

## **SECTION 11198 – FORCED ENTRY, BALLISTICS, BLAST AND FIRE RESISTANT DOORS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

This Section includes Forced Entry, Ballistics, Blast and Fire Resistant (FE/BBFR) products as shown in the contract drawings.

15 minute and 60 minute rated FE/BBFR doors and windows as designated on the Door Schedule, shall be constructed in accordance with designs of doors and windows that have met the test criteria in accordance with Section 1.06.A, and shall be equipped with FE/BR locks, FE/BR hinges, FE/BR glazing, and other options in accordance with the manufacturer's certified designs. The FE/BR hardware, glazing and other specified options, shall be pre-installed and the units furnished completely assembled, with site installation instructions included, in accordance with the manufacturer's certified designs.

5 minute rated FE/BBFR doors and windows as designated on the Door Schedule, shall be constructed in accordance with designs of doors and windows that have met the test criteria in accordance with Section 1.06.B, and shall be equipped with FE/BR locks, FE/BR hinges, FE/BR glazing, and other specified options in accordance with the manufacturer's certified designs. The FE/BR hardware, glazing and other options, shall be pre-installed and the units furnished completely assembled, with site installation instructions included, in accordance with the manufacturer's certified designs.

#### **1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. FE/BBFR doors, swinging type with specified ratings as shown in the door schedule. Doors shall be of the types and sizes shown on the contract drawings and as specified herein.
- B. FE/BBFR frames with specified ratings as shown in the door schedule. Frames shall be of the types and sizes shown on the contract drawings and as specified herein.
- C. FE/BBFR panels where shown, similar in construction to doors, including ratings where specified in the door schedule.
- D. FE/BBFR hardware, FE/BBFR glass and glazing, conventional hardware and other items to be provided as components of the FE/BBFR assemblies as shown on the contract drawings and as specified herein.

#### **1.03 RELATED PRODUCTS FURNISHED BY OTHERS BUT NOT SPECIFIED IN THIS SECTION**

- A. Gaskets and Weatherstrips

#### **1.04 RELATED SECTIONS**

- A. Section 03300 - Cast in Place Concrete
- B. Section 03345 - Concrete Floor Finishing
- C. Section 03400 - Pre-cast Concrete
- D. Section 04200 - Masonry System
- E. Section 05120 - Structural Steel

- F. Section 09900 - Painting
- G. Section 11190 – Security Locking Control Systems

## **1.05 REFERENCES**

- A. ANSI A 250.10 – 1998, Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- B. ANSI/NAAMM/HMMA 840-99 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames
- C. ANSI/NAAMM/HMMA 801-05 Glossary of Terms for Hollow Metal Doors and Frames
- D. ANSI/NAAMM/HMMA 850-00, Fire-Rated Hollow Metal Doors and Frames, Third Edition
- E. ANSI/NAAMM/HMMA 866–01, Guide Specifications for Stainless Steel Hollow Metal Doors and Frames
- F. ANSI/NFPA 80-07, Fire Doors and Windows
- G. ANSI/NFPA 252–2003, Standard Methods of Fire Tests of Door Assemblies
- H. ANSI/NFPA 257–2007, Methods for Fire Test Window Assemblies
- I. ANSI/UL 10 (C) - 2001, 8th edition, Fire Tests of Door Assemblies
- J. ASTM A 1008 / A 1008M – 07, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
- K. ASTM A 1011 / A 1011M – 06b, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
- L. ASTM A 653 / A 653M – 06a , Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dipped Process.
- M. ASTM A 666–03, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.
- N. ASTM C 143 / C 143M – 05a, Standard Test Method for Slump of Hydraulic Cement Concrete
- O. SD-STD-01.01, Rev. G (amended April 30, 1993), Certification Standard for Forced Entry and Ballistics Resistance of Structural Systems
- P. ASTM F 1450–05, Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities
- Q. ASTM F 1592–05, Standard Test Methods for Detention Hollow Metal Vision Systems
- R. ASTM F 2247–03, Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Load Method)

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## 1.06 TESTING AND PERFORMANCE

### A. Forced Entry and Ballistics Resistance Test

15 minute and 60 minute rated FE/BR doors and windows shall be designated on the Door Schedule, and shall be constructed in accordance with designs of doors that have met the following test criteria.

1. Test doors shall be 3' 0" x 7' 0" (914 mm x 2134 mm) minimum, constructed in accordance with Section 2.01 herein. Test frames shall be constructed in accordance with Section 2.03 herein. Test doors and frames shall be fitted with FE/BR hardware in accordance with the manufacturer's design and selection. Test doors, frames, glazing and hardware assembled shall constitute the "test door assemblies".
2. Test windows shall be constructed in accordance with Section 2.03 herein. Test frames, mullions, glazing, and other options, such as deal trays, shall constitute the "test window assemblies".
3. The test door and window assemblies shall be submitted to an independent materials testing laboratory and FE/BR testing shall be conducted on the test assembly in accordance with SD-STD-01.01, Rev. G. (Amended April 30, 1993). The time periods for forced entry certification shall be 15 minutes and 60 minutes. Reporting shall be in accordance with the standard.

### B. Multiple Impact and Static Load Tests

5 minute rated FE/BBFR doors and windows shall be designated on the Door Schedule, and shall be constructed in accordance with designs of doors and windows that have met the following test criteria.

#### 1. Door Assembly Impact Test

Two 3'-0" x 7'-0" (914 mm x 2134 mm) doors shall be constructed in accordance with Section 2.01, with 100 square inch (64 516 mm<sup>2</sup>) vision panel, 4 in. x 25 in. (102 mm x 635 mm) clear opening positioned generally as shown in ASTM F 1450, Figure 1. Two frames shall be constructed in accordance with Section 2.03. Test doors and frames shall be prepared and furnished with hardware, installed and tested in accordance with ASTM F 1450, Section 6, "Specimen Preparation" and Section 7.2 "Door Assembly Impact Test". The test assembly shall meet the acceptance criteria in Section 7.2 Grade #1, in order to qualify under Section 1.06 of this specification.

#### 2. Hollow Metal Vision System Impact Test In Accordance With ASTM F 1592

- a. A four (4) equal light multi-light security hollow metal assembly, overall dimensions of 50 in. (1270 mm) wide x 50 in. (1270 mm), shall be constructed in accordance with this specification, Section 2.03, and shall be impact tested in accordance with ASTM F1592, Sections 5, 6 and 7.2. The test assembly shall meet the acceptance criteria in Section 7.2, Grade #1, in order to qualify under Section 1.06 of this specification.

b. A single sidelight security hollow metal assembly, door dimensions 3'-0" x 7'-0" (914 mm x 2134 mm) and sidelight dimensions with clear opening size of 28 in. wide x 33 in. high +/- 1 in. (711 mm x 838 mm +/- 25 mm), shall be constructed in accordance with Sections 2.01 and 2.03, and shall be impact tested in accordance with ASTM F 1592, Sections 5, 6 and 7.2. The test assembly shall meet the acceptance criteria in Section 7.2, Grade #1, in order to qualify under Section 1.06 of this specification.

3. Door Static Load Test

Two (2) doors constructed identical to each of the test doors required for Paragraph A "Door Assembly Impact Test", 3'-0" x 7'-0" (914 mm x 2134 mm), with 4 in. x 25 in. (102 mm x 635 mm) vision panel, and with hardware preparations shall be tested in accordance with ASTM F 1450, Section 7.3 "Door Static Load Test". The test doors shall meet the acceptance criteria in Section 7.3, Grade #1 14,000 lbf distributed over two (2) quarter points, 24 p.s.i., in order to qualify under Section 1.06 of this specification.

4. Door Rack Test

Two (2) doors constructed identical to each of the test doors required in Paragraph A "Door Assembly Impact Test", 3'-0" x 7'-0" (914 mm x 2134 mm), with 4 in. x 25 in. (102 mm x 635 mm) vision panel, and with hardware preparations shall be tested in accordance with ASTM F 1450, Section 7.4 "Door Rack Test". The test doors shall meet the acceptance criteria in Section 7.4, Grade #1, 7500 lbf., 208 p.s.i., corner load, in order to qualify under Section 1.06 of this specification.

**ASTM F1450, Table 1: Security Grades and Test Load Requirements**

Grade No.	Recommended Door Face Sheet and Frame Thickness In. (mm) gage, Minimum	Static Load Test B Lbf. (N)	Rack Load Test C Lbf. (N)	Impact Test A Impact Energy - 200 ft. Lbf (271.2 J)			ASTM Reference Standards
				Lock Impacts	Hinge Impacts	Glazing Impacts	
1	0.093 (2.3) 12	14000 (62 272 )	7500 (33 360)	600	200	100	F 1450, F 1577 F 1643
2	0.093 (2.3) 12	14000 (62 272)	7500 (33 360)	400	150	100	F 1450, F 1577 F 1643
3	0.067 (1.7) 14	11000 (48 939)	5500 (24 470)	200	75	100	F 1450, F 1577
4	0.067 (1.7) 14	11000 (48 939)	5500 (24 470)	100	35	100	F 1450, F 1577

**ASTM F1592, TABLE 1: Impact Series for Frame and Glazing/Panel Impact Test Multi-light Frame, Fig. 2**

Sequence	Number Of Blows Grade 1	Number of Blows Grade 2	Number of Blows Grade 3	Number of Blows Grade 4	Impact Energy Of Each Blow Ft. Lbf. (J)	Location of Blows
1	600	400	200	100	200 (271.2)	<b>Frame</b> On the frame joint between the vertical mullion and the sill or head (test agent to select at time of test).
2	600	400	200	100	200 (271.2)	On the frame joint between the horizontal mullion and the jamb (either side, test agent to select at time of test).
3	600	400	200	100	200 (271.2)	On the frame joint where the vertical and horizontal mullions cross.
4	600	400	200	100	200 (271.2)	On the frame joint between the jamb and sill or head (either side, test agent to select at time of test).
5	600	400	200	100	200 (271.2)	<b>Glazing</b> On the glazing/panel at the corner of the glazing/panel within 6 in. (15.2 cm) of the frame stop. Corner selected by the test agent at time of test.
6	600	400	200	100	200 (271.2)	On the glazing/panel at the center of the glazing/panel. Glazing/panel to be selected by the test agent at time of test.
Cyclic Sequence	200	200	100	50		

**ASTM F1592, Table 2: Impact Series for Frame and Glazing/Panel Impact Test Sidelight Frame, Fig. 3**

Sequence	Number of Blows Grade 1	Number of Blows Grade 2	Number of Blows Grade 3	Number Of Blows Grade 4	Impact Energy Of Each Blow Ft. Lbf. (J)	Location of Blows
1	600	400	200	100	200 (271.2)	<b>Frame</b> On the frame joint between the side-light sill and the strike mullion.
2	600	400	200	100	200 (271.2)	On the frame joint between the strike mullion and the header.
3	600	400	200	100	200 (271.2)	<b>Glazing</b> On the glazing/panel at the corner of the glazing/panel closest to the joint between the side-light sill and the strike mullion, within 6 in. (15.2cm) of the frame stop.
4	600	400	200	100	200 (271.2)	On the glazing/panel at the corner of the glazing/panel closest to the joint between the strike mullion and the header within 6 in. (15.2cm) of the frame stop.
5	600	400	200	100	200 (271.2)	On the glazing/panel at the center of the glazing/panel.
Cyclic Sequence	200	200	100	50		

5. Door Edge Crush Test

Two (2) doors constructed identical to each of the test doors required in Paragraph A “Door Assembly Impact Test”, 3’-0” x 7’-0” (914 mm x 2134 mm), with 4 in. x 25 in. (102 mm x 635 mm) vision panel, and with hardware preparations shall be tested in accordance with ASTM F 1450, Section 7.7 “Door Edge Crush Test”, Grade #1.

#### 6. Bullet Penetration Test

Door, frame and window designs for 5 minute FE/BBFR assemblies shall be tested and certified to meet bullet resistance requirements in accordance with ASTM F 1450, section 7.1, “Bullet Penetration”.

#### C. Uniform Static Pressure Test:

15 minute and 60 minute rated FE/BR Doors shall be constructed in accordance with the manufacturer’s certified designs and shall be subjected to the following static pressure test criteria.

A 3’0” Min. x 7’0” Min. (914 mm Min. x 2134 mm Min.) sample door assembly shall be mounted into a pressure test chamber in accordance with ASTM F 2247 and exposed to static air pressure of 15 p.s.i.g. (103 kPa). Acceptability and reporting shall be in accordance with the standard.

*Note: The static pressure test is required in order to provide assurance that the manufacturer’s basic FE/BR door assembly constructions have the capability to resist uniformly distributed pressure such as may be encountered during an attack using explosives in addition to forced entry techniques and ballistics.*

#### D. Test Reports

The manufacturer shall provide test reports and documentation by independent testing laboratories in accordance with the reporting requirements of SD-STD-01.01, Rev. G, ASTM F1450-05, ASTM F1592-05, and ASTM F 2247, and certifying compliance Section 1.06 of this specification.

### 1.07 QUALITY ASSURANCE

Approval as a Qualified Manufacturer shall require, as a minimum, substantiation of the following requirements no less than ten (15) days prior to bid date: No substitutions will be allowed thereafter.

#### A. Manufacturer’s Qualifications

1. Qualified manufacturers shall have personnel, plant equipment, and capacity capable of fabricating hollow metal door and frame assemblies of the types and quantities required for this project. These capabilities shall be substantiated by current documentation of number of employees, a current listing of production equipment, and production space.
2. Qualified manufacturers shall employ production welders qualified to weld material types, thicknesses, and joint types typical for the hollow metal doors and frames on this project. These qualifications shall be substantiated by a copy of “Welders Certification” in accordance with AWS QC-3, D1.3, for employees performing welding operations on doors and frames for this project.

3. Qualified manufacturers shall have tested frame and door construction specified in Sections 2.01 and 2.03 within the last two (2) years, in accordance with Section 1.06 “Testing and Performance” and successfully met the performance criteria of the same. This qualification shall be substantiated by an independent laboratory test report in accordance with Section 1.06 “Testing and Performance” as specified herein.
4. Qualified manufacturers shall present a copy of their “Certificate of Registration” certifying that the manufacturer’s Quality System is in conformance with, and functions as required under ISO-9001: 2000. The manufacturer’s registrar shall be a nationally recognized, independent and accredited registrar which provides periodic factory follow-up surveillance audits assuring the manufacturer’s continuing compliance with the certified Quality System.

#### B. Quality Criteria

1. All door and frame construction shall be in accordance with the designs of assemblies which meet the requirements of Section 1.06 “Testing and Performance.”
  - a. The FE/BBFR assembly manufacturer shall submit a notarized certificate stating that the construction, materials, and methods used are in accordance with these specifications and have been proven to meet performance standards described in Section 1.06 “Testing Performance.”
2. Fabrication methods and product quality shall meet standards set by the Hollow Metal Manufacturers Association, HMMA, a division of the National Association of Architectural Metal Manufacturers, NAAMM, as set forth in these specifications.
3. 5 minute rated FE/BBFR doors and frames shall be fire rated for 1-1/2 hour under fire test standard UL – 10C. The manufacturer shall be listed as a producer of these types of doors under a recognized testing agency having a factory follow-up inspection and labeling service, such as UL or ITS. These doors and frames shall be constructed in accordance with the manufacturer’s fire rating procedures.
  - a. 5 minute rated FE/BBFR doors at stairwells shall be additionally rated for a maximum temperature rise (MTR) on the unexposed side of the door of 450 degrees F (232 degrees C) during the first 30 minutes of fire exposure.

### 1.08 SUBMITTALS

#### A. FE/BBFR Assembly Submittal Drawings

1. Show door and frame elevations, sections and construction.
2. Show listing of opening descriptions including quantities, locations, and anchors.
3. Identify materials on the submittal such that they may be referenced by markings used on the contract documents.
4. Include schedule for all conventional hardware, FE/BBFR hardware, FE/BBFR glazing, and other items to be provided as components of the FE/BBFR assemblies.

- B. Production of FE/BBFR assemblies shall begin not more than four (4) weeks after the final approved submittal drawings has been received by the manufacturer. Production shall be coordinated to provide for trailer load quantities to be delivered on a regular schedule such that the progress of the job is not delayed. Provisions shall be made by the responsible contractor for on site storage as necessary to prevent any delays in the FE/BBFR assembly production schedule. A FE/BBFR assemblies delivery priority list shall be provided by the General Contractor and shall be used as a production guideline by the manufacturer. Upon changes in priority by the General Contractor, the manufacturer shall provide a revised delivery schedule.

## **1.09 WARRANTY**

All FE/BBFR work shall be warranted from defects in workmanship and quality for a period of three (3) years from shipment.

## **PART 2 – PRODUCTS**

### **2.01 HOLLOW METAL DOORS**

#### **A. Materials**

1. Doors shall be constructed of commercial quality, level, cold-rolled steel conforming to ASTM A 1008 / A 1008M or hot rolled, pickled and oiled steel conforming to ASTM A 1011 / A 1011M. The steel shall be free of scale, pitting, coil breaks or other surface blemishes. The steel shall also be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
2. Exterior Doors: Face sheets shall be 0.093 in. (2.3 mm) minimum thickness as indicated in the schedule, and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M, Coating designation A60.
3. Interior Doors: Face sheets shall be 0.093 in. (2.3 mm) minimum thickness, as indicated in the schedule. Where scheduled, face sheets of interior doors shall have a zinc coating conforming to ASTM A 653/A 653M, Coating designation A60, or otherwise shall conform to either ASTM A 1008 / A 1008M or ASTM A 1011 / A 1011M.
4. For severely corrosive conditions and where specified for individual openings either interior or exterior: Face sheets shall be 0.093 in. (2.3 mm) minimum thickness as indicated in the schedule, and shall be stainless steel meeting ASTM A 666, type 304.

#### **B. Construction:**

1. All doors shall be of the types and sizes shown in the contract documents and on the approved submittal drawings. Doors shall be constructed in accordance with these specifications and in accordance with the applicable performance requirements of Section 1.06.
2. Door thickness shall be 2 in. (50 mm) minimum. Doors shall be neat in appearance and free from warp and buckle. Edge bends shall be true and straight and of minimum radius for the material used.

3. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door. After welding, edge seams shall be ground, filled and finished flush in order to completely conceal the seams. Edge seam continuous welding shall comply with the definitions in the Glossary of Terms for Hollow Metal Doors and Frames, ANSI/NAAMM/HMMA-801. See “weld, continuous” and “welded, continuously”.
4. The internal construction of FE/BBFR doors shall be in accordance with the manufacturer’s certified design as shown in the manufacturer’s submittal package in accordance with Section 1.08 or this specification.
5. The vertical edges as well as the tops and bottoms of FE/BBFR assemblies shall be reinforced by a continuous steel channel of the necessary thickness and welded in place in such a manner as to enable the completed assembly to meet the performance requirements set forth in Section 1.06 “Testing and Performance.”
6. The end channels shall be fitted with an additional flush closing channel of not less than 0.093 in. (2.3 mm) thickness. The flush closing channel shall be welded in place at the corners with continuous welds and 1 in. (25 mm) long welds, 12 in. (305 mm) o.c. maximum along the length, on both sides. Installation of closing channel using screws, security or otherwise, shall be unacceptable. The end channel and flush closing channel shall be installed so they are permanent and non-removable.
7. Edge profiles shall be provided on both vertical edges of doors as follows:
  - Single acting doors - beveled 1/8 in. (3.2 mm) in 2 in. (51 mm) profile
  - Sliding doors or equivalent - square profile
8. Hardware reinforcements:
  - a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the FE/BBFR assembly manufacturer.
  - b. Minimum thicknesses of hardware reinforcements shall be as follows:
    - Full mortise hinges and pivots – 0.167 in. (4.2 mm)
    - Surface applied maximum security hinges – 0.167 in. (4.2 mm)
    - Strike reinforcements – 0.167 in. (4.2 mm)
    - Reinforcements for lock fronts, concealed holders, or surface mounted closer - 0.123 in. (3.1 mm)
    - Internal reinforcements for all other surface applied hardware – 0.123 in. (3.1mm)
  - c. Hinge and pivot reinforcements shall consist of a press formed angle welded in place in such a manner as to enable the hinge edge portion of the assembly to meet the performance requirements set forth in Section 1.06 “Testing and Performance.”
  - d. Door Mounted Lock Preparations

Door mounted lock preparations shall be pressed steel unitized reinforcements and enclosures securely welded in place in accordance with the manufacturer's certified design.

- e. Where electrically operated hardware is required, and as shown on approved submittal drawings, hardware enclosures and junction boxes for doors shall be provided and shall be interconnected using U.L. approved 1/2 in. (12 mm) conduit, elbows, and connectors. Also, where shown on approved submittal drawings, junction boxes with access plates shall be provided to facilitate the proper installation of wiring. Access plates shall be the same gage as the door and fastened with a minimum of four 8-32 torx drive tamper resistant screws, not to exceed 6 in. (152 mm) o.c.

9. Glass moldings and stops:

- a. Where specified, doors shall be provided with steel moldings to secure glazing in accordance with glass sizes and thicknesses provided by the contractor and shown on approved submittal drawings.
- b. Fixed glazing molding shall be not less than 0.123 in. (3.1 mm), and shall be welded in place in accordance with the manufacturer's certified design. Glazing pocket shall be a minimum of 1-1/2 in. (38 mm) deep in order to facilitate 1-1/4 in. (31 mm) minimum glass engagement.
- c. Removable glazing stops shall be pressed steel angle, not less than 0.167 in. (4.2 mm) thickness. Angle stops shall be notched and tight fitting at the corner joints, and secured in place using fasteners and spacing in accordance with the manufacturer's certified design.
- d. Where glass thickness dictates, 0.167 in. (4.2 mm), offset surface mounted glazing stop shall be used. The corners shall be tight fitting mitered, welded and ground smooth. The glass stop shall be secured using fasteners and spacing in accordance with the manufacturer's certified design.
- e. The material to which glazing stops are secured and the material that the glazing stops are fabricated from shall be galvanized material conforming to ASTM A 653/A 653M, Coating designation A60, or shall be chemically treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the door.

**2.02 FE/BBFR PANELS**

- A. FE/BBFR panels shall be of the same materials, construction, and finish as specified for FE/BBFR doors.

**2.03 HOLLOW METAL FRAMES**

## A. Materials

1. Frames shall be constructed of commercial quality, cold rolled steel conforming to ASTM A 1008 / A 1008M or hot rolled, pickled and oiled steel conforming to ASTM A 1011 / A 1011M. The steel shall be free of scale, pitting, coil breaks or other surface defects.
2. Exterior openings: Steel for these openings shall be 0.093 in. (2.3 mm) minimum thickness and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M, Coating designation A60.
3. Interior openings: Steel for these openings shall be 0.093 in. (2.3 mm) minimum thickness, and shall conform to ASTM A 1008 / A 1008M or ASTM A 1011 / A 1011M.

## B. Construction:

1. All frames shall have integral stops and be welded units of the sizes and types shown in the contract documents and on the approved submittal drawings.
2. All finished work shall be neat in appearance, square, and free of defects, warp or buckle. Pressed steel members shall be straight and of uniform profile throughout their lengths.
3. Jamb, header, mullion and sill profiles shall be in accordance the approved submittal drawings. All frame sections shall be fabricated, and all frames shall be assembled, in accordance with the manufacturer's certified FE/BBFR design.
4. Corner joints shall have all contact edges closed tight with faces mitered and stops butted. Corner joints shall be continuously welded and faces finished smooth.
5. Minimum height of stops in door openings shall be 3/4 in. (19 mm) minimum. The height of stops in FE/BBFR glass or panel openings shall be as shown on approved submittal drawings.
6. Frames for multiple openings shall have mullion members which, after fabrication, are closed tubular shapes conforming to profiles shown on approved submittal drawings, and having no visible seams or joints. All joints between faces of abutted members shall be continuously welded and finished smooth. All joints between stops of abutted members shall be welded along the height of the stop and shall be left neat and uniform in appearance.
7. When shipping limitations dictate, frames for large openings shall be fabricated in sections designed for assembly in the field by others. Alignment plates or angles shall be installed at the corners of the profile, and shall extend at least 4 in. (102 mm) on either side of the joint. Such components shall be the same gage as the frame. Field joints shall be made in accordance with the approved submittal drawings. The contractor responsible for installation shall provide for welding and finishing all field joints between faces of abutted members.

### 8. Hardware Reinforcement and Preparation:

5 minute rated FE/BBFR frames shall be provided with hardware reinforcements and preparations as follows. 15 minute and 60 minute rated FE/BBFR frames shall be provided with hardware reinforcements and preparations in accordance with the manufacturer's certified design.

- a. Frames shall be mortised, reinforced, drilled and tapped for all templated mortised hardware

only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware - anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated mortised hardware - is to be applied, frames shall be reinforced, and all drilling and tapping shall be done by others in the field.

- b. Minimum thickness of hardware reinforcing plates shall be as follows:

Hinge and pivot reinforcements – 0.167 in. (4.2 mm)

Strike reinforcements – 0.167 in. (4.2 mm)

Closer reinforcements – 0.167 in. (4.2 mm)

Flush bolt reinforcements – 0.167 in. (4.2 mm)

Reinforcements for surface applied hardware – 0.123 in. (3.1 mm)

- c. Hinge and pivot reinforcements shall consist of 0.167 in. (4.2 mm) x 1 1/2 in. (38 mm) x 10 in. (254 mm) straps welded in place. All hinge reinforcements shall be additionally reinforced by a 0.167 in. (4.2 mm) x 1 1/2 in. (38 mm) wide angle welded in two places to the strap reinforcement and two places to the inside face of the frame to prevent possible twisting and deformation of the reinforcement and sagging of the door while in normal use. Tapped holes in reinforcements shall be protected by a steel grout guard which is welded in place and made grout tight.

- d. Jamb Mounted Lock Preparations

1. Jamb mounted lock preparations shall be pressed steel unitized reinforcements and enclosures securely welded in place in accordance with the manufacturer's certified design.
2. Lock access/coverplates, if required, shall be mounted opposite the attack side and shall be fastened in place using 1/4-20, torx drive, flathead security screws.
3. Lock preparations shall be grout guarded in order to protect preparations from grout infiltration. Grout guards shall be prepared with electrical conduit access where required for field connections by others.

- e. In cases where electrically operated hardware is required, and as shown on approved submittal drawings, hardware enclosures and junction boxes for frames shall be provided, and shall be interconnected using UL approved 3/4 in. (19.1 mm) EMT conduit, elbows, and connectors. Also, where shown on submittal drawings, junction boxes with access plates shall be provided to facilitate the proper installation of wiring. Access plates shall be the same gage as the frame and fastened opposite the attack side with a minimum of four 8-32 torx drive, tamper resistant screws, not to exceed 6 in. (152 mm) o.c.

- f. Conduit runs around frame section joints shall be 3/4 in. (19 mm) U.L. approved EMT to facilitate unrestricted wire feed. Where meeting sections permit, conduit shall be bent at a 2 in. (50 mm) minimum radius at turns. Where narrow profiles prevent bending conduit, turns shall be fabricated using 90 degree sweep elbows. Short 90 degree elbows are permitted only at entrances to junction boxes which allow adequate hand access and not in conduit runs. Conduit fittings shall be U.L. approved and either compression type or a combination of compression and threaded type.

preparations. Grout guards shall be sufficient to protect preparations from grout of a 4" maximum slump consistency, as measured in accordance with ASTM C 143 / C 143M – 00, which is hand troweled into place.

- a. Grout guards for glazing screws shall be tight fitting plastic caps, or steel grout guards welded in place, covering the exposed portion of the screws inside the frame throat, around the perimeter. Where mullions are required to be grouted, screws inside mullions shall be protected with steel grout guards welded in place.
- b. Silencer preparations shall be protected by steel grout guards where accessible from the frame throat. Where limited access prevents installation of metal grout guards in mullions, silencers shall be factory furnished and installed.

10. Floor Anchors:

15 minute and 60 minute rated FE/BBFR frames shall be provided with floor anchors in accordance with the manufacturer's certified design. 5 minute rated FE/BBFR frames shall be provided with floor anchors as follows.

- a. Floor anchors provided with two holes for fasteners shall be secured inside jambs with four (4) spot welds per anchor minimum.
- b. Where scheduled, adjustable floor anchors, providing not less than 2 in. (50 mm) height adjustment, shall be secured inside jambs with four (4) spot welds per anchor minimum.
- c. Minimum material thickness of floor anchors shall be the same as frame.

11. Jamb Anchors:

15 minute and 60 minute rated FE/BBFR frames shall be provided with jamb anchors in accordance with the manufacturer's certified design. 5 minute rated FE/BBFR frames shall be provided with jamb anchors as follows.

- a. Frames for installation in masonry walls shall be provided with anchors of the strap and stirrup type made from the same gage steel as the frame. Straps shall be not less than 2 in. x 10 in. (50 mm x 254 mm) in size and perforated. The number of anchors provided on each jamb shall be as follows:

Borrowed lite frames.....In the jambs 2 anchors plus 1 for each 18 in. (457 mm) or fraction thereof over 36 in. (914 mm), spaced at 18 in. (457 mm) maximum between anchors. In the head and sill, minimum of 2 anchors plus 1 for each 18 in. (457 mm) or fraction thereof over 3'0", spaced at 18 in. (457 mm) maximum between anchors.

Door frames..... In the jambs, 2 anchors plus 1 for each 18 in. (457 mm) or Fraction thereof over 54" (1372 mm), spaced at 18 in. (457 mm) maximum between anchors. In the head, minimum of 2 anchors plus 1 for each 18 in. (457 mm) or fraction thereof over 36 in. (914 mm), spaced at 18 in. (457 mm) maximum between anchors.

- b. Embedment Masonry Type

1. Frames for installation in pre-finished masonry or concrete openings shall be provided with removable faces at the jambs, and 0.167 in. x 2 in. x 2 in. (4.2 mm x 50 mm x 50 mm) angle anchors 4 in. (102 mm) long spaced as described in Paragraph 2.02B.11.a. The frame anchors shall be located to coincide with matching embedded anchors to be provided for installation in the wall.
2. Embedded wall anchors shall consist of a 0.167 in. (4.2 mm) x 4 in. (102 mm) wide x 6 in. (152 mm) plate with 0.167 in. x 2 in. x 2 in. (4.2 mm x 50 mm x 50 mm) angle anchors 4 in. (102 mm) long welded in place at locations to match angle anchors in frames. The embed plate shall be provided with two #4 re-bar wall anchors 10 in. (254 mm) long minimum, with 2 in. (50 mm) x 90 turn down on ends continuously welded in place, and spaced as described in Paragraph 2.03.B.11.a. Embedments shall be prime painted in accordance with Paragraph 2.06.
3. Angle anchors shall each be secured to jamb and to embed plate with two 1 in. (25 mm) long arc welds at each end of the anchor. Anchors shall be shipped separately.
4. The complete anchorage system shall provide that the jamb faces opposite the attack side be removed from the frames in the field by the contractor responsible for installation, and the frames be moved into the opening until the frame anchors contact and match the embedded anchors. The contractor responsible for installation shall field weld all anchors and install the jamb faces in place. Embedment anchoring details shall be provided on approved submittal drawings.

c. Expansion Bolt Type

1. Frames for installation in existing masonry or concrete walls shall be prepared for expansion bolt type anchors. The preparation shall consist of a countersunk hole for a 3/8-16, Grade #8, (or M10 x 100, class 10.9, pitch 1.5 mm), countersunk, tamper resistant security bolt, and a spacer from the surface of the frame to the wall. The spacer shall be welded to the frame and the preparations spaced as described in Paragraph 2.03.B.11.a.
2. Expansion bolt anchor preparations, shall be located such that they are not accessible from the attack side of the assembly.

d. Frames to be installed in pre-finished concrete, masonry or steel openings, shall be constructed and provided with anchoring systems of suitable design as shown on the approved submittal drawings.

12. Frames indicated to be installed in prefinished openings and required to have jambs grouted shall be provided with grout holes at each jamb to allow for grouting after installation.
  - a. Grout holes shall consist of a 1 1/4 in. (32 mm) square hole in the face of each jamb at the top of the frame. The square hole shall be backed up by a plate with a 1 1/4 in. (32 mm) round hole to allow for grouting. Frames shall be furnished with plugs to be installed by the responsible contractor after grouting. Plugs shall be welded in place and finished smooth.
  - b. Precautions shall be taken by the installation contractor to protect all frame preparations from grout leakage resulting from the use of a light consistency grout (greater than a 5 in. (127 mm) slump).

13. All frames shall be provided with two temporary steel spreaders welded to the bottom of the jambs

to serve as bracing during shipping and handling. Spreaders shall be removed prior to installation.

14. Removable glazing stops:

- a. Removable glazing stops shall be pressed steel angle, not less than 0.167 in. (4.2 mm) thickness. Angle stops shall be notched and tight fitting at the corner joints, and secured in place using fasteners and spacing in accordance with the manufacturer's certified design.
- b. The material to which glazing stops are secured and the material that the glazing stops are fabricated from shall be galvanized material conforming to ASTM A 653/A 653M, Coating designation A60, or shall be chemically treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the door.

**2.04 CLEARANCES AND TOLERANCES**

A. Edge clearances for swinging doors shall not exceed the following:

- 1. Between doors and frames at head and jambs:.....1/8 in. (3.2 mm)
- 2. Between edges of pairs of doors:.....1/8 in. (3.2 mm)
- 3. At door sills where a threshold is used:.....3/8 in. (9.5 mm)  
from bottom of  
door to top of threshold
- 4. At door sills where no threshold is used:.....3/4 in. (19.1) above floor
- 5. Between door bottom and nominal surface of floor coverings as provided in NFPA 80 -1995, Paragraph 2-2.7:.....1/2 in. (12.7 mm)

*Note: Floor is defined as the top of the concrete slab or structural floor. Where resilient tile, hardwood or other floor coverings are used, undercuts must be increased in order to accommodate those floor coverings.*

B. Manufacturing tolerance shall be maintained within the following limits:

1. Frames for single or pair of doors:

Width measured between rabbets at the head:.....Nominal opening width  
+ 1/16 in. (1.6 mm)  
-1/32 in. (0.8 mm)

Height (total length of jamb rabbet):.....Nominal opening height  
± 3/64 in. (1.2 mm)

Cross sectional profile dimensions:

Face.....+/- 1/32 in. (0.8 mm)  
Stop.....+/- 1/32 in. (0.8 mm)  
Rabbet.....+/- 1/32 in. (0.8 mm)  
Depth.....+/- 1/32 in. (0.8 mm)  
Throat.....+/- 1/16 in. (1.6 mm)

Frames overlapping walls to have throat dimension 1/8 in. (3.2 mm) greater than dimensioned

wall thickness to accommodate irregularities in wall construction.

2. Doors:

Width.....	+/- 3/64 in. (1.2 mm)
Height.....	+/- 3/64 in. (1.2 mm)
Thickness.....	+/- 1/16 in. (1.6 mm)
Hardware cutout dimensions.....	Template dimensions + 0.015 in. (0.38 mm) – 0 in.
Hardware location.....	+/- 1/32 in. (0.8 mm)
Bow/Flatness.....	+/- 1/8 in. (3.2 mm)

**2.05 HARDWARE LOCATIONS**

A. The location of hardware on doors and frames shall be as listed below. All dimensions except the hinge locations are referenced from the finished floor as defined in Paragraph 2.04.A.

B. Hinges:

Top.....	5 in. (127 mm) from frame head to top of hinge
Bottom.....	10 in. (254 mm) from finished floor to bottom of hinge
Intermediate.....	centered between top and bottom hinges
Locks and latches.....	40 - 5/16 in. (1024 mm) to centerline of strike
Deadlocks.....	46 in. (1168 mm) to centerline of strike
Exit hardware.....	38 in. (965 mm) to centerline of cross bar
Door pulls.....	42 in. (1067 mm) to centerline of grip
Push/pull bars.....	42 in. (1067 mm) to centerline of bar
Arm pulls.....	46 in. (1168 mm) to centerline
Push plates.....	46 in. (1168 mm) to centerline of plate
Intercoms.....	48 in. (1219 mm) to centerline of intercom push buttons

**2.06 FINISH**

After fabrication, all tool marks and surface imperfections shall be filled and sanded as required to make exposed surfaces smooth and free from irregularities. After appropriate metal preparation, all exposed surfaces of doors and frames shall receive a rust inhibitive primer which meets or exceeds ANSI A250.10. Stainless steel surfaces shall be finished in accordance with ANSI/NAAMM/ HMMA – 866, Glass Bead Finish similar to #4 Polish without grain.

**PART 3 - EXECUTION**

**3.01 SITE STORAGE AND PROTECTION OF MATERIALS**

The Contractor responsible for storage and installation shall perform the following in accordance with HMMA-840 “Installation and Storage of Hollow Metal Doors and Frames.”

- A. The contractor responsible for storage and installation shall remove wraps or covers from doors and frames upon delivery at the building site. The contractor responsible for installation shall see that any scratches or disfigurement caused in shipping or handling are promptly sanded smooth, cleaned and touched up with a compatible rust inhibitive primer.
  
- B. The contractor responsible for storage and installation shall see that materials are properly stored on planks in a dry location. Doors shall be stored in a vertical position and spaced by blocking. Materials shall be covered to protect them from damage but in such a manner as to permit air circulation.

**3.02 INSTALLATION**

The Contractor responsible for installation of FE/BBFR assemblies shall perform the following in accordance with HMMA-840, “Installation and Storage of Hollow Metal Doors and Frames, and shall abide by the manufacturer’s installation instructions.

- A. Prior to installation, all frames shall be checked for size, swing, and with temporary spreaders removed, corrected for squareness, alignment, twist and plumbness. Permissible installation tolerances shall not exceed the following:

Squareness:..... +/- 1/16 in. (1.6 mm) measured on a line, 90 degrees from one jamb, at the upper corner of the other jamb

Alignment:.....+/- 1/16 in. (1.6 mm) measured on jambs on a horizontal line parallel to the plane of the wall.

Twist:.....+/- 1/16 in. (1.6 mm) measured on jambs on horizontal lines perpendicular to the plane of the wall.

Plumbness:.....+/- 1/16 in. (1.6 mm) measured on the jamb at the floor.

These tolerances provide a guideline for proper installation of hollow metal frames. The cumulative affect of the tolerances at their maximum levels will result in sufficient misalignment to prevent the door from functioning properly. Installers should take care not to create a tolerance buildup. Tolerance buildup occurs when more than one dimension is at or near its maximum tolerance.

- B. Frame jambs, shall be fully grouted to provide added security protection against battering, wedging, spreading and other means of forcing open the door. Jamb mounted lock preparations, grout guards for hardware preparations, glazing stop screws, and junction boxes are intended to protect hardware mortises, tapped mounting holes, and exposed removable screws from masonry grout of 4 in. (102 mm) maximum slump consistency which is hand troweled in place. If a light consistency grout (greater than 5 in. (127 mm) slump when tested in accordance with ASTM C 143) is to be used, special precautions shall be taken in the field by the installation contractor to provide protection from grout.

Frames shall not be used as forms for grout or concrete. Grouting of hollow metal frames shall be done in "lifts", or precautions shall be otherwise taken by the contractor to insure that frames are not deformed or damaged by this process.

- C. Proper door clearances shall be maintained in accordance with 2.04 of these specifications, except for special conditions otherwise noted. Where necessary, metal hinge shims, furnished by the contractor responsible for installation, are acceptable to maintain clearances.
- D. Hardware shall be applied in accordance with hardware manufacturer's templates and instructions.
- E. Any grout or other bonding material shall be cleaned off of frames or doors immediately following installation. Hollow metal surfaces shall be kept free of grout, tar, or other bonding material or sealer.
- F. Primed or painted surfaces which have been scratched or otherwise marred during installation (including field welding) and/or cleaning shall promptly be finished smooth, cleaned, treated for maximum paint adhesion and touched up with a rust inhibitive primer by the installation contractor.

**END OF SECTION**