceed.
    2. Testing Mockup: See Section See Section 01 43 39, Mockups.
  - N. Pre-Installation Conference: Conduct at project site prior to the start of installation of curtain wall systems.
    1. Review methods and procedures related to curtain wall Work, including but not limited to the following:
      - a. Methods and sequence of installation, including construction scheduling.
      - b. Glazing procedures and standard of workmanship.
      - c. Quality control requirements.

- d. Evaluation of suitability of specified materials and sealants for anticipated weather conditions.
- e. Coordination with other trades.
- f. Field testing, inspecting and certifying procedures.

#### 1.10 DELIVERY, STORAGE AND HANDLING

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.
- C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.
- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Division 07 – "Sealants".

#### 1.11 PROJECT CONDITIONS

- A. Field Measurements: Where curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.
- B. Sequencing with Intumescent fireproofing: See Section 07 81 23 - Intumescent Fireproofing

#### 1.12 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
  - 1. MCWM-1 Metal Curtain Wall Manual
  - 2. CW 10 Care and Handling of Architectural Aluminum from Shop to Site
  - 3. CW 11 Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing
  - 4. CW 13 Structural Sealant Glazing Systems (A Design Guide)
  - 5. CWG 1 Installation of Aluminum Curtain Walls
  - 6. TIR A1 Sound Control for Aluminum Curtain Walls and Windows
  - 7. TIR A4 Recommended Guide Lines for Reflective Insulating Glass
  - 8. TIR A8 Structural Performance of Poured and Debridged Framing Systems
  - 9. TIR A9 Metal Curtain Wall Fasteners

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| 10. | TIR A11        | Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads  |
| 11. | 101-I.S.2/A440 | Windows, Doors and Unit Skylights  |
| 12. | 501            | Methods of Test for Exterior Walls   |
| 13. | 503            | Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems   |
| 14. | 2605           | Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels |
| 15. | 1503           | Thermal Transmission and Condensation Resistance of Windows, Doors and Glazed Wall Sections  |
- C. American National Standards Institute (ANSI):
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| 1. | Z97.1 | Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test |
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- D. American Society of Civil Engineers (ASCE):
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| 1. | ASCE/SEI 7  | Minimum Design Loads for Buildings and Other Structures |
| 2. | ASCE/SEI 24 | Flood Resistant Design and Construction                 |
- E. American Society for Testing and Materials (ASTM):
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| 1.  | A36/A36M   | Structural Steel   |
| 2.  | A123       | Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products  |
| 3.  | A193       | Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service   |
| 4.  | A307       | Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength  |
| 5.  | B209       | Aluminum and Aluminum Alloy Sheet and Plate  |
| 6.  | B211       | Aluminum and Aluminum Alloy Bar, Rod, Wire   |
| 7.  | B221/B221M | Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes  |
| 8.  | B316/B316M | Aluminum and Aluminum Alloy Rivet and Cold-Heading, Wire, and Rods   |
| 9.  | C509       | Elastomeric Cellular Preformed Gasket and Sealing Material.  |
| 10. | C661       | Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer  |
| 11. | C719       | Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).                              |
| 12. | C920       | Elastomeric Joint Sealants   |
| 13. | C794       | Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.   |
| 14. | C1135      | Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.   |
| 15. | C1363      | Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus  |
| 16. | D412       | Standard Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.                                     |
| 17. | D1037-99   | Evaluating the Properties of Wood-Base Fibers and Particle Panel Materials   |
| 18. | E84        | Surface Burning Characteristics of Building Materials  |
| 19. | E90        | Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements   |
| 20. | E283       | Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Difference Across this Specification |

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| 21. | E330  | Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference  |
| 22. | E331  | Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference   |
| 23. | E783  | Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.  |
| 24. | E1105 | Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors By Uniform or Cyclic Static Air Pressure Differences                             |
| 25. | E1886 | Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials |
| 26. | E1996 | Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes                        |
- F. American Welding Society, Inc. (AWS):
- |    |      |                                  |
|----|------|----------------------------------|
| 1. | D1.2 | Structural Welding Code-Aluminum |
|----|------|----------------------------------|
- G. Consumer Product Safety Commission (CPSC):
- |    |             |  |
|----|-------------|--|
| 1. | 16 CFR 1201 | Architectural Glazing Standards and Related Material |
|----|-------------|--|
- H. Federal Specifications (FS):
- |    |           |   |
|----|-----------|---|
| 1. | TT-P-645B | Primer, Paint, Zinc-Molybdate, Alkyd Type |
|----|-----------|---|
- I. Glass Association of North America (GANA):
- |    |    |  |
|----|----|--|
| 1. | 01 | Glazing Manual                             |
| 2. | 02 | Sealant Manual                             |
| 3. | 03 | Laminated Glass Design Guide               |
| 4. | 04 | Tempered Glass Engineering Standard Manual |
- J. Military Specifications (MIL):
- |    |             |  |
|----|-------------|--|
| 1. | MIL-C-18480 | (Rev. B) Coating Compound, Bituminous Solvent, Coal Tar Base |
|----|-------------|--|
- K. National Association of Architectural Metal Manufacturers (NAAMM):
- |    |            |                        |
|----|------------|------------------------|
| 1. | 500 Series | Metal Finishes Manual. |
|----|------------|------------------------|
- L. Steel Structures Painting Council (SSPC)
- |    |   |  |
|----|---|--|
| 1. | Paint 25  | Red Iron Oxide Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments) |
| 2. | Chapter 16 and Testing Application Standards (TAS) of the Florida Building Code (FBC) 2007. |  |
- M. Americans with Disabilities Act (ADA).

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1.13 WARRANTY

- A. Submit manufacturer's written warranty for materials, installation and weathertightness, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.
- B. Finish Warranty: As specified in Section 05 05 13 – Shop-Applied Coatings for Metal.
- C. Glass and Glazing Warranty: As specified in Section 08 88 53 - Security Glazing.

## PART 2 - PRODUCTS

## 2.1 FRAMING AND METAL COMPONENTS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless Steel: Shall conform to American Iron and Steel Institute's "Steel Products Manual" and the following:
  - 1. Tubing: ASTM A268 or A269.
  - 2. Hot-Finished and Cold Finished Bars and Shapes: ASTM A276.
  - 3. Plate, Sheet and Strip: ASTM A167, A176, or A666.
  - 4. Hot-Rolled and Cold-Rolled Sheet and Strip: ASTM A606.
- C. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with requirements of the standards indicated below.
  - 1. Alloys shall meet or exceed mechanical properties of 6063-T5 for extrusions or 5005 H32 for sheet.
  - 2. Sheet and Plate: ASTM B209.
  - 3. Extruded Bars, Rods, Shapes and Tubes: ASTM B221.
  - 4. Bars, Rods, and Wires: ASTM B211.
  - 5. Standard Structural Shapes: ASTM B308.
  - 6. Sand Casting: ASTM B26.
  - 7. Permanent Mold Castings: ASTM B108.
  - 8. Drawn Seamless Tube: ASTM B210.
  - 9. Extruded Structural Pipe and Tubes: ASTM B429.
  - 10. Die Castings: ASTM B85.
  - 11. Welding Rods and Die Electrodes: AWS A5.10.
- D. Fasteners:
  - 1. Fasteners used to join aluminum to aluminum shall be aluminum or stainless steel.
  - 2. Fasteners used to join stainless steel to stainless steel shall be stainless steel.
  - 3. Exposed fasteners to match finish of curtain wall system.
  - 4. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.
  - 5. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.
  - 6. Anchoring of Curtain wall to Support Structure: ASTM A307 zinc plated steel fasteners.

## 2.2 GLASS AND GLAZING

- A. Glass and Glazing: Provide as specified in Section 08 88 53 - Security Glazing.

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### 2.3 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Covers Assemblies: Provide in conformance with Section 07 95 13 - Expansion Joint Cover Assemblies at expansion joints occurring in and adjacent to the glazed aluminum curtain walls.

### 2.4 INSULATION

- A. Curtain wall insulation at opaque panels: Provide as specified in Section 08 88 53 - Security Glazing.

### 2.5 INSULATED METAL PANELS

- A. Composite panels consisting of interior and exterior sheet metal laminated to insulation core. Additional integral components as required to meet specified blast and impact load requirements. All components must be moisture resistant or completely and permanently protected from moisture exposure, including edge conditions exposed to glazing pocket of curtain wall.
  - 1. Interior sheet metal facing shall provide plane of primary air and watertight seal to curtain wall framing.
  - 2. Insulated metal panels shall be glazed into curtain wall framing.
- B. Metal panel finish: To match that of adjacent curtain wall framing.
- C. Insulation thickness: as required to achieve overall effective thermal resistance specified for opaque curtain wall spandrel areas.

### 2.6 FLASHING

- A. Flashing: Provide in conformance with Section 07 60 00 - Flashing and Sheet Metal with end dams and as follows:
  - 1. Concealed Flashing: Provide one or more of the following as appropriate for the condition:
    - a. Dead-soft stainless steel, 26-gauge, type selected by manufacturer for compatibility.
    - b. Manufacturer's standard aluminum.
    - c. Flexible neoprene or EDPM rubber membrane, minimum 0.045 inch thick.
  - 2. Exposed Brake Metal Flashing: Minimum 0.032" thick aluminum brake metal finished to match adjacent aluminum framing. Increase thickness where needed to maintain placement or straightness of visible edge due to conditions of support and anchorage.
  - 3. Sill flashing shall counter flash over sheet metal flashing at top edge of roof membrane, where possible.
  - 4. All flashing shall have water tight end dams.

### 2.7 EXTRUDED SILICONE TRANSITION SYSTEM

- A. Extruded Silicone Transition System to consist of Preformed Extruded Silicone Sheet, Joint Bonding Sealant, and Aluminum Attachment Bar to secure extruded sheet to designated substrate.
  - 1. Extruded Silicone Transition System shall provide a permanent and flexible seal between curtain wall and air weather barrier of adjacent assemblies.

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2. Extruded silicone transition systems manufactured by Tremco, Proglaze ETA, and conforming to these specifications are acceptable.
- B. Preformed Extruded Silicone Sheet Performance Requirements:
1. Minimum performance requirements for 1-1/2-inch silicone seal applied over 1/2-inch joint after 21 days cure:
    - a. Properties tested in accordance with ASTM C1135:
      - 1) Ultimate strength: 40 psi.
      - 2) Ultimate elongation: 800 percent.
      - 3) Stress at 25 percent elongation: 3 psi and 1.5 pli.
      - 4) Stress at 50 percent elongation: 5 psi and 2.5 pli.
      - 5) Stress at 50 percent compression: Less than 5 psi and 2.5 pli.
    - b. Moment capability: Plus 200 percent and minus 75 percent, tested in accordance with ASTM C719.
- C. Preformed Extruded Silicone Sheet Physical Properties:
1. Hardness: Minimum 25-durometer hardness, Shore A, ASTM C661.
  2. ASTM D412:
    - a. Tensile strength: Minimum 400 psi.
    - b. Elongation: Minimum 400 percent.
  3. Tear strength, die B: Minimum 100 ppi, ASTM C624.
- D. Preformed Extruded Silicone Sheet profiles and dimensions:
1. Manufacturers' standard sheet of widths required to provide seal across joint between curtain wall and adjacent systems, as detailed.
  2. Pre-formed shapes:
    - a. Required at all corners and at similar changes in planes of substrates to achieve continuity of seals. Forming and sealing of flat sheets at corners and similar transitions is not permitted without prior written approval of Architect.
- E. Preformed Extruded Silicone Sheet Color: As approved by Architect.
- F. Joint Bonding Sealant:
1. Type: Compatible silicone type as recommended and provided by silicone seal manufacturer. Acetoxy-cure silicone sealants are not acceptable.
    - a. Stain/bleed-resistant products to porous substrates, including limestone.
    - b. ASTM C920, silicone, neutral cure.
    - c. Type S.
    - d. Class 100: Joint movement range of plus 100 percent to minus 50 percent.
    - e. Grade NS.
    - f. Shore A hardness of 15-20.
    - g. Minimum elongation of 1200 percent.
  2. Color: Standard color as approved by Architect.
- G. Aluminum Attachment Bar: Extruded aluminum bar or shape to be mechanically attached to curtain wall to provide, along with Joint Bonding Sealant, a permanent connection between Extruded Silicone Sheet and curtain wall mullion. Aluminum attachment bar to provide continuous support of connection along full perimeter of curtain wall, except as required to accommodate movement joints in curtain wall system.

## 2.8 GASKETS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for



glazing applications indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Glazing Gaskets:

1. Gaskets, General:
  - a. Extruded with continuous integral locking projection to engage into metal glass holding members, designed to be in contact at all times with adjacent elements during dynamic loading, building and thermal movements, and provide a watertight seal as required to meet performance requirements.
  - b. Provide type which remains permanently elastic, non-shrinking, non-migrating, water and weather tight.
  - c. Unless otherwise approved by Architect, primary air seal glazing gaskets for any one light or glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs.
2. Sponge Gaskets: Neoprene, EPDM or Silicone, 35-45 Shore A hardness, ASTM C509. Size and profile as required for watertight seal.
3. Dense Gaskets: Neoprene or EPDM per ASTM C864 or Silicone per ASTM C 1115, 70-80 Shore A hardness for hollow profile; 55-65 shore A hardness for solid profiles. Size and profile as required for watertight seal.

C. Glazing Tapes:

1. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
  - a. Type 1, for glazing applications in which tape acts as the primary sealant.
  - b. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
2. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with spacer rod as recommended in writing by tape and glazing unit manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - a. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - b. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. Glazing Accessories:

1. Cleaners and Primers: Types recommended by gasket or sealant manufacturer.
2. Setting Blocks
  - a. Neoprene Type: Dense neoprene extrusions.
  - b. Silicone Type: Heat cured, preformed silicone.
    - 1) Silicone setting blocks are required when setting blocks are in contact with silicone sealant.
  - c. Shore A durometer hardness of 70-90
  - d. Profiles/Lengths/Locations: As required and recommended in writing by glass manufacturer to support glass and suit glass thickness.
3. Spacers
  - a. Neoprene or other resilient blocks with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated
  - b. Silicone spacers shall be used if in contact with silicone sealant, or for spacers used in structural glazing applications.
4. Edge Blocks:
  - a. Types:

- 1) Heat cured, preformed silicone rubber, ASTM C1115 or other elastomeric material recommended by glass manufacturer.
- b. Hardness: As required to limit lateral movement (side-walking) of glass.
- c. Lengths and Locations: As recommended in writing by glass manufacturer.
5. Butyl Sealant: Single component; Shore A hardness of 10-20; black color; nonskinning; compatible for use with glazing sealant.

## 2.9 SEALANTS

- A. Sealant For Non structural glazing conditions – Site or Shop/Factory Installed: ASTM C920 for Type S, Grade NS, Class 50 or greater, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by sealant and curtain wall manufacturers for this use.
- B. Sealant For Structural Glazing, One Component: Shop/Factory or Site Installed. ASTM C 1184, neutral-curing silicone formulation 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 curtain wall systems indicated.
- C. Sealant For Structural Glazing, Two Component: Shop/Factory or Site Installed. ASTM C 1184, neutral-curing silicone formulation 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 curtain wall systems indicated.
- D. Primer: Nonstaining type, recommended by sealant manufacturer to suit application.
- E. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials and not damaging to exposed surfaces.
- F. Joint Backing: Provide in conformance with JOINT SEALANT BACKING specified In Section 07 92 00 Joint Sealants; and approved by sealant manufacturer; oversized 30 to 50 percent larger than joint width or as recommended by product manufacturer.
- G. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- H. All joints within system to be sealed under this Section.
- I. Non-Moving Joints Within Curtain Wall Assembly: Low or medium modulus silicone in conformance with Section 07 92 00 – Joint Sealants.
- J. Moving Joints Within Curtain Wall Assembly: High range type; i.e.: Low modulus silicones, all as approved by manufacturer as being suitable for application and compatible with seals of insulated glazing units where applicable.
- K. Perimeter Joints: Provide products in conformance with Section 07 92 00 – Joint Sealants.

## 2.10 ALUMINUM FRAMED SWING DOOR WITH HARDWARE AND ACCESSORIES

- A. Door Material:
  1. Extruded aluminum as specified above.
  2. Steel Reinforcement: Complying with ASTM A 36/ A 36M for structural shapes, plates and bars; ASTM A611 for cold-rolled sheet and strip or ASTM A 570/ A 570M for hot-rolled sheet and strip.

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- 3. Fasteners: 300 Series, Stainless Steel.
  - B. Hardware: Provide as specified in Division 8 Section 08 71 00 "Door Hardware", and as follows:
    - 1. Provide heavy-duty hardware units indicated in sizes, number and type recommended by curtain wall manufacturer for entrances indicated. Finish exposed parts to match curtain wall finish, unless otherwise indicated.
    - 2. Butt Hinges: Provide manufacturer's mortised, top, bottom and intermediate aluminum 3-way adjustable butt hinges.
    - 3. Overhead Door Stop: Provide manufacturer's stainless steel overhead stop with rubber bumper door check mounted in the top rail of the door leaf.
    - 4. Standard Locking Hardware: Stainless steel multipoint locking gearbox consisting of swinghooks, latch lock and keyed dead bolt activated by a lever handle.
      - a. Cylinders: Two per lock. Furnished by Section 08 71 00.
  - C. Weatherstripping: Co-extruded dual durometer EPDM.
  - D. Threshold: Thermally broken threshold with removable threshold cover, cutouts coordinated for operating hardware and anchors. Material and finish to match door and frame.
  - E. Thermal Barrier: Shall be two continuous rows of polyamide glass reinforced 6/6 nylon at door rails, door stiles and frame.
  - F. Fabrication:
    - 1. Door corner construction shall be neatly mitered and reinforced with heavy-duty aluminum corner blocks forming a rigid watertight joint. Corners shall be welded or mechanically fastened.
      - a. Accurately fit and secure joints and corners.
    - 2. Make joints hairline in appearance.
    - 3. Arrange fasteners and attachments to conceal from view.
  - G. Power Door Operators: Provide as specified in Division 8 Section 08 71 13.11 "Low Energy Power Assist Door Operators"; for doors provided by this Section. See Door Schedule for doors requiring Power Door Operators.

## 2.11 ACCESSORIES

- A. Extruded or Formed Trim:
  - 1. Material: Aluminum.
  - 2. Thickness: Minimum 0.060".
  - 3. Sill Extensions: Extruded Aluminum.
- B. Accessories: Manufacturer's standard with exposed portions matching finish of curtain wall system. Provide slip-joint linings of sheets, pads, shims, or washers of fluorocarbon resin, or similar material recommended by manufacturer at joints where movement must be accommodated.
  - 1. Steel for Anchorage: 304 or 316 stainless steel, sizes as required meeting structural requirements.
- C. Special Shapes: As detailed or required; extruded shapes and bent aluminum sheet, minimum 0.060 inches, finished after fabrication.
- D. Adaptors: Extrusions designed to glaze into framing system to accept door.
- E. Vapor Barrier (Backpan): Provide one of the following:

1. Steel Sheet: Zinc-coated, commercial steel Type A, minimum 16 gage; ASTM A 653 with G-90 coating designation. Cut edges must be interior of wet zone.
- F. Perforated Shadow Box Liner: Aluminum sheet, minimum 0.080" thick, minimum 40% open.
- G. Condensation/Gutter: 1 inch x 1 inch aluminum angle, minimum 0.080' thick, with 1" x 1" end dams at both ends. Length to match clear width between mullions and space for sealant at end dams.
- H. Miscellaneous: As required for complete installation.

## 2.12 FABRICATION

- A. General: Fabricate curtain wall system according to Shop Drawings.
  1. See DESIGN REQUIREMENTS and PERFORMANCE REQUIREMENTS in Part 1 above.
  2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortions.
  3. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
  4. Complete welding, cutting, drilling and fitting of joints prior to chemical treatment, and application of coatings.
  5. Louvers Integral with Curtain Wall Framing: Incorporate into curtain wall framing. Install in accordance with requirements of Section 08 90 00, Louvers and Vents.
- B. Provide parts of curtain wall system of materials, design, sizes and thickness, subject to commercial tolerances, shown or called for on shop drawings and specified in this Section.
- C. Make provision in the glazing pocket of the framing for the minimum clearances for the thickness and type of glass scheduled in accordance with GANA Glazing Manual or manufacturer's recommendations or governing code requirements, whichever is most restrictive.
- D. Reinforcements and Anchors:
  1. Reinforce work as necessary to meet performance requirements, and for support to structure.
  2. Provide framing anchors for three-way adjustment to accommodate fabrication and construction tolerances, structurally adequate to carry the weight of the wall system; to allow noiseless thermal movement; and meet structural requirements specified.
    - a. Anchors to adequately secure components to structure to meet performance requirements and to provide fully for anticipated building movement or thermal movement of component materials; refer to PERFORMANCE REQUIREMENTS in Part 1.
  3. Separate dissimilar metals with bituminous paint or preformed separators which will prevent corrosion or electrolytic action in accordance with industry standards and procedures.
- E. Carefully match all exposed work to produce continuity of line and design, with all joints accurately fitted and rigidly secure.
- F. As far as practical, do all fitting and assembling in shop/factory.
- G. Provide protection against degradation caused by contact between dissimilar metals.

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- H. Fabricate Work true to detail with sharp, clean profiles, straight and free from defects, dents, marks, indentations, waves, or flaws of any nature impairing strength or appearance, fitted with proper joints and intersections, and with the specified finishes.
- I. Removable members such as glass stops, fillers, or closures shall be extruded and securely engaged into adjacent components.
- J. Design and construct expansion joints so that they will be and remain permanently watertight, and accommodate weather and building dynamics.
- K. Fabricate components to drain water-passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- L. Welding.
1. Do all welding in accordance with recommendations of the American Welding Society.
  2. Do welds behind finished surfaces to minimize distortion and discoloration on finished side. Remove weld splatter and welding oxides on finished surfaces by descaling or grinding.
  3. Protect all glass from weld splatter.
- M. Use sealing materials in accordance with recommendations of the manufacturer of the material. Seal joints in accordance with the design and tolerances shown on Shop Drawings.
- N. Insulation & Perforated Shadow Box Liner: Install condensation/gutter, insulation and shadow box liner at all non-vision areas including spandrel glass. Provide Insulation & Perforated Shadow Box Liner at any cavity with a backpan.
1. Condensation/Gutter: Set vertical face of angle 1 inch from face of glass and set on top side of bottom interior horizontal mullion. Horizontal leg of angle shall be towards interior. Set angle in sealant and seal watertight to framing. Secure with screws. Design to allow area between glass and vertical leg of angle with end dams to be water tight.
  2. Perforated Shadow Box Liner: Attach seamless sheet to interior face of framing with stainless steel screws.
    - a. Seal: Install continuous seal between framing and vapor barrier using one of the materials listed below. Provide complete seal between framing and vapor barrier.
      - 1) Silicone Sealant. Bead size as needed.
      - 2) Butyl Sealant Tape: Maximum 1/16" thick x minimum 1/2" wide. Butt joints tight before compression.
    - b. Screw Spacing: As needed to assure continuity of sealant bead.
    - c. Joints: Not permitted except directly over framing.
    - d. Provide slotted screw hole openings in metal backpan (vapor barrier) as needed to accommodate thermal movement. Provide neoprene washers for screws to assure airtight seal at fastener penetration.
  3. Insulation: Install tight to shadow box liner and framing; fill continuous between framing. Maintain placement with non-metallic stick clips adhered to shadow box liner. Insulation secured on stick clips with washers and retaining clip.
  4. Properly reinforce backpan at height corresponding to slab edge to resist compression of edge of slab firestopping, and requirements of Section 07 84 00 – Firestopping for Curtain Wall/Floor Intersection.
  5. Seal across unit joints with continuous vapor retarder tape to maintain vapor barrier. Install with minimum 1/2 inch wide beads of silicone adhesive each side of joint in accordance with manufacturer's instructions.

2.13 Backpan: Backpan shall be set in sealant and form an airtight seal at perimeter of backpan.

## 2.14 JOINERY IN METAL WORK

- A. Match exposed work to produce continuity of line, design, and finish. Accurately fit joints in exposed work, rigidly secured with hairline contact and sealed watertight unless otherwise shown or required for thermal movement. Clean excess sealant from exposed surfaces.
- B. Where two or more sections of metal are used in building up members, bring the contact surfaces to a smooth, true, and even surface. Secure together so that the joints are tight without the use of any pointing materials.

## 2.15 METAL FINISHES

- A. Exposed Surfaces: Spray painted coatings as specified under Section 05 05 13, Shop-Applied Coatings for Metal.
  - 1. Framing, Trim, Accessories:
    - a. Exterior: 2-Coat PVDF finish containing mica pearlescent flake pigments.
    - b. Interior: Thermal-set acrylic, "polycron" or equal. Color to match exterior finish unless indicated otherwise.
    - c. Colors: Custom color as selected by Architect, see Section 09 06 00 - Schedule for Finishes. See SUBMITTALS and PERFORMANCE & AESTHEIC MOCK-UPS in PART 1 above.
  - 2. Metal Cladding Panels: Match exterior framing above.
  - 3. Insulated Metal Panels: Match exterior framing above.
  - 4. Shadow Box Liner: Baked enamel, same as interior framing.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of finished work: Noticeable variations the same piece is not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

## 2.16 STEEL PRIMING

- A. General: Prime finish 1 coat zinc chromate paint conforming to FS TT-P-645.
- B. Finish: Exposed clips, anchors, and supports shall have finish matching aluminum curtain wall system finish.

## 2.17 FIRESTOPPING

- A. Firestopping: Provide as specified under Section 07 84 00 – Firestopping.

## 2.18 EXPANSION JOINT COVERS

- A. Expansion Joint Covers: Provide as specified under Section 07 95 13 - Expansion Joint Cover Assemblies

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**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
  - 1. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence.
- B. Acts of omissions by other parties that will modify the Warranty shall be brought to the Resident Engineer's and Architect's attention, in writing, within 7 days.
- C. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.
- D. Do not proceed until unsatisfactory conditions have been corrected. Starting Work indicates acceptance of conditions and installer assumes full responsibility for results.

**3.2 PREPARATION**

- A. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint, or other approved separation for prevention of electrolytic action and corrosion.

**3.3 INSTALLATION**

- A. Comply with manufacturers written instructions for protection, handling, and installing curtain wall system.
- B. Install curtain wall system, including glass, insulated metal spandrel panels, framing, anchors, and all associated components and accessories in accordance with approved Shop Drawings.
- C. Erect curtain wall framing units plumb and true, in proper alignment and relation to established lines as shown on Shop Drawings.
- D. Do not install damaged components. Replace or repair damaged components prior to installation.
- E. Field paint all field cuts whether exposed or concealed with primer and finish coat to match finish of cut material, unless conditions are demonstrated to not affect performance or durability and are approved by Resident Engineer.
- F. Metal protection: Where aluminum will contact dissimilar metals, concrete or masonry, protect against galvanic or corrosive action by painting contact surfaces with primer, bituminous paint or by applying sealant, tape, or other materials as recommended by manufacturer.
- G. Maintain continuity of air barrier and drainage plane, including at interfaces with adjacent construction.

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- H. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- I. Install glazing as specified Division 08 Section 08 88 53 - Security Glazing.
- J. Install sealants as specified in Division 07 Section "Joint Sealants.", and Curtain Wall manufacturer's recommendations.
- K. Extruded Silicone Transition System: Comply with manufacturers written instructions and the following requirements:
1. Coordinate with installer of air weather barrier at adjacent assemblies to ensure proper sequencing of work.
  2. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
  3. Seams: Apply Joint Bonding Sealant to each side of joint to produce a bead of size complying with Extruded silicone transition system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
  4. Within 10 minutes of Joint Bonding Sealant application, press Preformed Extruded Silicone Sheet into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
  5. Complete installation of sealant system in horizontal joints before installing in vertical joints. Use preformed pieces of Extruded Silicone sheets at all corners and similar changes in substrate planes.
  6. Aluminum Attachment Bar to be installed to permanently lock Extruded Silicone Sheet against curtain wall mullion. Sequence installation of Attachment Bar as required to achieve permanent flexible joint seal.
  7. Transition of Extruded Silicone Transition System to AWB: Seal preformed extruded silicone sheet from curtain wall to AWB using joint bonding sealant to maintain a continuous air barrier. Fish mouths and air bubbles in membrane are not acceptable. Use sufficient joint bonding sealant that it is visible along the full length of the silicone membrane's transition edge. Unless indicated otherwise on drawings or approved by Architect, preformed extruded silicone sheet shall be sealed into glazing pocket of curtain wall.
- L. Flashing shall be formed, installed, and joined in accordance with Shop Drawings.
1. Where not indicated, form and install flashings to comply with SMACNA's Architectural Sheet Metal Manual.
- M. Use flashings in longest practical length.
1. Allow for thermal expansion and contraction of flashings and accommodation of specified building movements without buckling or warping.

### 3.4 TOLERANCES

- A. Design and fabricate the glazed curtain wall system to accommodate permissible dimensional tolerances in the building frame and other work adjacent to the wall. Provided irregularities do not exceed them, and clearances in Shop Drawings are maintained, all parts of the curtain wall, when completed, shall be within the following tolerances.
1. Maximum variation from plane or location shown on approved Shop Drawings: 1/8 inch per 12 feet of length but not exceeding 1/2 inch in any total length.
  2. Maximum offset from true alignment between two identical members abutting end to end in line: 1/16 inch.



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3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an AAMA Accredited Laboratory or other independent testing and inspecting agency, approved by the Architect and Contracting Officer, to perform field tests and prepare test reports. The Architect and Contracting Officer will designate areas for each curtain wall area to be tested.
- B. Water Penetration and Air Leakage Field Testing:
1. Notify the Architect and Resident Engineer, in writing, a minimum of 14 days prior to conducting the field-testing.
  2. Testing Methodology:
    - a. Water Penetration Resistance Testing shall be conducted in accordance with ASTM E1105, Procedure A, consisting of 15 minutes induced air pressure difference.
      - 1) Field Test pressure shall be same test pressure specified in the Performance and Testing Requirements section.
      - 2) Water penetration shall be as specified in the in PERFORMANCE REQUIREMENTS and Section 01 45 29 - Mockups.
    - b. Air Leakage Testing shall be conducted in accordance with ASTM E783
      - 1) Test pressure shall be 6.24 psf
      - 2) Maximum air leakage rate shall be as specified in PERFORMANCE REQUIREMENTS and Section 01 45 29 - Mockups.
  3. Testing Procedure and Extent:
    - a. Conduct initial field test at designated completed curtain wall area selected by Architect's and Contracting Officer's as soon as is practical after installation of curtain wall has started. Test early during installation so that errors in fabrication or installation can be found and corrections made before remainder of curtain wall assemblies are installed.
      - 1) As applicable, test area shall include interface with adjacent building envelope systems, as well as typical sill, vertical and horizontal mullions. Test shall include both vision and opaque panels.
      - 2) Test Procedure:
        - a) Initial field test shall include air leakage testing followed by Water Penetration Resistance Testing.
    - b. After initial testing of earliest installation, test one area selected by Architect and Contracting Officer prior to completing 10 percent of curtain wall installation, two additional tests prior to completing 30 percent of the glazed wall area and two additional tests prior to completing 50 percent of the glazed wall areas.
      - 1) As applicable, test areas shall include interface with adjacent building envelope systems, as well as typical vertical and horizontal mullions, corner mullions, and typical penetrations through curtain wall. Tests shall include both vision and opaque panels.
      - 2) All tests following initial field test shall be for water penetration resistance only.
  4. Unless otherwise directed by Architect and Contracting Officer, each test area shall extend at least 15 feet wide by one storey height.
  5. If any installation fails performance tests, correct observed deficiencies and re-test at Contractors own expense. Incorporate corrective measures into all final curtain wall assembly installations.
  6. If any of the units fails the performance tests, at Architects discretion, one additional area shall be tested at contractor's expense. If these installations also fail performance tests, correct observed deficiencies and re-test at Contractors expense. At Architects discretion, for each additional area that fails the testing, one additional area shall be tested. All additional testing shall be conducted at Contractors expense.
  7. Work that does not meet the performance requirements or that is damaged by testing shall be repaired or replaced to conform to the specified requirements.

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8. Submit test reports and photographs indicating the procedures and results of all field tests.

### 3.6 CLEANING

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

### 3.7 PROTECTION

- A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, sealant smears, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

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SECTION 08 44 13.3  
GLAZED ALUMINUM CURTAIN WALLS FOR DIXIE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Curtain all in existing Dixie Building only.
  - 1. Delegated Design.
  - 2. The curtain wall system is specified for its historical appearance and superior performance requirements.
  - 3. Metal flashing with end dams.
  - 4. Extruded aluminum mullion extensions.
  - 5. Extruded aluminum window sill extensions.
  - 6. Sealant work associated with systems.
  - 7. Engineering design, shop drawings, calculations, testing.
  - 8. Supports, bracing, reinforcing, and anchorage for above systems, but required to meet performance requirements and for structural integrity of completed work.
  - 9. Thermal simulation of curtain wall with adjacent wall systems.
- B. Products Provided but not specified Under this Section:
  - 1. Glazing as specified in Section 08 88 53 - Security Glazing.
  - 2. Work of this Section shall comply with Section 08 44 13.30 - Life Safety Blast Requirements for Glazed Aluminum Curtain Wall System.
  - 3. Work of this Section shall comply with Section 08 71 13.50 - Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.

1.2 RELATED WORK (Items not included in this Project Manual are available through Construction Manager upon request)

- A. Requirements of Division 1 Sections apply to this Section.
- B. Summary of Work including Interior HVAC Design Data: Section 01 11 10 - Summary of Work.
- C. Testing Laboratory Services: Section 01 45 29.
- D. Exterior Wind Enclosure Requirements: Section 01 83 16.13.
- E. Wood trim pilasters at exterior windows of Dixie Building: Section 06 40 00.
- F. Facility Exterior Enclosure Commissioning: Section 07 08 00.
- G. Flashing and Sheet Metal: Section 07 60 00.
- H. Firestopping at edge of slab: Section 07 84 00 - Firestopping
- I. Intumescent Fireproofing: Section 07 81 23.
- J. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain-wall systems and for sealants to the extent not specified in this Section.
- K. Exterior glazing: Section 08 88 53 - Security Glazing.

- L. Color texture and finish: Section 09 06 00, Schedule for Finishes.

### 1.3 DEFINITIONS

- A. "Preformed Extruded Silicone Sheet", "Preformed Extruded Silicone Joint Sealant" are interchangeable terms for purposes of this Section.
- B. "Sealant", "Joint Sealer", "Calk", "Caulk", "Calking", and "Caulking" are interchangeable terms for purposes of this Section.
- C. "Glazed aluminum curtain wall", "curtain wall", "curtainwall" and "glazed framing system" are interchangeable terms for purposes of this Section.
- D. For purposes of this section with Section 08 44 13.30 and Section 08 44 13.50 the word "window" is interchangeable with the word "curtain wall".

### 1.4 BLAST REQUIREMENTS

- A. Blast Requirements:
1. Life Safety Structures: As specified in Section 08 44 13.30 - Life Safety Blast Requirements for Glazed Aluminum Curtain Wall System
  2. Mission Critical Structures: As specified in Section 08 44 13.50 - Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.

### 1.5 DESIGN REQUIREMENTS DESCRIPTION

- A. The Drawings show aesthetic design intent. Products provided must conform to design intent shown and performance levels specified. The drawings and specifications are complementary regarding the aesthetic design intent.
1. Framing Systems: Four-sided captured glazing with faux muntins on interior, exterior, and inside glass lites.
- B. Products provided under this Section shall meet or exceed BLAST REQUIREMENTS specified above.
- C. Structural Support:
1. The connection of the curtain wall to the building occurs as shown, and the building structure is reinforced for this load.
  2. Movement and Loads: See "Deflection of Framing Members" and "Thermal Movements" under PERFORMANCE REQUIREMENTS below.
- D. Contractor is solely responsible for engineering design of the systems following the below listed architectural design criteria and performance criteria specified under PERFORMANCE REQUIREMENTS.
- E. See "Engineer's Seal/Signature" under SUBMITTALS below.
- F. Glazing System:
1. Typical: Externally glazed.

Per RFI 4883: Internal muntin to be 3/16" in lieu of full depth.

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- G. Exposed Break Metal: Fabricate Work true to detail with sharp, clean profiles, straight and free from defects, dents, marks, indentations, waves, or flaws of any nature impairing strength or appearance, fitted with proper joints and intersections, and with the specified finishes.
1. Welding.
    - a. Do all welding in accordance with recommendations of the American Welding Society.
    - b. Do welds behind finished surfaces to minimize distortion and discoloration on finished side. Remove weld splatter and welding oxides on finished surfaces by descaling or grinding.
    - c. No field welding will be allowed.
- H. Size Requirements:
1. Width (Sight Line): Horizontal and vertical member width shall be the same within each system. Field and perimeter member widths as shown on drawings.
  2. Depth: Horizontal and vertical member depth to be as required for specified loading and for sill as shown on drawings, but without affecting the building structure or intended tolerances.
  3. Provide reinforcement concealed within curtain wall system, as required to meet PERFORMANCE REQUIREMENTS.
- I. Field Installed Sealant Joints:
1. Bonding Surface: Provide water tight metal return the full depth of vertical and horizontal mullions, including glazing pocket, to allow for dual stage sealant joints within the full depth of the aluminum mullion extrusion; except metal caps at exterior side of glass are not required to be water tight.
  2. Typical Size: 5/8 inch wide unless specifically accepted by Architect or required to accommodate calculated movement with low modulus sealant. See details on drawings and sealant matrix on drawings for other sealant joint sizes.
- J. Design Modifications: Make design modifications of work shown only as necessary to meet performance requirements and coordinate the work. Maintain the general exterior design concept without altering spacing, profiles, or alignments shown.

## 1.6 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design curtain wall, including comprehensive engineering analysis by a qualified Professional Engineer, using performance requirements, blast requirements, and design criteria indicated.
- B. Provide glazed aluminum curtain wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:
1. Structural loads, including wind, blast, and seismic.
  2. Thermal movements.
  3. Movements of supporting structure indicated on Drawings and specified in Related Sections including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  4. Dimensional tolerances of building frame and other adjacent construction.
  5. Failure includes, but not limited to, the following:
    - a. Deflection exceeding specified limits.
    - b. Thermal stresses transferred to building structure.
    - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
    - d. Noise or vibration created by wind and thermal and structural movements.
    - e. Loosening or weakening of fasteners, attachments, and other components.

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- f. Sealant failure
    - g. Gasketing failure.
    - h. Water penetration
    - i. Air leakage exceeding specified limits
  - C. The curtain wall systems and interface details between the curtain wall systems and adjacent envelope components shall be designed utilizing rainscreen principles.
    - 1. Two distinct lines of protection against water ingress shall be provided, with the interior line of protection providing the primary air barrier of the system.
      - a. The air seal shall extend from the curtain wall frame to the appropriate air and water barrier of the adjacent system.
      - b. The exterior weather seal or flashing shall extend from the exterior of the curtain wall system to the exterior cladding or similar water shedding surface of the adjacent construction.
    - 2. Provide weeps to allow drainage to the exterior of water, which enters the space between the interior and exterior seals. Where feasible, provide drainage to the exterior at horizontal mullions below each glazing unit. Unless otherwise indicated or approved by the Architect, drainage paths shall be concealed or similarly protected from direct exposure to wind driven rain.
  - D. Structural Design:
    - 1. Wind Loads: See Section 01 83 16.13 - Exterior Wind Enclosure Requirements.
    - 2. Seismic Loads: See Structural drawings
    - 3. Importance Factor: See Structural Drawings.
    - 4. Exposure Category: See Structural Drawings.
    - 5. Blast Loads: See drawings and "BLAST REQUIREMENTS" above.
    - 6. Structural-Test Performance: Provide glazed aluminum curtain wall systems tested according to ASTM E 330 as follows:
      - a. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
      - b. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
      - c. Test Duration: As required by design wind velocity but not less than 10 seconds.
    - 7. Deflection of Framing Members:
      - a. Deflection Normal to Wall Plane: Limited to 1/180.
      - b. Deflection Parallel to Glazing Plane: Limited to an amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch when carrying full loads, and the clearance between the member and an operable window or door shall be minimum 1/16 inch.
      - c. Cantilever Deflection: Where framing members overhang an anchor point, limited to 2 times the length of cantilevered member, divided by 180.
    - 8. Windborne-Debris Impact Resistance: The glazed openings to meet requirements of the p. 1609.1.2 of the Chapter 16 of the International Building Code (IBC) 2006 as follows:
      - a. Top of openings within 30 feet from Grade: Large Missile Test, Level D.
      - b. Bottom of openings more than 30 feet from Grade: Small Missile Test.
      - c. Test specimens for small and large missile test shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
      - d. Perform applicable impact tests for wind-borne debris in accordance with the testing standards ASTM E1886 and ASTM E1996 for Wind Zone 4 and Enhanced Protection level (Essential Facilities), Missile Level "D".
    - 9. Interstory Drift (seismic or wind): The maximum movement in all directions as measured between points in a plumb line between floors subjected to the maximum wind or seismic

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- loads. Provide curtain wall systems that accommodate the following displacement between adjacent floor levels:
- a. Elastic Displacement (base event): 1/2 inch.
    - 1) After being subjected to elastic displacement limit, no permanent damage or deformation shall occur and the curtain wall shall meet all performance criteria indicated in this specification without repairs.
    - 2) Test procedure shall be in accordance with AAMA 501.4.
  - b. Inelastic Displacement (maximum considered event): 3/4-inch.
    - 1) After being subjected to inelastic displacement limit, gaskets and sealant may fail and frame deformation may occur, but no component may fall from the building.
    - 2) Test procedure shall be in accordance with AAMA 501.4.
  - c. Glass installed in the curtain wall shall meet the glass fallout requirements of ASCE-7 to accommodate seismic displacement without glass fallout.
10. Vertical Floor Deflection:
    - a. Curtain wall system shall be designed to accommodate vertical floor deflection equal to 3/8 inch downward at all locations.
  11. Erection Tolerance:
    - a. Curtain wall system shall be designed to accommodate erection tolerances of supporting and adjacent construction as specified in related sections.
  12. Eccentric Loads: Eccentricity to be taken by the curtain wall framing and not be transferred to the anchor / structure.
- E. Air Infiltration and Exfiltration:
1. Curtain wall: Maximum air infiltration and exfiltration leakage rate shall be 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure differential of 6.24 lbf/sq. ft.
- F. Water Leakage Resistance:
1. Water Penetration Under Static Pressure:
    - a. Curtain wall: No evidence of water penetration when tested according to ASTM E 331 for 15 minute duration at a minimum differential static pressure of 15 lbf/sq. ft. positive wind load.
  2. Water Penetration Under Dynamic Pressure:
    - a. Curtain wall: No evidence of water leakage when tested according to AAMA 501.1 for 15 minute duration under dynamic pressure equal to not less than 15 lbf/sq. ft. positive wind load pressure.
  3. Water penetration shall be defined as the appearance of any water on the interior side of any part of the glazed wall assembly, including the interface locations with adjacent envelope systems, that is not contained and drained back to the exterior, or that can cause damage to adjacent materials or finishes. Water fully contained in drained flashings, gutters, and sills is not considered water penetration.
- G. Thermal Movements: Provide glazed aluminum curtain wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
  2. Test Performance: No buckling, stress on glass, glazing-edge seal failure, sealant failure, excess stress on curtain wall framing, anchors and fasteners, or reduction of performance when tested according to AAMA 501.5.
    - a. Test High Exterior Ambient Air Temperature: The greater of 120 deg F or that which produces an exterior metal surface temperature of 180 deg F
    - b. Test Low Exterior Ambient Air Temperature: 0 deg F.
    - c. Test Interior Ambient Air Temperature: 75 deg` F.

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**H. Energy Performance:**

1. Thermal Transmission:
  - a. Curtain wall: The curtain wall, including vision glass and metal framing, shall have an average thermal transmittance U-factor not more than 0.5 BTU/ft<sup>2</sup>/°F when tested in accordance with AAMA 1503.1.
  - b. Spandrel Thermal Resistance: Opaque and spandrel panels shall have average effective thermal value of at least:
    - 1) R-value: Not less than 13.
2. Thermal breaks and separation:
  - a. Curtain wall system framing to incorporate thermal enhancement reducing thermal transfer of framing components exposed to interior and exterior environments.
3. Condensation Resistance:
  - a. Curtain wall: The condensation-resistance factor (CRF) shall be no less than 60 for the frame and glass, when tested according to AAMA 1503.
4. Comply with "Thermal Simulation" under QUALITY ASSURANCE below.

**I. Condensation Requirements:**

1. Exterior Glazed Framing: Provide manufacturer's thermally improved construction which has been tested or simulated, to provide an assembly or assemblies which will not allow condensation to occur on the interior side of framing or glass under winter design conditions and conditions of installation shown on drawings
  - a. See STRUCTURAL DESIGN DATA and HVAC DESIGN DATA under Section 01 11 10 – Summary of Work for winter design conditions.
  - b. Humidity may vary with type of spaces listed under Section 01 11 10.
2. Interior Glazed Framing: No requirements.
3. The above Condensation Requirements do not apply to CW-6.

**J. Glass Statistical Factor (Safety Factor):** Glass thicknesses when shown on the drawings are for convenience of detailing only and are to be confirmed by the Contractor and/or glass manufacturer. All glass for the size openings shown will be provided in thicknesses such that the probability of breakage at the design wind pressure will not exceed 8 lights per 1000 lights (S.F. = 2.5). Glass manufacturer to provide, on request, substantiating glass breakage data if such data is not otherwise available as manufacturer's published data.**K. Surface-Burning Characteristics of Interior Materials:**

1. Flame-Spread Index: 25 or less, ASTM E84.
2. Smoke-Developed Index: 450 or less, ASTM E84.

**1.7 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Engineer's Seal/Signature: Shop drawings and associated calculations required for structural design shall bear seal and signature of curtain wall manufacturer's Professional Engineer. See Professional Engineer under QUALITY ASSURANCE below, and "Structural Calculations" below.
- C. Shop Drawings: Prepared by curtain wall system manufacturer. Information contained in Shop Drawings shall include, but not necessarily be limited to the following:
  1. Each shop drawing sheet shall include manufacturer's name and trademark.
  2. Plans, elevations and sections at a scale as large as practical. Provide references to detail numbers on the Architectural Drawings and references to the Specifications section and paragraph numbers to identify material types and finishes.
  3. Key to metal thickness, types, and metal finishes.



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4. Key to glass types, thickness, and attributes.
  5. Details of field connections and anchorages and their relationship to the work of other building trades. Include transition details of curtain wall system to adjacent construction. See Anchorage Drawings, below.
  6. Details showing concealed reinforcement.
  7. Drainage paths, weeps, flashings and baffles.
  8. Details of sealing methods, dimensions, and materials; gaskets, and product joinery.
  9. Glazing details and methods.
  10. Type of construction including joinery, fasteners and welds, anchorage assemblies and components, fabrication tolerances for the Work of this Section and the adjoining related work, and layout of inserts.
  11. Continuous line of air tightness for the system, including at interfaces with adjacent construction.
  12. Details of adjoining work to ensure coordination of this Work and work of other Sections.
  13. Shimming Depths: For each type of anchorage to structure, show maximum allowable depths of shims permitted for normal conditions. Show details for shim depths exceeding normal conditions and their limits. Design custom anchorages as needed to meet field conditions.
  14. Adjustability: Show details of anchors indicating range of adjustment and accommodation of tolerances of adjoining work.
  15. Do not proceed with fabrication until Shop Drawings have been reviewed and approved by Architect.
  16. Anchorage Drawings:
    - a. Show embed types and layouts, anchorage locations, types and sizes of anchors, and proposed methods of attachment to structure.
    - b. Show details of anchors. Include range of adjustment for each anchor type and bolt size, including those perpendicular to face of building.
    - c. Describe all materials including shimming devices.
    - d. Indicate all reactions or loads-imposed-on structure imposed on structure under maximum design load conditions for Engineer to review.
    - e. Shimming Depths: For each type of anchorage to structure, show maximum allowable depths of shims permitted for normal conditions. Show details for shim depths exceeding normal conditions.
  17. Minimum scale of details 3" = 1'-0".
- D. Structural Calculations: Submit triplicate copies of structural calculations made by or for curtain wall manufacturer in connection with design and detailing of the curtain wall work, including connections and attachments. Submittals may or may not be returned, and will not bear stamp of approval. Base calculations on worst case conditions for all allowable variations, tolerances and connections. Perform calculations under direct supervision of manufacturer's Professional Engineer. Calculations shall be sealed and signed, and shall include:
1. Direction and magnitude of thermal expansion; direction and magnitude of applicable building and seismic movements.
  2. Structural forces imposed on the building structure under all conditions of construction and loading, as specified.
  3. Section property computations for framing members.
- E. Glass and Glazing Provided by This Section: Provide submittals in conformance with Section 08 88 53 - Security Glazing.
- F. Submittals required for this Sections shall be submitted complete and concurrently with Blast Submittals. Partial submittals are not acceptable.
1. Blast Submittals: Submittals as specified in:
    - a. Section 08 44 13.30 - Life Safety Blast Requirements for Glazed Aluminum Curtain Wall System.

- b. Section 08 44 13.50 - Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.
- G. Thermal Simulation report(s).
- H. Installation Instructions.
- I. QA/QC procedures.
- J. Shop QA/QC reports.
- K. Sample Warranties, per Section 01 33 25 – Warranties.
- L. Laboratory Test Reports: Submit duplicate copies of certified test reports on the performance of curtain wall system and components based on testing to specified requirements by AAMA accredited laboratory or other qualified laboratory.
- M. Maintenance Data: Submit detailed procedures for periodic inspection, maintenance and cleaning of applicable elements.
1. Include relevant information related to interior components, such as installation of blinds or similar finishes, or procedures that may impact the performance or warranty of the curtain wall or glazing components.
- N. Schedules: Provide the following:
1. Detailed schedule for sealants and related items such as primers and back-up material; designation of areas and locations for all types of sealants, primer and back-up materials used in each case; methods of application, special instructions, and specification data sheets. Cross-reference scheduled items with Shop Drawings.
  2. Schedule of tapes, gaskets, separators, and related items including the designation of areas and specific locations; materials used; special instructions; specification data sheets, and related information. Cross-reference scheduled items with Shop Drawings.
  3. Schedule of fasteners, connectors, and related items, such as washers and spacers including the designation of areas and specific locations; materials used; special instructions; specification data sheets, and related information. Cross-reference scheduled items with Shop Drawings.
  4. Detailed instructions for the installation of glass. Include sequence of installation and method of installation for materials including the glass, glazing gaskets, setting blocks, jamb blocks and related items; location of specific items such as the setting blocks and jamb blocks; any special instructions that may be required. Include instructions related to replacement of glazing units.
- O. Pre-Construction Adhesion Tests: See QUALITY ASSURANCE below. Submit results in format which allows comparison with manufacturer's published values.
- P. Samples.
1. Submit samples of each type and color of finish required by this Section. Include two (2) or more samples in each set, showing near-limits of variations (if any) in color and texture of finish.
  2. Window Rail: 12" sections of extrusion plus connection detail assembled.
  3. **Muntins:** 12" sections of extrusions, interior, exterior, and between lites.
  4. Sample Assemblies: After approval of the above listed samples is obtained, submit one each sample of assemblies listed below. Fabricate samples within the guidelines set forth under FABRICATION in PART 2 and show proposed construction methods, joinery, materials, and be prefinished. Sample may be reduced in size but show full size details.
    - a. Cut-Away Assembly (Typical of 2): Nominal 36" x 36". Beginning with a four-lite with vertical and horizontal mullions centered in sample, cut assembly at 45

Per RFI 4883: Internal muntin to be 3/16" in lieu of full depth.

degrees at approximately 3 inches above center to expose framing profiles and internal attachments and glazing details. Fabricate insulated glass units to match framing (1 square and 2 cut units). Include faux muttins

Per RFI 4883: Internal muntin to be 3/16" in lieu of full depth.

Q. Samples for Color Verification:

1. Mullions: Submit samples of each type and color of finish required by this Section, on 12" sections of extrusions or formed shapes and on 12" squares of sheet/plate. Include two (2) or more samples in each set, showing near-limits of variations (if any) in color and texture of finish.
2. Glass: As specified in Division 8 Section "Security Glazing".
3. Sealant (cured strips): duplicate samples, minimum 6 inches long, in each color proposed for use in exposed finish conditions.
4. Gaskets: duplicate samples, minimum 6 inches long, in each color proposed for use in exposed finish conditions.

R. Fabricator Qualification Certificate: Signed by curtain wall system manufacturer certifying that the manufacturer has approved, authorized, or licensed the fabrication facility to fabricate the manufacturer's curtain wall system, and that the facility is capable of producing the work herein specifically for this Project. Certificate is not required if curtain wall systems are fabricated by product manufacturer.

S. Installer Qualification Certificate: Signed by curtain wall system manufacturer certifying that installer is approved, authorized, or licensed by manufacturer to install curtain wall system. Certificate is not required if curtain wall systems are installed by product manufacturer.

T. Manufacturer's Field Reports:

1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during the course of curtain wall installation. Indicate results of field testing of mockup, and any directions given to Contractor for corrective action.

U. Certificate of Compliance: Fabricator shall provide certification of compliance after completion of fabrication in conformance with "QUALITY ASSURANCE".

1. Stating that aluminum has been given specified thickness of anodizing.

V. Provide documentation to show that fabricator meets requirements of "APPROVED FABRICATOR" in conformance with "QUALITY ASSURANCE".

W. LEED Submittals:

1. Product Data for Credit IEQ 4.3: For sealers, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

X. Sealants: Provide submittal in conformance with Section 07 92 00 - Joint Sealants for sealant products provided by this Section.

Y. Finish and Maintenance Data: Provide written instructions for the following:

1. Finishes. List each type of coating and the names of products receiving that type of coating.
2. Maintenance: Recommended materials and methods for proper maintenance of work for each type of coating provided under this Section.

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1.8 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide each curtain wall system from one source.
- B. Manufacturer Qualifications: Manufacturer shall specialize in designing and manufacturing the types of metal, glass and glazing accessories specified in this section, with a minimum of 10 years of documented successful experience of similar project size and type, and have the facilities capable of meeting all requirements of the Contract Documents as a single-source responsibility and warranty. Manufacturer shall fabricate and design the Glazed Aluminum Curtain system. Manufacturer's Professional Engineer shall design the curtain wall system.
- C. Installer Qualifications:
  - 1. Curtain Wall: A qualified firm that is certified by curtain wall system manufacturer to install manufacturer's product and that is specifically experienced with a minimum of 10 years experience in similar glazed wall systems for similar project size and type.
  - 2. Firestopping: Specialty contractor as specified under Section 07 84 00 - Firestopping. Refer to Section 07 84 00 for training and approval requirements.
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Louisiana and who has a minimum of 10 years experience in similar glazed wall systems in providing engineering services of the kind indicated.
- E. Qualified Blast Consultant: Provide in conformance with Section 08 44 13.50 Mission Critical Blast Requirements for Glazed Aluminum Curtain Wall System.
- F. Welding:
  - 1. Perform welding by skilled and qualified mechanics licensed where required in accordance with local governing regulations.
  - 2. Perform welding in conformance with AWS Structural Welding Code D1.1 for steel and D1.2 for aluminum.
- G. Pre-construction Sealant Test Reports:
  - 1. Compatibility and adhesion test reports from sealant manufacturer indicating that the glazing materials were tested for compatibility and adhesion with glazing sealant. Include the following:
    - a. Sealant manufacturer's interpretation of test results relative to the sealant performance and recommendations for primers and substrate preparation needed for adhesion.
    - b. Certification from the sealant manufacturer that any structural silicone sealants and accessories comply with the Contract Documents and are recommended by the sealant manufacturer for the use intended, and that the samples tested for adhesion comply with the manufacturers requirements for structural glazing.
    - c. Cost of testing to be borne by Contractor.
- H. Label: Provide metal label on frame to show compliance with building code and specifications. Label to meet requirements of authority having jurisdiction. Locate label where directed by Architect.
- I. Manufacturer shall afford the Architect, Resident Engineer, and their authorized agents full access to plant, shop (excluding paint facility), and assembly point to view and inspect the processes and methods employed in the fabrication, assembly, and finishing of the curtain wall.
- J. Fabricator shall meet requirements of "APPROVED FABRICATOR" as defined in Section 1702 of the 2006 International Building Code.

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- K. At completion of fabrication submit a certificate of compliance, in conformance with Section 1704.2.2 of 2006 IBC; to the building official, Contracting Officer, and Architect stating that the work was performed in compliance with approved construction documents and shop drawings.
- L. Thermal Simulation: Perform 2-D Finite Element Thermal Simulation Models of the curtain wall system with a temperature between minimum 32°F and 150°F. Thermal models shall include fenestration, glazing, spacers, and adjacent construction and represent each project-specific condition.
1. Provide thermal model outputs showing temperatures of glass, framing, and surrounding conditions through a 2-D cross section for each condition modeled.
  2. Analyze model output for dew point temperatures and report conditions under which dew point temperatures are reached.
  3. Internal Design Conditions: See HVAC DESIGN DATA under Section 01 11 10 Summary of Work for conditioned spaces.
  4. Surfaces that fall below the ASHRAE identified dew point for the condition shall be considered non-compliant.
- M. Pre-Installation Conference: Conduct at project site prior to the start of installation of curtain wall systems.
1. Review methods and procedures related to curtain wall Work, including but not limited to the following:
    - a. Methods and sequence of installation, including construction scheduling.
    - b. Glazing procedures and standard of workmanship.
    - c. Quality control requirements.
    - d. Evaluation of suitability of specified materials and sealants for anticipated weather conditions.
    - e. Coordination with other trades.
    - f. Field testing, inspecting and certifying procedures.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.
- C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.
- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Division 07 – “Sealants”.

#### 1.10 PROJECT CONDITIONS

- A. Field Measurements: Where curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain

wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

- B. Sequencing with Intumescent fireproofing: See Section 07 81 23 - Intumescent Fireproofing

#### 1.11 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.

- B. American Architectural Manufacturers Association (AAMA):

1. MCWM-1 Metal Curtain Wall Manual
2. CW 10 Care and Handling of Architectural Aluminum from Shop to Site
3. CW 11 Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing
4. CW 13 Structural Sealant Glazing Systems (A Design Guide)
5. CWG 1 Installation of Aluminum Curtain Walls
6. TIR A1 Sound Control for Aluminum Curtain Walls and Windows
7. TIR A4 Recommended Guide Lines for Reflective Insulating Glass
8. TIR A8 Structural Performance of Poured and Debridged Framing Systems
9. TIR A9 Metal Curtain Wall Fasteners
10. TIR A11 Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads
11. 101-I.S.2/A440 Windows, Doors and Unit Skylights
12. 501 Methods of Test for Exterior Walls
13. 503 Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems
14. 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
15. 1503 Thermal Transmission and Condensation Resistance of Windows, Doors and Glazed Wall Sections

- C. American National Standards Institute (ANSI):

1. Z97.1 Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test

- D. American Society of Civil Engineers (ASCE):

1. ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures
2. ASCE/SEI 24 Flood Resistant Design and Construction

- E. American Society for Testing and Materials (ASTM):

1. A36/A36M Structural Steel
2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. A193 Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
4. A307 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
5. B209 Aluminum and Aluminum Alloy Sheet and Plate
6. B211 Aluminum and Aluminum Alloy Bar, Rod, Wire

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- |     |            |   |
|-----|------------|---|
| 7.  | B221/B221M | Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes   |
| 8.  | B316/B316M | Aluminum and Aluminum Alloy Rivet and Cold-Heading, Wire, and Rods  |
| 9.  | C509       | Elastomeric Cellular Preformed Gasket and Sealing Material.   |
| 10. | C661       | Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer   |
| 11. | C719       | Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).   |
| 12. | C920       | Elastomeric Joint Sealants  |
| 13. | C794       | Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.  |
| 14. | C1135      | Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.  |
| 15. | C1363      | Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus   |
| 16. | D412       | Standard Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.  |
| 17. | D1037-99   | Evaluating the Properties of Wood-Base Fibers and Particle Panel Materials  |
| 18. | E84        | Surface Burning Characteristics of Building Materials   |
| 19. | E90        | Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements  |
| 20. | E283       | Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Difference Across this Specification                                  |
| 21. | E330       | Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference  |
| 22. | E331       | Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference   |
| 23. | E783       | Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.  |
| 24. | E1105      | Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors By Uniform or Cyclic Static Air Pressure Differences                             |
| 25. | E1886      | Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials |
| 26. | E1996      | Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes                        |

## F. American Welding Society, Inc. (AWS):

- |    |      |                                  |
|----|------|----------------------------------|
| 1. | D1.2 | Structural Welding Code-Aluminum |
|----|------|----------------------------------|

## G. Consumer Product Safety Commission (CPSC):

- |    |             |  |
|----|-------------|--|
| 1. | 16 CFR 1201 | Architectural Glazing Standards and Related Material |
|----|-------------|--|

## H. Federal Specifications (FS):

- |    |           |   |
|----|-----------|---|
| 1. | TT-P-645B | Primer, Paint, Zinc-Molybdate, Alkyd Type |
|----|-----------|---|

## I. Glass Association of North America (GANA):

- |    |    |                |
|----|----|----------------|
| 1. | 01 | Glazing Manual |
|----|----|----------------|

2. 02 Sealant Manual
3. 03 Laminated Glass Design Guide
4. 04 Tempered Glass Engineering Standard Manual

J. Military Specifications (MIL):

1. MIL-C-18480 (Rev. B) Coating Compound, Bituminous Solvent, Coal Tar Base

K. National Association of Architectural Metal Manufacturers (NAAMM):

1. 500 Series Metal Finishes Manual

L. Steel Structures Painting Council (SSPC)

1. Paint 25 Red Iron Oxide Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
2. Chapter 16 and Testing Application Standards (TAS) of the Florida Building Code (FBC) 2007.

M. Americans with Disabilities Act (ADA).

1.12 WARRANTY

- A. Submit manufacturer's written warranty for materials, installation and weathertightness, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.
- B. Finish Warranty: As specified in Section 05 05 13 - Shop-Applied Coatings for Metal.
- C. Glass and Glazing Warranty: As specified in Section 08 88 53 - Security Glazing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers of products that may be incorporated into the Work include, but are not limited to, the following:
  1. Basis of Design: 5600 Series by EFCO with mullion covers as follows:
    - a. 2-1/2" head, jamb, and sill: #13B5.
    - b. 4" mullion cap: #6721 CRV.
    - c. 8" mullion: Standard cover.

2.2 FRAMING AND METAL COMPONENTS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless Steel: Shall conform to American Iron and Steel Institute's "Steel Products Manual" and the following:
  1. Tubing: ASTM A268 or A269.



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2. Hot-Finished and Cold Finished Bars and Shapes: ASTM A276.
  3. Plate, Sheet and Strip: ASTM A167, A176, or A666
  4. Hot-Rolled and Cold-Rolled Sheet and Strip: ASTM A606.
- C. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with requirements of the standards indicated below.
1. Alloys shall meet or exceed mechanical properties of 6063-T5 for extrusions or 5005 H32 for sheet.
  2. Sheet and Plate: ASTM B209.
  3. Extruded Bars, Rods, Shapes and Tubes: ASTM B221.
  4. Bars, Rods, and Wires: ASTM B211.
  5. Standard Structural Shapes: ASTM B308.
  6. Sand Casting: ASTM B26.
  7. Permanent Mold Castings: ASTM B108.
  8. Drawn Seamless Tube: ASTM B210.
  9. Extruded Structural Pipe and Tubes: ASTM B429.
  10. Die Castings: ASTM B85.
  11. Welding Rods and Die Electrodes: AWS A5.10.
- D. Fasteners:
1. Fasteners used to join aluminum to aluminum shall be aluminum or stainless steel.
  2. Fasteners used to join stainless steel to stainless steel shall be stainless steel.
  3. Exposed fasteners to match finish of curtain wall system.
  4. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.
  5. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.
  6. Anchoring of Curtain wall to Support Structure: ASTM A307 zinc plated steel fasteners.

## 2.3 GLASS AND GLAZING

- A. Glass and Glazing: Provide as specified in Section 08 88 53 - Security Glazing.

## 2.4 INSULATION

- A. Curtain wall insulation at opaque panels: Provide as specified in Section 08 88 53 - Security Glazing.

## 2.5 FLASHING

- A. Flashing: Provide in conformance with Section 07 60 00 - Flashing and Sheet Metal with end dams and as follows:
1. Concealed Flashing: Provide one or more of the following as appropriate for the condition:
    - a. Dead-soft stainless steel, 26-gauge, type selected by manufacturer for compatibility.
    - b. Manufacturer's standard aluminum.
    - c. Flexible neoprene or EDPM rubber membrane, minimum 0.045 inch thick.
  2. Exposed Brake Metal Flashing: Minimum 0.032" thick aluminum brake metal finished to match adjacent aluminum framing. Increase thickness where needed to maintain placement or straightness of visible edge due to conditions of support and anchorage.
  3. Sill flashing shall counter flash over sheet metal flashing at top edge of roof membrane, where possible.

4. Sill Pans: 0.060-inch thick aluminum extrusion with end dams not less than 0.030-inch thick.
5. All flashing shall have water tight end dams.

## 2.6 EXTRUDED SILICONE TRANSITION SYSTEM

- A. Extruded Silicone Transition System to consist of Preformed Extruded Silicone Sheet, Joint Bonding Sealant, and Aluminum Attachment Bar to secure extruded sheet to designated substrate.
  1. Extruded Silicone Transition System shall provide a permanent and flexible seal between curtain wall and air weather barrier of adjacent assemblies.
  2. Extruded silicone transition systems manufactured by Tremco, Proglaze ETA, and conforming to these specifications are acceptable.
- B. Preformed Extruded Silicone Sheet Performance Requirements:
  1. Minimum performance requirements for 1-1/2-inch silicone seal applied over 1/2-inch joint after 21 days cure:
    - a. Properties tested in accordance with ASTM C1135:
      - 1) Ultimate strength: 40 psi.
      - 2) Ultimate elongation: 800 percent.
      - 3) Stress at 25 percent elongation: 3 psi and 1.5 pli
      - 4) Stress at 50 percent elongation: 5 psi and 2.5 pli.
      - 5) Stress at 50 percent compression: Less than 5 psi and 2.5 pli
    - b. Moment capability: Plus 200 percent and minus 75 percent, tested in accordance with ASTM C719.
- C. Preformed Extruded Silicone Sheet Physical Properties:
  1. Hardness: Minimum 25-durometer hardness, Shore A, ASTM C661.
  2. ASTM D412:
    - a. Tensile strength: Minimum 400 psi.
    - b. Elongation: Minimum 400 percent.
  3. Tear strength, die B: Minimum 100 ppi, ASTM C624.
- D. Preformed Extruded Silicone Sheet profiles and dimensions:
  1. Manufacturers' standard sheet of widths required to provide seal across joint between curtain wall and adjacent systems, as detailed.
  2. Pre-formed shapes:
    - a. Required at all corners and at similar changes in planes of substrates to achieve continuity of seals. Forming and sealing of flat sheets at corners and similar transitions is not permitted without prior written approval of Architect.
- E. Preformed Extruded Silicone Sheet Color: As approved by Architect.
- F. Joint Bonding Sealant:
  1. Type: Compatible silicone type as recommended and provided by silicone seal manufacturer. Acetoxy-cure silicone sealants are not acceptable.
    - a. Stain/bleed-resistant products to porous substrates, including limestone.
    - b. ASTM C920, silicone, neutral cure.
    - c. Type S.
    - d. Class 100: Joint movement range of plus 100 percent to minus 50 percent.
    - e. Grade NS.
    - f. Shore A hardness of 15-20.
    - g. Minimum elongation of 1200 percent.
  2. Color: Standard color as approved by Architect.

- G. Aluminum Attachment Bar: Extruded aluminum bar or shape to be mechanically attached to curtain wall to provide, along with Joint Bonding Sealant, a permanent connection between Extruded Silicone Sheet and curtain wall mullion. Aluminum attachment bar to provide continuous support of connection along full perimeter of curtain wall, except as required to accommodate movement joints in curtain wall system.

## 2.7 GASKETS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing applications indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Glazing Gaskets:
1. Gaskets, General:
    - a. Extruded with continuous integral locking projection to engage into metal glass holding members, designed to be in contact at all times with adjacent elements during dynamic loading, building and thermal movements, and provide a watertight seal as required to meet performance requirements.
    - b. Provide type which remains permanently elastic, non-shrinking, non-migrating, water and weather tight.
    - c. Unless otherwise approved by Architect, primary air seal glazing gaskets for any one light or glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs.
  2. Sponge Gaskets: Neoprene, EPDM or Silicone, 35-45 Shore A hardness, ASTM C509. Size and profile as required for watertight seal.
  3. Dense Gaskets: Neoprene or EPDM per ASTM C864 or Silicone per ASTM C 1115, 70-80 Shore A hardness for hollow profile; 55-65 shore A hardness for solid profiles. Size and profile as required for watertight seal.
- C. Glazing Tapes:
1. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
    - a. Type 1, for glazing applications in which tape acts as the primary sealant.
    - b. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
  2. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with spacer rod as recommended in writing by tape and glazing unit manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
    - a. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
    - b. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- D. Glazing Accessories:
1. Cleaners and Primers: Types recommended by gasket or sealant manufacturer.
  2. Setting Blocks:
    - a. Neoprene Type: Dense neoprene extrusions.
    - b. Silicone Type: Heat cured, preformed silicone.
      - 1) Silicone setting blocks are required when setting blocks are in contact with silicone sealant.
    - c. Shore A durometer hardness of 70-90.

- d. Profiles/Lengths/Locations: As required and recommended in writing by glass manufacturer to support glass and suit glass thickness.
3. Spacers:
  - a. Neoprene or other resilient blocks with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
  - b. Silicone spacers shall be used if in contact with silicone sealant, or for spacers used in structural glazing applications.
4. Edge Blocks:
  - a. Types:
    - 1) Heat cured, preformed silicone rubber, ASTM C1115 or other elastomeric material recommended by glass manufacturer.
  - b. Hardness: as required to limit lateral movement (side-walking) of glass
  - c. Lengths and Locations: As recommended in writing by glass manufacturer.
5. Butyl Sealant: Single component; Shore A hardness of 10-20; black color; nonskinning; compatible for use with glazing sealant.

## 2.8 SEALANTS

- A. Sealant For Non structural glazing conditions – Site or Shop/Factory Installed: ASTM C920 for Type S, Grade NS, Class 50 or greater, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by sealant and curtain wall manufacturers for this use.
- B. Primer: Nonstaining type, recommended by sealant manufacturer to suit application.
- C. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials and not damaging to exposed surfaces.
- D. Joint Backing: Provide in conformance with JOINT SEALANT BACKING specified In Section 0792 00 Joint Sealants; and approved by sealant manufacturer; oversized 30 to 50 percent larger than joint width or as recommended by product manufacturer.
- E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- F. All joints within system to be sealed under this Section.
- G. Non-Moving Joints Within Curtain Wall Assembly: Low or medium modulus silicone in conformance with Section 07 92 00 – Joint Sealants.
- H. Moving Joints Within Curtain Wall Assembly: High range type; i.e.: Low modulus silicones, all as approved by manufacturer as being suitable for application and compatible with seals of insulated glazing units where applicable.
- I. Perimeter Joints: Provide products in conformance with Section 07 92 00 – Joint Sealants.

## 2.9 ACCESSORIES

- A. Extruded or Formed Trim:
  1. Material: Aluminum
  2. Thickness: Minimum 0.060".
  3. Sill Extensions: Extruded Aluminum.

- B. Accessories: Manufacturer's standard with exposed portions matching finish of curtain wall system. Provide slip-joint linings of sheets, pads, shims, or washers of fluorocarbon resin, or similar material recommended by manufacturer at joints where movement must be accommodated.
  - 1. Steel for Anchorage: Type 304 or 316 stainless steel, sizes as required meeting structural requirements.
- C. Special Shapes: As detailed or required; extruded shapes and bent aluminum sheet, minimum 0.060 inches, finished after fabrication.
- D. Adaptors: Extrusions designed to glaze into framing system to accept door.
- E. Vapor Barrier (Backpan): Provide one of the following:
  - 1. Steel Sheet: Zinc-coated, commercial steel Type A, minimum 16 gage; ASTM A 653 with G-90 coating designation. Cut edges must be interior of wet zone.
- F. Perforated Shadow Box Liner: Aluminum sheet, minimum 0.080" thick, minimum 40% open.
- G. Condensation/Gutter: 1 inch x 1 inch aluminum angle, minimum 0.080' thick, with 1" x 1" end dams at both ends. Length to match clear width between mullions and space for sealant at end dams.
- H. Miscellaneous: As required for complete installation.

## 2.10 FABRICATION

- A. General: Fabricate curtain wall system according to Shop Drawings
  - 1. See DESIGN REQUIREMENTS and PERFORMANCE REQUIREMENTS in Part 1 above.
  - 2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortions.
  - 3. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
  - 4. Complete welding, cutting, drilling and fitting of joints prior to chemical treatment, and application of coatings.
- B. Provide parts of curtain wall system of materials, design, sizes and thickness, subject to commercial tolerances, shown or called for on shop drawings and specified in this Section.
- C. Make provision in the glazing pocket of the framing for the minimum clearances for the thickness and type of glass scheduled in accordance with GANA Glazing Manual or manufacturer's recommendations or governing code requirements, whichever is most restrictive.
- D. Reinforcements and Anchors:
  - 1. Reinforce work as necessary to meet performance requirements, and for support to structure.
  - 2. Provide framing anchors for three-way adjustment to accommodate fabrication and construction tolerances, structurally adequate to carry the weight of the wall system; to allow noiseless thermal movement; and meet structural requirements specified.
    - a. Anchors to adequately secure components to structure to meet performance requirements and to provide fully for anticipated building movement or thermal movement of component materials; refer to PERFORMANCE REQUIREMENTS in Part 1.

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3. Separate dissimilar metals with bituminous paint or preformed separators which will prevent corrosion or electrolytic action in accordance with industry standards and procedures.
- E. Carefully match all exposed work to produce continuity of line and design, with all joints accurately fitted and rigidly secure.
  - F. As far as practical, do all fitting and assembling in shop/factory.
  - G. Provide protection against degradation caused by contact between dissimilar metals.
  - H. Fabricate Work true to detail with sharp, clean profiles, straight and free from defects, dents, marks, indentations, waves, or flaws of any nature impairing strength or appearance, fitted with proper joints and intersections, and with the specified finishes.
  - I. Removable members such as glass stops, fillers, or closures shall be extruded and securely engaged into adjacent components.
  - J. Design and construct expansion joints so that they will be and remain permanently watertight, and accommodate weather and building dynamics.
  - K. Fabricate components to drain water-passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
  - L. Welding.
    1. Do all welding in accordance with recommendations of the American Welding Society.
    2. Do welds behind finished surfaces to minimize distortion and discoloration on finished side. Remove weld splatter and welding oxides on finished surfaces by descaling or grinding.
    3. Protect all glass from weld splatter.
  - M. Use sealing materials in accordance with recommendations of the manufacturer of the material. Seal joints in accordance with the design and tolerances shown on Shop Drawings.
  - N. Insulation & Perforated Shadow Box Liner: Install condensation/gutter, insulation and shadow box liner at all non-vision areas including spandrel glass. Provide Insulation & Perforated Shadow Box Liner at any cavity with a backpan.
    1. Condensation/Gutter: Set vertical face of angle 1 inch from face of glass and set on top side of bottom interior horizontal mullion. Horizontal leg of angle shall be towards interior. Set angle in sealant and seal watertight to framing. Secure with screws. Design to allow area between glass and vertical leg of angle with end dams to be water tight.
    2. Perforated Shadow Box Liner: Attach seamless sheet to interior face of framing with stainless steel screws.
      - a. Seal: Install continuous seal between framing and vapor barrier using one of the materials listed below. Provide complete seal between framing and vapor barrier.
        - 1) Silicone Sealant. Bead size as needed.
        - 2) Butyl Sealant Tape: Maximum 1/16" thick x minimum 1/2" wide. Butt joints tight before compression.
      - b. Screw Spacing: As needed to assure continuity of sealant bead.
      - c. Joints: Not permitted except directly over framing.
      - d. Provide slotted screw hole openings in metal backpan (vapor barrier) as needed to accommodate thermal movement. Provide neoprene washers for screws to assure airtight seal at fastener penetration.

3. Insulation: Install tight to shadow box liner and framing; fill continuous between framing. Maintain placement with non-metallic stick clips adhered to shadow box liner. Insulation secured on stick clips with washers and retaining clip.
4. Properly reinforce backpan at height corresponding to slab edge to resist compression of edge of slab firestopping, and requirements of Section 07 84 00 – Firestopping for Curtain Wall/Floor Intersection.
5. Seal across unit joints with continuous vapor retarder tape to maintain vapor barrier. Install with minimum ½ inch wide beads of silicone adhesive each side of joint in accordance with manufacturer's instructions.

2.11 Backpan: Backpan shall be set in sealant and form an airtight seal at perimeter of backpan.

## 2.12 JOINERY IN METAL WORK

- A. Match exposed work to produce continuity of line, design, and finish. Accurately fit joints in exposed work, rigidly secured with hairline contact and sealed watertight unless otherwise shown or required for thermal movement. Clean excess sealant from exposed surfaces.
- B. Where two or more sections of metal are used in building up members, bring the contact surfaces to a smooth, true, and even surface. Secure together so that the joints are tight without the use of any pointing materials.

## 2.13 METAL FINISHES

- A. Exposed Surfaces: Spray painted coatings as specified under Section 05 05 13, Shop-Applied Coatings for Metal.
  1. Framing, Trim, Accessories:
    - a. Exterior: 2-Coat PVDF finish containing mica pearlescent flake pigments.
    - b. Interior: Thermal-set acrylic, "polycron" or equal. Color to match exterior finish unless indicated otherwise.
    - c. Colors: Custom color as selected by Architect, see Section 09 06 00 - Schedule for Finishes. See SUBMITTALS and PERFORMANCE & AESTHEIC MOCK-UPS in PART 1 above.
  2. Metal Cladding Panels: Match exterior framing above.
  3. Insulated Metal Panels: Match exterior framing above.
  4. Shadow Box Liner: Baked enamel, same as interior framing.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of finished work: Noticeable variations the same piece is not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

## 2.14 STEEL PRIMING

- A. General: Prime finish 1 coat zinc chromate paint conforming to FS TT-P-645.
- B. Finish: Exposed clips, anchors, and supports shall have finish matching aluminum curtain wall system finish.

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PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
  - 1. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence.
- B. Acts of omissions by other parties that will modify the Warranty shall be brought to the Resident Engineer's and Architect's attention, in writing, within 7 days.
- C. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.
- D. Do not proceed until unsatisfactory conditions have been corrected. Starting Work indicates acceptance of conditions and installer assumes full responsibility for results.

## 3.2 PREPARATION

- A. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint, or other approved separation for prevention of electrolytic action and corrosion.

## 3.3 INSTALLATION

- A. Comply with manufacturers written instructions for protection, handling, and installing curtain wall system.
- B. Install curtain wall system, including glass, insulated metal spandrel panels, framing, anchors, and all associated components and accessories in accordance with approved Shop Drawings.
- C. Sill Pans: Set in full bed of sealant.
- D. Erect curtain wall framing units plumb and true, in proper alignment and relation to established lines as shown on Shop Drawings.
- E. Do not install damaged components. Replace or repair damaged components prior to installation.
- F. Field paint all field cuts whether exposed or concealed with primer and finish coat to match finish of cut material, unless conditions are demonstrated to not affect performance or durability and are approved by Resident Engineer.
- G. Metal protection: Where aluminum will contact dissimilar metals, concrete or masonry, protect against galvanic or corrosive action by painting contact surfaces with primer, bituminous paint or by applying sealant, tape, or other materials as recommended by manufacturer.



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- H. Maintain continuity of air barrier and drainage plane, including at interfaces with adjacent construction.
- I. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- J. Install glazing as specified Division 08 Section 08 88 53 - Security Glazing.
- K. Install sealants as specified in Division 07 Section "Joint Sealants" and Curtain Wall manufacturer's recommendations.
- L. Extruded Silicone Transition System: Comply with manufacturers written instructions and the following requirements:
1. Coordinate with installer of air weather barrier at adjacent assemblies to ensure proper sequencing of work.
  2. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
  3. Seams: Apply Joint Bonding Sealant to each side of joint to produce a bead of size complying with Extruded silicone transition system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
  4. Within 10 minutes of Joint Bonding Sealant application, press Preformed Extruded Silicone Sheet into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
  5. Complete installation of sealant system in horizontal joints before installing in vertical joints. Use preformed pieces of Extruded Silicone sheets at all corners and similar changes in substrate planes.
  6. Aluminum Attachment Bar to be installed to permanently lock Extruded Silicone Sheet against curtain wall mullion. Sequence installation of Attachment Bar as required to achieve permanent flexible joint seal.
  7. Transition of Extruded Silicone Transition System to AWB: Seal preformed extruded silicone sheet from curtain wall to AWB using joint bonding sealant to maintain a continuous air barrier. Fish mouths and air bubbles in membrane are not acceptable. Use sufficient joint bonding sealant that it is visible along the full length of the silicone membrane's transition edge.
- M. Flashing shall be formed, installed, and joined in accordance with Shop Drawings.
1. Where not indicated, form and install flashings to comply with SMACNA's Architectural Sheet Metal Manual.
- N. Use flashings in longest practical length.
1. Allow for thermal expansion and contraction of flashings and accommodation of specified building movements without buckling or warping.

### 3.4 TOLERANCES

- A. Design and fabricate the glazed curtain wall system to accommodate permissible dimensional tolerances in the building frame and other work adjacent to the wall. Provided irregularities do not exceed them, and clearances in Shop Drawings are maintained, all parts of the curtain wall, when completed, shall be within the following tolerances.
1. Maximum variation from plane or location shown on approved Shop Drawings: 1/8 inch per 12 feet of length but not exceeding 1/2 inch in any total length.
  2. Maximum offset from true alignment between two identical members abutting end to end in line: 1/16 inch.

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3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an AAMA Accredited Laboratory or other independent testing and inspecting agency, approved by the Architect and Contracting Officer, to perform field tests and prepare test reports. The Architect and Contracting Officer will designate areas for each curtain wall area to be tested.
- B. Water Penetration and Air Leakage Field Testing:
1. Notify the Architect and Resident Engineer, in writing, a minimum of 14 days prior to conducting the field-testing.
  2. Testing Methodology:
    - a. Water Penetration Resistance Testing shall be conducted in accordance with ASTM E1105, Procedure A, consisting of 15 minutes induced air pressure difference.
      - 1) Field Test pressure shall be same test pressure specified in the Performance and Testing Requirements section.
      - 2) Water penetration shall be as specified in the in PERFORMANCE REQUIREMENTS and Section 01 45 29 - Mockups.
    - b. Air Leakage Testing shall be conducted in accordance with ASTM E783
      - 1) Test pressure shall be 6.24 psf.
      - 2) Maximum air leakage rate shall be as specified in PERFORMANCE REQUIREMENTS and Section 01 45 29 - Mockups.
  3. Testing Procedure and Extent:
    - a. Conduct initial field test at designated completed curtain wall area selected by Architect's and Contracting Officer's as soon as is practical after installation of curtain wall has started. Test early during installation so that errors in fabrication or installation can be found and corrections made before remainder of curtain wall assemblies are installed.
      - 1) As applicable, test area shall include interface with adjacent building envelope systems, as well as typical sill, vertical and horizontal mullions. Test shall include both vision and opaque panels.
      - 2) Test Procedure:
        - a) Initial field test shall include air leakage testing followed by Water Penetration Resistance Testing.
    - b. After initial testing of earliest installation, test one area selected by Architect and Contracting Officer prior to completing 10 percent of curtain wall installation, two additional tests prior to completing 30 percent of the glazed wall area and two additional tests prior to completing 50 percent of the glazed wall areas.
      - 1) As applicable, test areas shall include interface with adjacent building envelope systems, as well as typical vertical and horizontal mullions, corner mullions, and typical penetrations through curtain wall. Tests shall include both vision and opaque panels.
      - 2) All tests following initial field test shall be for water penetration resistance only.
  4. Unless otherwise directed by Architect and Contracting Officer, each test area shall extend at least 15 feet wide by one storey height.
  5. If any installation fails performance tests, correct observed deficiencies and re-test at Contractor's expense. Incorporate corrective measures into all final curtain wall assembly installations.
  6. If any of the units fails the performance tests, at Architect's discretion, one additional area shall be tested at contractor's expense. If these installations also fail performance tests, correct observed deficiencies and re-test at Contractor's expense. At Architect's discretion, for each additional area that fails the testing, one additional area shall be tested. All additional testing shall be conducted at Contractor's expense.
  7. Work that does not meet the performance requirements or that is damaged by testing shall be repaired or replaced to conform to the specified requirements.

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8. Submit test reports and photographs indicating the procedures and results of all field tests.

### 3.6 CLEANING

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

### 3.7 PROTECTION

- A. After installation, protect curtain wall, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, sealant smears, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

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## SECTION 08 44 13.30

## LIFE SAFETY BLAST REQUIREMENTS FOR GLAZED ALUMINUM CURTAINWALL SYSTEM

## PART 1 - GENERAL

## 1.1 REFERENCES

- A. Physical Security Design Manual for VA Facilities, Life-Safety Protected (PSDM), Final Draft, July 2007.
- B. WinGARD Version 5.5.1 or later.

## 1.2 RELATED SECTIONS

- A. Blast Loads: Section 01 83 16.23 Exterior Blast Dynamic Loading
- B. Glazing and Curtain Wall:
  - 1. Section 08 44 13 Glazed Aluminum Curtain Walls.
  - 2. Section 08 44 13.3 Glazed Aluminum Curtain Walls for Dixie.
- C. Door hardware: Section 08 71 00 - Door Hardware.
- D. Security Glazing: Section 08 88 53 Security Glazing

## 1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Minimum performance requirements for Blast Resistant Curtain Walls are specified herein for a VA building designed as a Life Safety Protected building in accordance with the PSDM.
    - a. The following buildings have been assigned a VA PSDM status of 'Life Safety':
      - 1) Dixie Building.
      - 2) New Research Building (8).
  - 2. In conjunction with meeting aesthetic and performance requirements, the Contractor may propose alternate detailing methods for consideration.
- B. Performance Requirements:
  - 1. General: Provide design of exterior curtain walls and skylights to meet the minimum requirements of the PSDM. Glazed doors shall be designed such that they seat within a continuous door stop, which is mechanically attached to a door frame. Doors may fail outward in response to blast loading and hardware (i.e. hinges and locks) may fail. Mullions and structure serving to support doors shall be designed for blast loading.
  - 2. Curtain Wall System Design shall include but not be limited to the following:
    - a. Glass Design Requirements:
      - 1) Use WinGARD 5.5.1 or latest to design exterior glass panes to resist pressures and impulses as specified herein.

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- 2) Blast Resistant Curtain Wall Systems: curtain walls and glazed doors are to meet the equivalent of GSA Performance Condition 3B or better under the specified blast loads. Condition 3B is defined as when the glazing breaks, glass fragments enter the space, and land on the floor no further than 10 feet (3 meters) from the curtain wall.
  - 3) Blast Resistant Skylight Systems: skylights are to meet the equivalent of GSA Performance Condition 2 or better under the specified blast load. Condition 2 is defined as the glazing cracks but remains in the frame.
  - b. Framing Component Requirements:
    - 1) Provide curtain wall and skylight frames, mullions, and sashes of aluminum or steel. Design framing members and mullions to resist the applied blast load over the glass tributary to the mullion applied over the appropriate effective area of the mullion.
    - 2) Support Rotation: Limit mullion deformation to no greater than  $L/30$ . Analysis must show that glazing will not disengage from the curtain wall framing system when mullion rotations exceed  $2^\circ$  or provide a minimum 1/4-in. of structural silicone sealant in accordance with this specification.
  - c. Connections: Design connections to the lesser of the following:
    - 1) Design connections to the average peak dynamic loads from the glazing by distributing the dynamic loads over the perimeter length of the frame.
    - 2) Sum all mullion reaction forces framing into a connection joint based on each element's flexural yield capacity.
  - d. Connection Safety Factors (SF):
    - 1)  $SF = 1$  shall be allowed for connection elements that provide a ductile mode of failure (e.g. bolt bearing, tensile yielding, etc.)
    - 2)  $SF = 1.5$  shall be used for connection elements that provide a non-ductile mode of failure (e.g. weld fracture, concrete cone failure due to anchor bolt pull-out, etc.)
    - 3) Connection assembly may be designed for the lesser of a  $SF = 1.5$  or the strength of the actual failure mechanism in the assembly, provided it is governed by a ductile mode.
  - e. Spandrel Panels: Analysis should be performed to determine the response of the spandrel glass, panels and/or the back-up wall system. Performance should focus on the limitation of flying debris into occupied space.
    - 1) Glass: Laminated meeting a Performance Condition Level 3B or better.
    - 2) Metal Panel: Metal panels backing up the spandrel glass are to be designed for:
      - a) Deformation:  $L/30$
      - b) Connections: Develop capacity of the metal panels
  - f. Sunshades:
    - 1) Exterior Appendages: Exterior appendages to the curtain wall system (i.e. Sun and Wind Screens) shall be connected to their supporting elements to ensure that the connection can develop the components moment capacity (using plastic section modulus,  $Z$ ).
  3. Design Blast Loads:
    - 1) Unless otherwise indicated on the Pressure Zone drawings, the design loading for dynamic analysis is: Ramp down load with a peak pressure of 4 psi and impulse of 28 psi-msec. This design load shall be applied over the areas tributary to the element being analyzed. At locations indicated in the Pressure Zone drawings, design for a peak pressure and impulse as noted in Section 01 83 16.23 Exterior Blast Dynamic Loads.

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1.4 SUBMITTALS

- A. Calculations: Provide calculations prepared by qualified blast consultant verifying that curtain wall and glazing meet specific blast resistance requirements detailed in this Section.
1. Prior to performing engineering calculations intended to address the blast loading identified, submit a description of the technique(s) that will be employed to calculate the response of the system to the defined dynamic loading.
  2. Calculation package is to include a summary sheet briefly outlining the following:
    - a. Evaluation criteria
    - b. Calculation assumptions
    - c. Table of results by curtain wall type/location
    - d. Statement of Conformance with specification requirements.
  3. Calculation submittal is to be stamped and signed by a registered Professional Engineer whose qualifications meet or exceed Quality Assurance criteria.
  4. Submit single degree of freedom (or better) dynamic analysis for curtain wall system. Submit engineering calculations to show that curtain wall response meets specified performance requirements under design load. Additionally, illustrate that brittle modes of failure (such as shear and buckling) are avoided. These calculations must include, but may not be limited to, analysis of the following:
    - a. Glass. Determine glass pane performance using an analysis program such as WinGard (Version 5.5.1 or later), developed by the General Service Administration. If a program other than WinGard is used, it must be approved by the Owner prior to calculations. WinGard calculations provided in the calculation package are to include the complete text rather than the "concise" text printout.
    - b. Mullions and framing members. Provide a clear load path from the glass to the primary element and supporting analysis which illustrates each component's ability to transfer the design load to the primary element. Analysis of primary element shall illustrate flexural and shear capacity. Analysis will include verification that the structural silicone sealant can hold the glass in the frame under design loads.
    - c. Anchorage. Analyze the strength of embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Analyze the curtain wall wall anchor clip inserts and fasteners and assemblies, including bolts and stiffeners. Include exact loadings to be transferred to the building structure in the analysis.
    - d. Mechanical Anchors. Mechanical anchor capacities shall be developed from dynamic testing. An International Code Council (ICC-ES) evaluation report showing testing for dynamic loading (i.e. seismic or blast) is to be submitted with calculations.
    - e. Supporting structure. Coordination of the curtain wall/supporting structure interaction shall be the contractors' responsibility. The curtain wall contractor's engineer performing blast calculations for the curtain wall system shall coordinate loading scenarios with the cladding contractor's engineer providing design for the exterior cladding system. Forces transmitted from the appropriate curtain wall tributary area shall be the maximum capacity or design loads, whichever is greater, from the glazing area.
  5. Analysis is required to verify its ability to develop its plastic capacity without instability. Additional calculations must include, but may not be limited to, analysis of the following:
    - a. Global performance of mullion. Analysis shall verify that the plastic moment of the mullion, acting in a composite manner with its individual components, can be attained under maximum calculated deflections. Fasteners between each component shall be designed for the plastic capacity of the mullion.

- b. Lateral torsional buckling. Analysis shall verify the ability of the mullion to provide adequate resistance against lateral torsional buckling under maximum calculated deflections.
  - c. Local buckling. Analysis shall verify the ability of the mullion and its individual components and connections to provide adequate resistance against localized buckling along the entire load path under maximum calculated deflections.
  - d. Structural silicone stress. Analysis shall verify the capacity of the silicone to retain the glass under maximum calculated deflections.
- B. Certificates: Engineer's qualifications that meet or exceed Quality Assurance criteria: At a minimum, qualifications must list each project in which the Engineer performed analysis of curtain wall systems, the effective start and end dates of performance of the analysis and a reference.

#### 1.5 QUALITY ASSURANCE

- A. Provide products that meet the requirements of Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Life-Safety Protected, Final Draft.
- B. Engineer: Engage an Engineering Professional to perform dynamic analysis of the Blast Resistant Curtain Walls. The Engineer shall have a minimum of 5 years experience performing dynamic analysis for blast resistant design and demonstrable experience designing blast resistant curtain wall systems in the past 18 months.
- C. Glazing Bite: The required glazing system bite must be verified in the field.
- D. Installation Orientation: Curtain Walls delivered to the construction site are to be clearly labeled as to the proper installation orientation (i.e. laminated pane of glass to be installed as the interior pane.)

#### 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):
  - 1. ASTM A36/A36M-05..... Standard Specification for Carbon Structural Steel
  - 2. ASTM A123/A123M-02..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

- 3. ASTM B221-06..... Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- C. National Association of Architectural Metal Manufacturers (NAAMM)
  - 1. AMP 500-505-88 .Metal Finishes Manual
- D. Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Life-Safety Protected, Final Draft.
- E. WinGARD Version 5.5.1 or latest

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER/FABRICATOR

- A. 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 non-removable 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; provide alloy 6063-T5, -T6, or -T52 for trim and stops which are not exposed to forced entry attack.
- E. Framing Members:
  - 1. Yield Strength: Provide supporting references that grade of steel or aluminum used is capable of achieving calculated ductility ratio.
  - 2. The yield strength of framing members may be increased to account for dynamic strain rate effects as follows:
    - a. Structural Steel: For  $f_y = 36$  ksi, the yield strength may be increased by a factor of 1.42. For  $f_y = 46$  ksi, the yield strength may be increased by a factor of 1.31.
    - b. Structural Aluminum: The yield strength may be increased by a factor of 1.14.
  - 3. Section Modulus: The plastic section modulus may be used in dynamic design calculations.
  - 4. Built-up Sections: Design built-up sections using ultimate stress and strain compatibility approaches as defined by industry standards. If built-up section is analyzed as one unit, full shear stress transfer along the line of contact between the individual sections must be illustrated.



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- F. Glazing Materials: Refer to Section 08 88 53 Security Glazing.
1. Glass-to-Glass Interlayers: Clear polyvinyl butyral (PVB) laminating film/sheet shall be used on the inner lite of exterior curtain wall systems.
  2. Glazing bite: The minimum allowable bite is 1/2" [12.7 mm].
  3. Probability of Failure. To determine the response of the glass and the anchorage loads, the probability of breakage for the glass is to be 750 breaks per 1000.
- G. Structural Silicone Sealant:
1. Ultimate Tensile Stress: Minimum 350 psi in tension.
  2. Safety Factors: ultimate tension and shear capacities are to be used with a safety factor of 1.0.
  3. Apply the silicone sealant to the interior perimeter of the glass to bond the glass to the frame. The minimum bead size is 1/4" [6 mm].

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## SECTION 08 44 13.50

## MISSION CRITICAL BLAST REQUIREMENTS FOR GLAZED ALUMINUM CURTAIN WALL SYSTEM

## PART 1 - GENERAL

## 1.1 REFERENCES

- A. Physical Security Design Manual for VA Facilities, Mission Critical Facilities (PSDM), Final Draft, July 2007.
- B. WinGARD Version 5.5.1 or later.

## 1.2 RELATED SECTIONS

- A. Blast Loads: Section 01 83 16.23 Exterior Blast Dynamic Loading
- B. Glazing and Curtain Wall:
  - 1. Section 08 44 13 Glazed Aluminum Curtain Walls.
  - 2. Section 08 44 13.3 Glazed Aluminum Curtain Walls for Dixie.
- C. Door hardware: Section 08 71 00 - Door Hardware.
- D. Security Glazing: Section 08 88 53 Security Glazing

## 1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Minimum performance requirements for Blast Resistant Curtain Walls are specified herein for a VA building designed as a Mission Critical building in accordance with the PSDM.
    - a. The following buildings have been assigned a VA PSDM status of 'Mission Critical':
      - 1) Research Building (Building 8): The research building consists of an existing building (Dixie) and façade with a new added structure. The new structure only is classified as a Mission Critical rated structure.
  - 2. In conjunction with meeting aesthetic and performance requirements, the Contractor may propose alternate detailing methods for consideration.
- B. Performance Requirements:
  - 1. General: Provide design of exterior curtain walls and skylights to meet the minimum requirements of the PSDM. Glazed doors shall be designed such that they seat within a continuous door stop, which is mechanically attached to a door frame. Doors may fail outward in response to blast loading and hardware (i.e. hinges and locks) may fail. Mullions and structure serving to support doors shall be designed for blast loading.
  - 2. Curtain Wall System Design shall include but not be limited to the following:
    - a. Glass Design Requirements:

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- 1) Use WinGARD 5.5.1 or latest to design exterior glass panes to resist pressures and impulses as specified herein.
  - 2) Blast Resistant Curtain Wall Systems: curtain walls and glazed doors are to meet the equivalent of GSA Performance Condition 3B or better under the specified blast loads. Condition 3B is defined as when the glazing breaks, glass fragments enter the space, and land on the floor no further than 10 feet (3 meters) from the curtain wall.
  - 3) Blast Resistant Skylight Systems: skylights are to meet the equivalent of GSA Performance Condition 2 or better under the specified blast load. Condition 2 is defined as the glazing cracks but remains in the frame.
  - b. Framing Component Requirements:
    - 1) Provide curtain wall and skylight frames, mullions, and sashes of aluminum or steel. Design framing members and mullions to resist the applied blast load over the glass tributary to the mullion applied over the appropriate effective area of the mullion.
    - 2) Support Rotation: Limit mullion deformation to no greater than  $L/30$ . Analysis must show that glazing will not disengage from the curtain wall framing system when mullion rotations exceed  $2^\circ$  or provide a minimum 1/4-in. of structural silicone sealant in accordance with this specification.
  - c. Connections: Design connections to the lesser of the following:
    - 1) Design connections to the average peak dynamic loads from the glazing by distributing the dynamic loads over the perimeter length of the frame.
    - 2) Sum all mullion reaction forces framing into a connection joint based on each element's flexural yield capacity.
  - d. Connection Safety Factors (SF):
    - 1)  $SF = 1$  shall be allowed for connection elements that provide a ductile mode of failure (e.g. bolt bearing, tensile yielding, etc.)
    - 2)  $SF = 1.5$  shall be used for connection elements that provide a non-ductile mode of failure (e.g. weld fracture, concrete cone failure due to anchor bolt pull-out, etc.)
    - 3) Connection assembly may be designed for the lesser of a  $SF = 1.5$  or the strength of the actual failure mechanism in the assembly, provided it is governed by a ductile mode.
  - e. Spandrel Panels: Analysis should be performed to determine the response of the spandrel glass, panels and/or the back-up wall system. Performance should focus on the limitation of flying debris into occupied space.
    - 1) Glass: Laminated meeting a Performance Condition Level 3B or better.
    - 2) Metal Panel: Metal panels backing up the spandrel glass are to be designed for:
      - a) Deformation:  $L/30$
      - b) Connections: Develop capacity of the metal panels
  - f. Sunshades:
    - 1) Exterior Appendages: Exterior appendages to the curtain wall system (i.e. Sun and Wind Screens) shall be connected to their supporting elements to ensure that the connection can develop the components moment capacity (using plastic section modulus,  $Z$ ).
  3. Design Blast Loads:
    - 1) Unless otherwise indicated on the Pressure Zone drawings, the design loading for dynamic analysis is: Ramp down load with a peak pressure of 4 psi and impulse of 28 psi-msec. This design load shall be applied over the areas tributary to the element being analyzed. At locations indicated in the

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Pressure Zone drawings, design for a peak pressure and impulse as noted in Section 01 83 16.23 Exterior Blast Dynamic Loads.

#### 1.4 SUBMITTALS

- A. Calculations: Provide calculations prepared by qualified blast consultant verifying that curtain wall and glazing meet specific blast resistance requirements detailed in this Section.
1. Prior to performing engineering calculations intended to address the blast loading identified, submit a description of the technique(s) that will be employed to calculate the response of the system to the defined dynamic loading.
  2. Calculation package is to include a summary sheet briefly outlining the following:
    - a. Evaluation criteria
    - b. Calculation assumptions
    - c. Table of results by curtain wall type/location
    - d. Statement of Conformance with specification requirements.
  3. Calculation submittal is to be stamped and signed by a registered Professional Engineer whose qualifications meet or exceed Quality Assurance criteria.
  4. Submit single degree of freedom (or better) dynamic analysis for curtain wall system. Submit engineering calculations to show that curtain wall response meets specified performance requirements under design load. Additionally, illustrate that brittle modes of failure (such as shear and buckling) are avoided. These calculations must include, but may not be limited to, analysis of the following:
    - a. Glass. Determine glass pane performance using an analysis program such as WinGard (Version 5.5.1 or later), developed by the General Service Administration. If a program other than WinGard is used, it must be approved by the Owner prior to calculations. WinGard calculations provided in the calculation package are to include the complete text rather than the "concise" text printout.
    - b. Mullions and framing members. Provide a clear load path from the glass to the primary element and supporting analysis which illustrates each component's ability to transfer the design load to the primary element. Analysis of primary element shall illustrate flexural and shear capacity. Analysis will include verification that the structural silicone sealant can hold the glass in the frame under design loads.
    - c. Anchorage. Analyze the strength of embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Analyze the curtain wall wall anchor clip inserts and fasteners and assemblies, including bolts and stiffeners. Include exact loadings to be transferred to the building structure in the analysis.
    - d. Mechanical Anchors. Mechanical anchor capacities shall be developed from dynamic testing. An International Code Council (ICC-ES) evaluation report showing testing for dynamic loading (i.e. seismic or blast) is to be submitted with calculations.
    - e. Supporting structure. Coordination of the curtain wall/supporting structure interaction shall be the contractors' responsibility. The curtain wall contractor's engineer performing blast calculations for the curtain wall system shall coordinate loading scenarios with the cladding contractor's engineer providing design for the exterior cladding system. Forces transmitted from the appropriate curtain wall tributary area shall be the maximum capacity or design loads, whichever is greater, from the glazing area.
  5. Analysis is required to verify its ability to develop its plastic capacity without instability. Additional calculations must include, but may not be limited to, analysis of the following:

- a. Global performance of mullion. Analysis shall verify that the plastic moment of the mullion, acting in a composite manner with its individual components, can be attained under maximum calculated deflections. Fasteners between each component shall be designed for the plastic capacity of the mullion.
  - b. Lateral torsional buckling. Analysis shall verify the ability of the mullion to provide adequate resistance against lateral torsional buckling under maximum calculated deflections.
  - c. Local buckling. Analysis shall verify the ability of the mullion and its individual components and connections to provide adequate resistance against localized buckling along the entire load path under maximum calculated deflections.
  - d. Structural silicone stress. Analysis shall verify the capacity of the silicone to retain the glass under maximum calculated deflections.
- B. Certificates: Engineer's qualifications that meet or exceed Quality Assurance criteria: At a minimum, qualifications must list each project in which the Engineer performed analysis of curtain wall systems, the effective start and end dates of performance of the analysis and a reference.

#### 1.5 QUALITY ASSURANCE

- A. Provide products that meet the requirements of Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Mission Critical Facilities, Final Draft.
- B. Engineer: Engage an Engineering Professional to perform dynamic analysis of the Blast Resistant Curtain Walls. The Engineer shall have a minimum of 5 years experience performing dynamic analysis for blast resistant design and demonstrable experience designing blast resistant curtain wall systems in the past 18 months.
- C. Glazing Bite: The required glazing system bite must be verified in the field.
- D. Installation Orientation: Curtain Walls delivered to the construction site are to be clearly labeled as to the proper installation orientation (i.e. laminated pane of glass to be installed as the interior pane.)

#### 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):

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1. ASTM A36/A36M-05..... Standard Specification for Carbon Structural Steel
  2. ASTM A123/A123M-02..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  3. ASTM B221-06..... Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- C. National Association of Architectural Metal Manufacturers (NAAMM)
1. AMP 500-505-88 .Metal Finishes Manual
- D. Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Mission Critical Facilities, Final Draft.
- E. WinGARD Version 5.5.1 or latest

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER/FABRICATOR

- A. 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 non-removable 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; provide alloy 6063-T5, -T6, or -T52 for trim and stops which are not exposed to forced entry attack.
- E. Framing Members:
1. Yield Strength: Provide supporting references that grade of steel or aluminum used is capable of achieving calculated ductility ratio.
  2. The yield strength of framing members may be increased to account for dynamic strain rate effects as follows:
    - a. Structural Steel: For  $f_y = 36$  ksi, the yield strength may be increased by a factor of 1.42. For  $f_y = 46$  ksi, the yield strength may be increased by a factor of 1.31.
    - b. Structural Aluminum: The yield strength may be increased by a factor of 1.14.
  3. Section Modulus: The plastic section modulus may be used in dynamic design calculations.
  4. Built-up Sections: Design built-up sections using ultimate stress and strain compatibility approaches as defined by industry standards. If built-up section is analyzed as one unit,

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full shear stress transfer along the line of contact between the individual sections must be illustrated.

- F. Glazing Materials: Refer to Section 08 88 53 Security Glazing.
1. Glass-to-Glass Interlayers: Clear polyvinyl butyral (PVB) laminating film/sheet shall be used on the inner lite of exterior curtain wall systems.
  2. Glazing bite: The minimum allowable bite is 1/2" [12.7 mm].
  3. Probability of Failure. To determine the response of the glass and the anchorage loads, the probability of breakage for the glass is to be 750 breaks per 1000.
- G. Structural Silicone Sealant:
1. Ultimate Tensile Stress: Minimum 350 psi in tension.
  2. Safety Factors: ultimate tension and shear capacities are to be used with a safety factor of 1.0.
  3. Apply the silicone sealant to the interior perimeter of the glass to bond the glass to the frame. The minimum bead size is 1/4" (6 mm).

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