HOLLOW METAL MANUAL

AMERICAN NATIONAL STANDARD

ANSI/ NAAMM

HMMA 862-03

METAL DOORS & FRAMES 8d

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GUIDE SPECIFICATIONS FOR COMMERCIAL SECURITY HOLLOW METAL DOORS AND FRAMES

ANSI/NAAMM HMMA 862-03 August 26, 2003

8d METAL DOORS & FRAMES

HMMA
HOLLOW METAL MANUFACTURERS ASSOCIATION

A Division of
NAAMM
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

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INTRODUCTION

COMMERCIAL SECURITY HOLLOW METAL SYSTEMS

For many years, hollow metal door and framing systems have been used as the primary and initial defense against forced entry. Architects, specifiers, and end users have come to understand the advantages of using hollow metal doors and frames in commercial security applications, such as, airports, convention centers, hotels, and offices, and in foreign and domestic government buildings such as, embassies, offices, and barracks.

This standard, ANSI/NAAMM HMMA 862-03, has been developed to provide guidance in the specification of commercial security hollow metal doors and frames where protection from vandalism, forced entry, theft, and firearms attack is a paramount concern.

It is necessary when writing a commercial security specification to keep in mind the security aspects of the entire opening – door, frame, hardware, glazing and wall construction. The test performance criteria set forth in this document simulates the “total opening” and its ability to frustrate forced entry, and ballistic penetration.

DESIGN VERSATILITY

Commercial hollow metal construction provides the architect with a great deal of freedom in the design of hollow metal products. The architect can also take advantage of the expertise acquired by those hollow metal manufacturers experienced in commercial security work. Over the years NAAMM/HMMA manufacturers have developed advanced methods and equipment enabling them to efficiently manufacture hollow metal assemblies, which address today’s difficult commercial security applications. These applications include working with the latest in burglary and bullet resisting hardware and security glazing. A number of these manufacturers offer proven economical and functional designs of commercial security hollow metal systems.

EVALUATING COMMERCIAL SECURITY HOLLOW METAL SYSTEMS

In order to evaluate the performance of commercial security hollow metal, it has been necessary to develop testing methods which simulate in the laboratory the system’s ability to frustrate attacks initiated by unskilled, semi-skilled and skilled burglars and/or the system’s ability to resist ballistic penetrations. One objective of this development work is to provide a standardized means of measuring performance which architects can call for in their specifications. Another objective is to provide manufacturers standardized means of testing and inspecting their products, improving their designs and maintaining high quality construction. Finally, maintenance of rigorous standards and methods of testing construction and performance gives assurance of protection to the end user and the public in general. The performance requirement and methods of testing set forth in this voluntary standard will go a long way towards realizing the stated objectives.

TESTING

This standard for commercial security hollow metal has been developed to allow architects to specify doors and frames based on the level of security required for specific openings. There are six Security Rating Classifications, 1 being the lowest or least secure, and 6 being the highest rating. This standard considers two conditions, Forced Entry Resistance and Ballistic Resistance. There are tests described by this specification which shall be conducted in accordance with; ASTM F476, “Standard Test Methods for Security of Swinging Door Assemblies”; SD-STD-01.01, Revision G, 1993; "Certification Standard on Forced Entry and Ballistic Resistance of Structural Systems”; UL Standard 752, “Bullet Resisting Equipment”; and LPS 1175: Issue 5 (2000), "Specification for Testing and Classifying the Burglary Resistance of Building Components, Strong Points and Security Enclosures". A brief description of the tests follows:

1) Bullet resistance tests
2) Door static load test
3) Door assembly impact testing
   Soft body impact attack test Class 1, 2, 3
   Hard body impact attack test Class 4, 5, 6
4) Removable glazing stop test for vision systems

5) Forced entry

6) Jamb/wall stiffness test

7) Edge crush test

The *bullet resistance test* is conducted in accordance with UL Standard 752 and SD-STD-1.01, Rev. G. These standards cover bullets fired from super power rated handguns to high-powered rifles using armor-piercing ammunition. "Bullet resisting" signifies protection against complete penetration, passage of fragments of projectiles, or spalling (fragmentation) of the protective material to the degree that injury would be caused to a person standing directly behind the bullet resisting barrier.

Under the static *load test*, a door complete with hardware is mounted in its frame with the entire assembly in the vertical position so that the door and locking elements are operable. The assembly is then subjected to a series of static loads. The test performance standard requires that the door not exceed a specified maximum deflection when a specified load is applied.

The *impact test* provides a realistic measure of an assembly's ability to withstand the treatment it can receive under attempted forced entry using simulated ramming techniques. Using an assembly prepared exactly as identified in the static load tests, the assembly is subjected to a series of impacts using either a soft body ram (simulating a person using a shoulder to gain entry) or hard body ram (simulating a person using a sledge hammer to gain entry). The removable glazing stops test is also done with impact loads. Its purpose is to assure that the glazing stops used in the frame, when fastened in place, are at least equal to the strength of the security glazing they support.

The *jamb/wall stiffness* test gauges the frame assembly's ability to withstand prying pressure apparent when trying to disengage the lock bolt from the strike.

The *edge crush* test gauges the door's ability to withstand prying pressure apparent when trying to disengage the lock bolt from the frame.

The *forced entry attack* tests demonstrate a "real world" battery of tests where a person(s) actually attacks the face of the assembly and the hinge and locking elements using a host of tools and equipment provided for by the rating classification required.

CONSTRUCTION

The construction of commercial security hollow metal varies much depending upon the rating classification required. Also many manufacturers that have tested to these standards guard the construction of their products with patents or proprietary information. The ensuing specification denotes recommended material thickness, how the doors and frames shall be welded, how stiffeners shall be attached to the face sheets, how and where hardware reinforcements shall be used, and how the product shall be finished and packaged for shipment. Such prescriptive requirements are not intended to restrict innovative design. This is essentially a performance based specification, and alternative construction shall be permitted so long as the manufacturer demonstrates successful completion of the prescribed test requirements.

FOREWORD

These specifications have been prepared in accordance with CSI recommended format with Part 1 - General, Part 2 - Product, and Part 3 - Execution. Guide specifications are intended to be used as the basis for developing job specifications and shall be edited to fit specific job requirements. Inapplicable provisions shall be deleted, appropriate selections shall be made where there are choices, and provisions applicable to the job shall be added where necessary. Optional items or requirements are shown in brackets. Notes and instructions to specifiers are given in italics directly following or at the start of the section to which they apply. Notes that contain permissive language are not considered part of the standard. Dates given with ASTM, Underwriters Laboratories, Loss Prevention Council and the US State Department Standards were current at the time this specification was published. When a more recent standard is available, the specifier should verify its applicability to this guide prior to its inclusion. Note: While the CSI Section Format locates Delivery, Storage, and Handling in Part 1, NAAMM Standards include them under Part 3 - Execution.

Materials and fabrication methods are specified in detail in Part 2. Commercial Security Hollow Metal made in accordance with these specifications have successfully met the testing and performance requirements of Section 1.05. However, the materials and fabrication methods called for in these specifications, while providing a sound guide, are not meant to restrict the use of other materials and methods where it can be demonstrated through the specified testing procedures in Section 1.05 that the construction can equal or exceed the performance levels specified in this Section. In order to ensure that a manufacturer's product meets the desired performance levels, the construction specifications shall include the testing and performance requirements of Section 1.05 and the quality requirements of Section 1.06.

The values stated in inch-pound units are to be regarded as the standard. Corresponding metric values are included in parentheses for reference purposes only.

The CSI format places commercial security hollow metal products in Section 08113. While 08113 is the preferred CSI location for Steel Security Doors and Frames, some specifiers use 08305 - Specialty Steel Doors and Frames.

CSI BROADSCOPE SECTION (08113) (08305)
COMMERCIAL SECURITY HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

This section includes commercial security hollow metal [bullet resistant] [forced entry resistant] assemblies as scheduled in the contract documents and as specified herein.

1.02 PRODUCTS PROVIDED UNDER THIS SECTION

A. Commercial security hollow metal [bullet resistant] [forced entry resistant] doors [with 3 hour, 1-1/2 hour, 3/4 hour, 1/3 hour fire rating], swinging type as scheduled in the contract documents and as specified herein.

B. Commercial security hollow metal [bullet resistant] [forced entry resistant] doors shall include [glazing molding and stops] [louvers] [speaking devices] [other] as scheduled in the contract documents and specified herein.

C. Commercial security hollow metal [bullet resistant] [forced entry resistant] frames [for 3 hour, 1-1/2 hour, 3/4 hour, 1/3 hour fire rating] with anchors.

D. Commercial security hollow metal [bullet resistant] [forced entry resistant] frames shall include [glazing molding and stops] [pass through devices] as scheduled in the contract documents and specified herein.

E. Commercial security hollow metal [bullet resistant] [forced entry resistant] panels [with 3 hour, 1-1/2 hour, 3/4 hour, 1/3 hour fire rating] of the same construction as the commercial security doors.

Indicate bullet resistant/forced entry resistant doors, frames and panels only if applicable to the job. If these are to be fire-rated doors, frames and panels, indicate the required rating. Also indicate those items in 1.02.B and 1.02.D, which need to be included with the doors.

1.03 RELATED SECTIONS

A. Section 08110 - Commercial Hollow Metal Doors and Frames

B. Section 08320 - Detention Security Hollow Metal Doors and Frames

C. Section 08348 - Swinging Sound Control Hollow Metal Doors and Frames

D. Section 08130 - Stainless Steel Hollow Metal Doors and Frames

E. Section 08700 - Builders Hardware

F. Section 08720 - Weather Stripping and Seals

G. Section 08730 - Commercial Security Hardware

H. Section 08800 - Security Glass and Glazing

I. Section 09900 - Field Painting

J. Section [ ] - Field Measurements

K. Section [ ] - Lintels, Posts, Columns or Other Load Bearing Elements

Not included in this section are installation of doors, frames, panels, door hardware or rough hardware of any kind, weatherstripping, gasketing, operable windows, items furnished by others, field painting and protection at the building site of products furnished under this section.

1.04 REFERENCES

The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only. When a more recent standard is available, the specifier should verify its applicability to this Guide prior to its inclusion.

A. ANSI A 115.1 to A 115.11, July 1971, Specifications for Door and Frame Preparation for Hardware

B. ANSI A 250.10, Test Procedures and Acceptance Criteria for Prime Painting Steel Surfaces for Steel Doors and Frames

C. ANSI/BHMA A 156, Series for Hardware Standards

D. ANSI/NAAMM HMMA 801-98, Glossary of Terms for Hollow Metal Doors and Frames

E. ANSI/NAAMM HMMA 866-01, Guide Specification for Stainless Steel Hollow Metal Doors and Frames

F. ANSI/NFPA 80-1999, Standard for Fire Doors and Fire Windows

G. ANSI/NFPA 252-1999, Standard Methods of Fire Tests of Door Assemblies

H. ANSI/NFPA 257-2000, Standard for Fire Test for Window and Glass Block Assemblies

I. ANSI/UL 9-00, Fire Tests of Window Assemblies, 7th Edition

J. ANSI/UL 10B-01, Fire Tests of Door Assemblies, 9th Edition

K. ANSI/UL 10C-01, Positive Pressure Fire Tests of Door Assemblies, 1st Edition

L. ANSI/UL 752 Bullet-Resisting Equipment

M. ASTM A 653/A 653M-01 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

N. ASTM A 666-00, Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

O. ASTM A 1008/A 1008M-02, Specification for Steel, Sheet and Strip, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability

P. ASTM A 1011/A 1011M-02, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability

Q. ASTM B 117-97, Practice for Operating Salt Spray (Fog) Apparatus

R. ASTM C 143/C 143M-00, Test Method for Slump of Hydraulic-Cement Concrete

S. ASTM D 610-95, Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces

T. ASTM D 714-87 (1994), Test Method for Evaluating Degree of Blistering of Paints

U. ASTM D 1735-99, Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

V. ASTM F 476-84, Test Methods for Security of Swinging Door Assemblies

W. ASTM F 1450-97, Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities

X. ASTM F 1592-01, Test Methods for Detention Hollow Metal Vision Systems

Y. ICBO UBC 7-2 (1997), Fire Tests of Door Assemblies

Z. ICBO UBC 7-4 (1997), Fire Test of Window Assemblies

AA. NAAMM HMMA 850-00, Fire-Rated Hollow Metal Doors and Frames, 3rd Edition

AB. NILECJ-STD-0306.00, May 1976, Physical Security of Door Assemblies and Components/ Class IV

AC. LPS 1175: Issue 5 (2000), Specification for Testing and Classifying the Burglary Resistance of Building Components, Strong Points and Security Enclosures (see LPC Loss Prevention Council)

AD. State Department Standard SD-STD-01.01, Revision G, Certification Standard for Forced Entry and Ballistic Resistance

ANSI American National Standards Institute, Inc.
25 West. 43rd Street
New York, New York 10036
(212) 642-4900 www.ansi.org

ASTM American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, Pennsylvania 19428-2959
(610) 832-9585 www.astm.org

BHMA Builders Hardware Manufacturers Association
355 Lexington Avenue 17th Floor
New York, New York 10017
(212) 299-2100 www.builders hardware.com

DOS US Department of State
A/FBO/AP/AD/SSE, Room L600, SA-6
P.O. Box 12248, Rosslyn Station
Arlington, Virginia 22219
(703) 875-6570

ICBO International Code Council – Los Angeles Office
Formerly known as International Conference of Building Officials
Uniform Building Code
5360 Workman Mill Road
Whittier, California 90601-2298
(562) 692-4226 www.icbo.org

LPC Loss Prevention Council
140 Adlersgate Street
London, England EC1A4HY
011-44-171-606-3757

NAAMM National Association of Architectural Metal Manufacturers
8 South Michigan Avenue
Suite 100
Chicago, Illinois 60603
(312) 332-0405 www.naamm.org

NFPA National Fire Protection Association
1 Battery March Park
P.O. Box 9101
Quincy, Massachusetts 02269
(617) 770-3000 www.nfpa.org

UL Underwriters Laboratory Inc.
333 Pfingsten Road
Northbrook, Illinois 60062
(708) 272-8800 www.ul.com

1.05 TESTING AND PERFORMANCE

These test methods are intended to evaluate simulated forced entry resistance of a door and frame assembly to attacks using battering devices, common hand tools, powered hand tools, static loading, and bullets. These test methods are not to provide a measure of resistance for door and frame assemblies subjected to attack by corrosive agents.

The primary purpose of these test methods is to approximate the levels of abuse to which door and frame assemblies can be subjected in the course of a forced entry. The desired result of its use is to help ensure the protection to both public and private property and the safety of the inhabitants or occupants of the building where these door and frame assemblies will ultimately be used.

It is recommended that architects and building design personnel decide which security rating is required for each opening.

A. Test Samples

1. Test sample door and frame assemblies shall be constructed in accordance with Part 2 of this specification.
2. The manufacturer shall permanently mark the test samples and retain them at the manufacturing facility for future reference for a period of one (1) year from date tested. All tests will be verified using an independent testing agency. Test reports shall include photographs of the testing apparatus and installation instructions including templates for the items of hardware used.

B. Specimen Preparation

1. The construction and size of the test door assemblies consisting of single/double doors, frames, mulled systems and all hardware components shall be representative of the application under investigation and the desired security classification needed for the application. The same basic construction and size of test doors and assemblies shall apply to all tests. Each test door shall be equipped with a vision panel if applicable.

C. Static Load – Forced Entry – Impact and Jamb/Wall Stiffness Test Fixturing

1. The wall and door assembly shall be installed in a fixture typically constructed from steel tube, I-beam and angles. This fixture shall simulate the rigidity normally provided to a door assembly in a building by the ceiling, floor and walls. Figure 1 shows an acceptable fixture.
2. The test wall shall be a rigid vertical wall section suitable for mounting the door and frame assembly in its normal attitude. The wall section shall be constructed in a manner that will not contribute to the deflection of the door and frame assembly when under static or impact loading.
3. Mounting shall be used for static load, forced entry, impact, and jamb/wall stiffness testing.
4. Mount the door and frame assembly under test in the rough opening in accordance with the manufacturer's installation instructions. Secure any opening elements in their optimum locked condition as appropriate.

D. Procedures

1. Bullet Penetration
   a. Scope: When specified by the contract documents, test door assemblies for bullet penetration resistance in accordance with UL-752 or SD-STD-01.01, Rev. G.
   b. Significance and Use: Testing of door, frame, hardware or security glazing as individual components is acceptable if conducted in accordance with UL-752 or SD-STD-01.01, Rev. G. The level of performance shall meet the rating of super-power small arms: [44 magnum], [super-power rifle arms: 30-06].
   c. The pass/fail criteria shall be in accordance with Standard UL-752 or SD STD-01.01, Rev. G.
2. Door Assembly Static Load Testing
   a. Scope: This test is designed to evaluate the capability of a commercial security hollow metal door, prepared for hardware and other options, installed in the frame to resist a steadily increasing force applied at corner points, between lock points and at the lock points.
   b. Significance and Use: This test method is intended to simulate a door and frame assembly's resistance to prying or pulling at vulnerable locations.
   c. Apparatus: The test fixture and wall described in Section 1.05.C shall be used in this test.
      i. A 2 in. (50.8 mm) travel dial indicator with resolution of 0.001 in. (0.025 mm) and support stand shall be provided such that the deflection point of the test sample can be accurately measured as the static load is applied.

ii. A hydraulic ram and pump equipped with a gauge or load cell shall be used to provide the static load. The pump ram and gauge shall be calibrated by the testing laboratory, and a chart provided that converts gauge units from pound-force per square inch (pascal) to pound-force (newton). If a load cell is used, it shall be certified by the testing laboratory within one (1) year prior to use. (See Figure 2, Static Load Apparatus)

d. Procedure: Apply static load to the attack side of the component at the locations and magnitude appropriate to the security rating desired in accordance with that specified in Table 1, and Loss Prevention Council - LPS 1175.

e. Record the resulting deflection at 500 lb. (2.2 kn) increments to produce a graph, static load versus deflection. Increase the load until target loads for each sample are reached.

3. Door Assembly Impact Testing

a. Impact testing under this section is performed using the methods and testing equipment described in ASTM F 476 for Security Classes 1, 2, and 3 soft body impacting and ASTM F 1450 for Security Classes 4, 5, and 6 hard body impacting.

b. Scope: These tests are designed to evaluate a door and frame assembly's ability to resist repetitive impact forces at the designated critical areas. Either the same door assembly used for the static load tests shall be reused for this test, or another assembly shall be used, at the discretion of the manufacturer.

c. Significance and Use: This test method is intended to closely simulate a sustained battering ram-style attack and provide an evaluation of the assembly's capability to prevent, delay and frustrate forced entry. Security Classes 1, 2, and 3 soft body impacting simulates a person using a foot or shoulder to gain entry. Security Classes 4, 5, and 6 hard body impacting simulates a person using a sledgehammer or similar battering implement to gain entry.

d. Apparatus: The test fixture and wall described in Section 1.05.C shall be used in this test.

i. Ram: The ram shall be a pendular system with a steel weight capable of delivering horizontal impact of up to 200 ft-lbf (271.2 J). The weight of the ram shall be 80 lb (36 kg). ± 0.25 lb (0.1 kg.). The striking nose of the ram shall be made from C1010-1020 carbon steel, the striking surface area of which shall be 4.0 in^2 ± 0.04 in^2 (2580 mm^2 ± 25 mm^2) The ram weight of 80 lb (36 kg) shall apply to all security levels 1 through 6. See Figure 3.

e. Procedure: In accordance with ASTM F 476 for levels 1, 2, and 3, and in accordance with ASTM F 1450 for levels 4, 5, and 6, using the test fixture and test apparatus, deliver the series of impacts listed in Table 1 and shown in Figure 4, to the assembly on the attack side of the door.

i. For soft body testing, attach to the door, centered on the impact point, a rigid foam polystyrene impact buffer that has a diameter of 6 in. (152 mm), a thickness of 2 in. (50.8 mm) and a density of 2 lb/ft3 (32 kg/m3). Position the ram such that its striking nose just touches the surface of the buffer when at rest. Pull back the pendulum weight to the height necessary to produce the required impact, and release it. Subject the door to the number of impacts in accordance with Table 1 and Figure 4, at each required impact level, attaching a new buffer for each impact.

ii. Keep the door closed and locked, and keep security glazing, or plate, whichever is used in the assembly, in place throughout the testing procedure. Failure is constituted by the assembly being damaged to the extent that forcible egress can be achieved. Disengage the lock electronically or manually. If the lock will not disengage normally, disengage it using tools commonly found in a facility maintenance tool kit, such as: hand screwdrivers, (various sizes and tip configuration including tips for lock cover plates, tamper resistant security screws), claw hammer, ball peen hammer, chisel, pliers (any common size) and vice grips. Once the lock is disengaged, open the door enough to provide normal personal egress. If the lock cannot be disengaged with conventional

hand tools as listed, or the door cannot be opened enough to provide personal egress, the assembly shall be judged to have failed the impact test.

iii. For hard body testing, use the same criteria as in soft body testing less the polystyrene buffer, striking the door with the ram directly on the door surface. Use the requirements in Table 1 and Figure 4, at each required impact level. The same pass/fail criteria shall be used as described Section 1.05.D.3.e.ii.

4. Vision System Impact Testing

a. Impact testing under this section is performed using the methods and testing equipment described in ASTM F 476 for Security Classes 1, 2, and 3 soft body impacting and ASTM F 1592 for Security Classes 4, 5, and 6 hard body impacting.

b. Scope: These tests are designed to evaluate a glazed frame assembly's ability to resist repetitive impact at the designated critical areas. The testing of a vision panel on a door is described in Section 1.05.D.3.

c. Significance of Use: This test method is intended to closely simulate a sustained battering ram style attack and provide an evaluation of the assembly's capability to prevent, delay and frustrate forced entry. Security Classes 1, 2, and 3 soft body impacting simulates a person using a foot or shoulder to gain entry. Security Classes 4, 5, and 6 hard body impacting simulates a person using a sledgehammer to gain entry.

d. Apparatus: The test fixture and wall described in Section 1.05.C shall be used in this test.

i. Ram: The ram shall be a pendular system with a steel weight capable of delivering horizontal impact of up to 200 ft-lbf (271.2 J). The weight of the ram shall be 80 lb (36 kg) ± 0.25 lb (0.1 kg.). The striking nose of the ram shall be made from C1010-1020 carbon steel, the striking surface area of which shall be 4.0 in^2 ± 0.04 in^2 (2580 mm^2 ± 25mm^2) The ram weight of 80 lb (36 kg) shall apply to all security levels 1 through 6. See Figure 3.

e. Procedure: With the fixture and test apparatus deliver the series of impacts listed in Table 1 at points shown in Figure 5, to the assembly on the fixed stop side of the frame. In lieu of glazing a 0.375 in. (9.5 mm) thick steel plate can be used.

f. For soft body testing, attach to the glazing, centered on the impact point, a rigid foam polystyrene impact buffer that has a diameter of 6 in. (152 mm), a thickness of 2 in. (50.8 mm) and a density of 2 lb/ft3 (32 kg/m3). Position the ram such that its striking nose just touches the surface of the buffer when at rest. Pull back the pendulum weight to the height necessary to produce the required impact, and release it. Subject the door to the number of impacts in accordance with Table 1 and Figure 5, at each required impact level, attaching a new buffer for each impact.

g. Install and test vision in accordance with ASTM F 1592, Section 7. Use Table 1 for pass/fail criteria.

h. Keep security glazing, or plate, whichever is used, in the assembly, in place throughout the testing procedure. Failure is constituted by the assembly being damaged to the extent that forcible egress can be achieved.

i. For hard body testing, use the same criteria as in soft body testing less the polystyrene buffer, striking the glazing material with the ram directly on the surface. Use the requirements in Table 1 and Figure 5, at each required impact level. The same pass/fail criteria shall be used as described in Section 1.05.D.4.g.

5. Forced Entry Attack Test

a. Scope: This test is designed to evaluate the burglary resistance to physical attack of commercial security door and frame assemblies prepared for hardware and other options. Either the same door assembly used for the static load, impact tests or another shall be used for this test, at the discretion of the manufacturer.

b. Significance of Use: This test is intended to simulate actual field conditions whereby an assailant(s) has full access to certain handheld tools and attacks the door face, hinge elements and locking elements in an attempted forced entry.

c. Apparatus: The test fixture and wall described in Section 1.05.C shall be used in this test.

d. Procedure: Install and test door and frame and/or window assemblies in accordance with LPS 1175: Issue 5 (2000) Specification for Testing and Classifying the Burglary Resistance of Building Components, Strongpoints and Security Enclosures or SD-STD-01.01, Revision G (amended 4/30/1993), Certification Standard for Forced Entry and Ballistic Resistance of Structural Systems. Use Table 1 for pass/fail criteria. The selection of Test Personnel shall be in accordance with SD-STD-01.01 Revision G Section 2.5 (a).

6. Jamb/Wall Stiffness Test

a. Scope: This test is designated to measure the ability of a hollow metal frame prepared for hardware, installed in a wall with the specified anchorage, to resist a load applied to each jamb perpendicularly to the frame rabbets.

b. Significance of Use: The test measures the frame's ability to withstand prying pressure when trying to disengage the lock bolt from the strike.

c. Apparatus: The test fixture and wall described in 1.05.C shall be used in this test. Figure 6 shows an acceptable loading fixture.

i. A 1 in. (25.4 mm) travel dial indicator with a resolution of 0.001 in (0.025mm) and support shall be provided such that the deflection point of the test sample can be accurately measured as the load is applied.

ii. A hydraulic ram and pump equipped with a gauge or load cell shall be used to provide the load. The pump and gauge shall be calibrated by the testing laboratory and a chart provided that converts guage units from pound-force per square inch gauge (pascal) to pound-force (newton). If a load cell is used, it shall be certified by the testing laboratory within one (1) year prior to use.

d. Procedure: Apply load to the hinge and strike jamb at the locations and magnitude appropriate to the security rating desired in accordance with that specified in Table 1 and in accordance with ASTM F 476.

e. Record the resulting deflection at 500 lbf (2.2 kn) increments to produce a graph of load versus deflection. Increase the load while measuring deflection until target loads for each sample are reached.

7. Edge Crush Test

a. Scope: This test is designed to measure the ability of the edge of a hollow metal door prepared for hardware and other options not installed in the frame to resist a load applied perpendicularly to the edge, in the plane of the door leaf.

b. Significance and Use : Damage to swinging doors occurs frequently when a door is forced against an object placed between the door and the jamb, especially the hinge jamb. If the door is dented sufficiently it can be unserviceable and security can be impaired.

c. This test is used to assist in identifying a required resistance to such vandalism.

d. Apparatus: A framework shall be constructed which will hold a sample door. The framework shall be constructed so that a calibrated load cell or hydraulic ram can be used to apply force to the edge of the door, with the ram acting in the plane of the door leaf and perpendicular to the door edge. Figure 7 shows an acceptable apparatus.

e. An end piece shall be provided for the ram comprising a 1.5 in (38.1 mm) diameter steel cylinder mounted to the ram so that the axis of the cylinder is perpendicular to the door leaf edge surface.

f. An attachment point shall be provided so that a dial indicator having at least 1 in (25.4 mm) of travel with resolution of 0.001 in (0.025 mm) can be attached to the framework, and measure the travel of the hydraulic ram once it is in contact with the edge of the sample door.

g. Install and test door panels in accordance with ASTM F 1450, Section 7.7, Door Edge Crush Test. Use Table 1 for pass/fail criteria.

E. Labeled Fire-Rated Doors and Frames

1. Doors and frames shall be provided for those openings requiring fire protection ratings as determined and scheduled by the Architect. Such doors and frames shall be constructed as tested in accordance with [ANSI/NFPA 252, ANSI/UL-10B] [ANSI/UL-10C, UBC 7-2] and listed and/or classified for labeling by a recognized testing agency having a factory inspection service.

2. Window frames shall be provided for those openings requiring fire protection ratings as determined and scheduled by the Architect. Such frames shall be constructed as tested in accordance with [ANSI/NFPA 257, ANSI/UL 9] [UBC 7-4] and listed for labeling by a recognized testing agency having a factory inspection service.

Note: UBC 7-2, ANSI/UL 10C, and UBC 7-4 provide for positive pressure testing to accommodate the requirements of some jurisdictions and should be included only for such jurisdictions.

3. If doors or frames specified by the Architect to be fire-rated cannot qualify for appropriate labeling because of design, hardware or other reasons, the Architect shall be so advised in the submittal drawings.

Note: Refer to NAAMM HMMA 850, Fire-Rated Hollow Metal Doors and Frames, for additional information.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Manufacturer shall provide evidence of having personnel and plant equipment capable of fabricating hollow metal door and frame assemblies of the type specified herein.

2. The manufacturer shall provide evidence of having a written quality control system in place.

B. Quality Criteria

1. All doors, frames, and assemblies shall meet the requirements of Section 1.05 of these specifications. Fabricate in strict accordance with the approved submittal drawings.

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 the contract documents and NAAMM's HMMA 800 through 850 Series documents.

3. Job site door check.

At the owner's option, a door at the job site shall be selected at random and sawed in half or otherwise taken apart as deemed necessary, for verification that construction is in accordance with these specifications. The manufacturer shall include the cost of the replacement door in his quotation. If the door construction does not conform to these specifications the non-conforming doors shall be repaired or replaced at the manufacturer's expense.

1.07 SUBMITTALS

A. Submittal Drawings

1. Show dimensioned door and frame elevations and sections.

2. Show listing of opening descriptions including locations, thicknesses, and anchors.

3. Show location and details of openings.
4. Indicate performance grade levels on the submittal as they are shown on the contract documents and in the door schedule.

B. Samples (if required)

1. Door: 1 ft x 1 ft (305 mm x 305 mm) corner section with hinge mortise and reinforcement showing internal construction.
2. Frame: 1 ft x 1 ft (305 mm x 305 mm) corner section showing welding of head to jamb. Include hinge mortise, reinforcement and grout guard in one rabbet, and glazing stop applied as specified in the opposite rabbet. Glazing stop shall be applied in both head and jamb section to show corner joint.
3. Samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any deficiency of quality compared to the approved samples may be cause for rejection of the work.

C. Test Report

1. Manufacturer shall submit to the Architect upon request, an independent testing laboratory report certifying that door and frame assemblies meet the performance requirements of Section 1.05 and are constructed in accordance with Sections 2.01 and 2.03 of these specifications.

D. Qualifications

1. Manufacturer shall submit to the architect upon request, ten (10) days prior to bid date, his qualifications as required by Section 1.06.

1.08 WARRANTY

Hollow metal work shall be warranted from defects in workmanship and quality for a period of three (3) years from shipment.

PART 2 – PRODUCTS

2.01 COMMERCIAL SECURITY HOLLOW METAL DOORS

A. Materials

1. Doors shall be manufactured of cold-rolled steel conforming to ASTM A 1008 / A 1008M CS Type B, or hot-rolled, pickled and oiled steel conforming to ASTM A 1011 / A 1011M CS Type B. Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves, or other defects.
2. Interior doors: Face sheets shall be [for Grades 1, 2, and 3; 0.067 in. (1.7 mm)] [for Grades 4, 5 and 6; 0.093 in. (2.3 mm)] minimum thickness.

   Note: For interior areas subject to corrosive conditions it is recommended that zinc-coated face sheets as specified in 2.01.A.3 be used.

3. Exterior Doors: Face sheets shall be [for Grades 1, 2, and 3; 0.067 in. (1.7 mm)] [for Grades 4, 5 and 6; 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 Commercial Steel (CS), coating designation A60 (ZF180) or G60 (Z180).
4. For severely corrosive conditions and where specified on individual openings either interior or exterior: Face sheets shall be [for Grades 1, 2, and 3; 0.067 in. (1.7 mm)] [for Grades 4, 5 and 6; 0.093 in. (2.3 mm)] minimum thickness. Face sheets and components shall be stainless steel conforming to ASTM A 666, Type [304] [316]. Steel stiffened construction methods and finishes for stainless steel doors shall comply with ANSI/NAAMM HMMA 866.

Note: If the Architect determines that zinc-coated components are needed in addition to zinc-coated or stainless face sheets, 201.A.3 and 201.A.4 are the appropriate locations to specify that requirement.

B. Construction:

1. Doors shall be the types, sizes and construction in accordance with the contract documents, and shall meet the performance requirements of Section 1.05 where applicable. Alternate materials and methods of construction, which meet the aforementioned performance criteria, shall be permitted.

2. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door.

   Note: See "Weld, Continuous" and "Welded, Continuously" in ANSI/NAAMM HMMA 801, Glossary of Terms for Hollow Metal Doors and Frames.

3. Minimum nominal door thickness shall be 1-3/4 in. (44 mm). Doors shall be neat in appearance and free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the thickness of metal used.

4. Doors shall be stiffened by continuous vertically formed steel sections. Additional core materials shall be the manufacturer's proprietary standard, engineered and tested in accordance with the level of protection as specified by the Architect.

5. The vertical edges shall be reinforced continuously using steel, not less than the thickness of the face sheets extending the full length of the door. The top and bottom edges shall be closed with a continuous channel, not less than the thickness of the face sheets and spot welded to face sheets a maximum of 4 in. (101 mm) o.c. The closing end channel shall be continuously welded to the vertical edge reinforcing at all four corners producing a fully welded perimeter reinforcing.

6. The top end channel shall be fitted with an additional flush closing channel of not less than 0.053 in. (1.3 mm) thickness. The flush closing channel shall be welded in place at the corners and at the center.

7. Edge profiles shall be provided on both vertical edges of doors as follows:

   a. Single acting doors . . . . . beveled 1/8 in. (3mm) in 2 in. (50.8 mm)

   b. Sliding doors or equivalent . . . . . square edge

8. Hardware reinforcements and preparation:

   a. The hollow metal manufacturer shall be consulted for specific hardware sets needed at each level of security.

   b. Doors shall be mortised, reinforced, drilled and tapped at the factory for templated mortise 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 hardware apply, doors shall be reinforced, and all drilling and tapping shall be done by others in the field.

   c. Minimum thickness for hardware reinforcements shall be as follows:

      i. Full mortise hinges and pivots . . . . . 0.187 in. (4.7 mm)

      ii. Surface applied maximum security hinges . . . . . 0.250 in. (6.3 mm)

      iii. Strikes . . . . . 0.187 in. (4.7 mm)

      iv. Slide device hanger attachment . . . . . per device manufacturer's recommendations

      v. Lock fronts, concealed holders, or surface mounted closers . . . . . 0.093 in. (2.3 mm)

vi. Internal reinforcements for all other surface applied hardware . . . . . 0.093 in. (2.3 mm)

d. In cases where electrically or electronically operated hardware is required, and where indicated on approved hardware schedule, conduit, hardware enclosures, and/or junction boxes within the door shall be provided. Access plates, where required, shall be the same material and thickness as the door face sheet and fastened with not less than four (4) #8-32 tamper resistant machine screws, at a spacing not to exceed 6 in. (152 mm) o.c.

9. Glazing moldings and stops:

   a. Where specified, doors shall be provided with steel moldings to secure glazing by others in accordance with security glazing sizes and thicknesses shown on the contract documents.

   b. Fixed glazing molding shall be welded to both face sheets 5 in. (127 mm) o.c. maximum.

   c. In security glazing openings for Grades 1 and 2, removable glazing stops shall be pressed steel channel not less than 0.067 in. (1.7 mm) thickness with tight fitting butt or mitered corner joints, and secured with #8-32 countersunk, tamper resistant machine screws located 2 in. (50.8 mm) maximum from each end and 9 in. (228 mm) o.c. maximum.

   d. In security glazing openings for Grades 3, 4, 5, and 6, removable glazing stops shall be pressed steel angles, not less than 0.093 in. (2.3 mm) thickness. Angle stops shall be mitered or notched and tight fitting at the corner joints, and secured in place using 1/4-20 or 1/4-28 button head tamper resistant machine screws with spacing necessary to satisfy the performance criteria outlined in Section 1.06, spaced 2 in. (50.8 mm) maximum from each end and 9 in. (228 mm) o.c. maximum.

   e. The surface underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the door.

   Note: It is recommended that view window stop heights be specified to provide 1 in. (25.4 mm) security glazing engagement.

10. Louvers shall be of the welded inverted “V” or “Y” type construction providing free air delivery as specified. The louver opening shall be flush, fabricated using interior channels 0.093 in. (2.3 mm) minimum thickness, securely welded to the inside of both face sheets. A rectangular louver shall not exceed 18 in. (457 mm) in width without being reinforced at its midpoint by a vertical rectangular steel bar at least 0.25 in. x 1.50 in. (6.3 mm x 38 mm) or a vertical round steel bar at least 0.75 in. (19 mm) diameter. The vanes shall be not less than 0.093 in. (2.3 mm) thickness and shall be spaced so that no rigid flat instrument can be passed through them. Insect screens and flattened expanded metal not less than 0.093 in. (2.3 mm) thickness shall be provided on louvered doors in exterior locations where shown on approved submittal drawings.

11. Speaking devices shall consist of a rectangular pattern of round holes, no more than 0.25 in. (6.3 mm) dia., in both face sheets directly across from each other. The minimum size of the rectangular hole pattern shall be 1 in. (25 mm) high x 4 in. (101 mm) wide with holes spaced no more than 1 in. (25 mm) o.c. vertically and horizontally. The interior of the door between the rectangular hole patterns shall be baffled using pressed steel sections, not less than 0.067 in. (1.7 mm), so that no objects can be passed through.

12. Paper pass openings:

   a. The pass opening shall be flush, fabricated using interior channels 0.093 in. (2.3 mm) minimum thickness, securely welded to the inside of both face sheets. The four corner seams shall be continuously welded and dressed smooth. The finished opening shall be of such construction that it cannot be dismantled or otherwise affected by tampering or scraping.

   b. The pass shutter shall be constructed to conform with the attack resistance as specified by the Architect and conform to that of the door/frame assembly.

   c. The shutters shall be treated for maximum paint adhesion and given a shop coat of rust inhibitive primer and shall be factory installed.

2.02 COMMERCIAL SECURITY HOLLOW METAL PANELS

A. Hollow metal panels shall be made of the same materials and construction and finished in the same way as specified in Sections 2.01 and 2.06.

2.03 COMMERCIAL SECURITY HOLLOW METAL FRAMES

A. Materials

1. Frames shall be manufactured of cold rolled-steel conforming to ASTM A 1008 / A 1008M CS Type B or hot-rolled, pickled and oiled steel conforming to ASTM A 1011 / A 1011M CS Type B. The steel shall be free of scale, pitting, coil breaks or other surface defects.

2. Interior frames: Frame sections shall be [for Grades 1, 2, and 3; 0.067 in. (1.7 mm)] [for Grades 4, 5 and 6; 0.093 in. (2.3 mm)] minimum thickness.

   Note: For interior areas subject to corrosive conditions it is recommended that zinc-coated frame sections as specified in 2.03.A.3 be used.

3. Exterior Frames: Frame sections shall be [for Grades 1, 2, and 3; 0.067 in. (1.7 mm)] [for Grades 4, 5 and 6; 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 Commercial Steel (CS), coating designation A60 (ZF180) or G60 (Z180).

4. For severely corrosive conditions and where specified on individual openings either interior or exterior: Frame sections and components shall be [for Grades 1, 2, and 3; 0.067 in. (1.7 mm)] [for Grades 4, 5 and 6; 0.093 in. (2.3 mm)] minimum thickness. Frame sections and components shall be stainless steel meeting ASTM A 666, Type [304] [316]. Construction methods and finishes for stainless steel frames shall comply with ANSI/NAAMM HMMA 866.

   Note: If the Architect determines that zinc-coated components are needed in addition to zinc-coated or stainless face sheets, 2.03.A.3 and 2.03.A.4 are the appropriate locations to specify that requirement.

B. Construction

1. Frames, with the exception of cased openings such as for sliding doors, shall have integral stops and be welded units of the sizes and types shown on approved submittal drawings. Frames shall be constructed in accordance with these specifications and meet performance criteria specified in Section 1.05 where applicable. Alternate materials and methods of construction, which meet the aforementioned performance criteria, shall be permitted.

2. All finished work shall be neat in appearance, square, and free of defects, warps and buckles. Pressed steel members shall be straight and of uniform profile throughout their lengths.

3. Jamb, header and sill profiles shall be in accordance with the frame schedule and as shown on the approved submittal drawings.

4. Corner joints shall have all contact edges closed tight with faces mitered and stops either butted or mitered. Faces and soffits shall be continuously welded (see Figure 8) and the faces finished smooth. The use of gussets or splice plates as a substitute for welding shall not be acceptable.

5. Other face joints shall be continuously welded and finished smooth.

6. Minimum height of stops in door openings shall be 0.625 in. (15.8 mm). Height of stops on security glazing or panel openings shall be as shown on approved submittal drawings.

7. When shipping limitations so dictate, or when advised by the contractor responsible for co-ordination or installation, frames for large openings shall be fabricated in sections designated for assembly in the field by others. Alignment plates or angles shall be installed at each joint. Such components shall be the same thickness as the frame. Field joints shall be made in accordance with approved submittal drawings and shall be field welded by others.

8. 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 soffit and shall be left neat and uniform in appearance. The contractor responsible for installation shall provide for welding and finishing all field joints between faces of abutted members.

9. Hardware Reinforcements and Preparation:

   a. The hollow metal manufacturer shall be consulted for specific hardware sets needed at each level of security.

   b. Frames shall be mortised, reinforced, drilled and tapped at the factory for all templated mortise 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 hardware apply, frames shall be reinforced, with all drilling and tapping done by others in the field.

   c. Minimum thickness of hardware reinforcing shall be as follows:

      i. Hinges and pivots . . . . . 0.187 in. x 1.5 in. x 10 in. length (4.7 mm x 38 mm x 254 mm)

      ii. Surface applied maximum security hinges . . . . . 0.250 in. (6.3 mm)

      iii. Strikes . . . . . 0.187 in. (4.7 mm)

      iv. Closers . . . . . 0.187 in. (4.7 mm)

      v. Flush bolts . . . . . 0.187 in. (4.7 mm)

      vi. All other surface applied hardware . . . . . 0.093 in. (2.3 mm)

   d. In cases where electrically or electronically operated hardware is required, and where indicated on approved hardware schedule, hardware enclosures, and/or junction boxes shall be provided. Access plates, where required, shall be the same thickness as the frame and fastened with not less than four (4) #8-32 tamper resistant machine screws, not to exceed 6 in. (152 mm) o.c.

10. Floor Anchors:

    a. Where applicable, floor anchors shall be provided with two (2) holes for fasteners and shall be fastened inside jambs with at least four (4) spot welds per anchor.

    b. Where so scheduled, adjustable floor anchors, providing not less than 2 in. (50 mm) height adjustment, shall be fastened in place with at least four (4) spot welds per anchor.

    c. Thickness of floor anchors shall be the same as frame.

11. Jamb Anchors:

    a. Anchor Spacing

       The number of anchors provided on each jamb shall be as follows:

       Borrowed light frames: 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

       Door frames: 2 anchors plus 1 for each 18 in. (457 mm) or fraction thereof over 54 in. (1372 mm), spaced at 18 in. (457 mm) maximum between anchors (fire ratings can require additional anchors)

    b. Masonry Type

       Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the strap and stirrup type made from the same thickness steel as frame. Straps shall be no less than 2 in. x 10 in. (50.8 mm x 254 mm) in size, corrugated and/or perforated.

c. Embedment Masonry Type

i. Frames for installation in pre-finished masonry or concrete openings shall be provided with removable faces at the jambs, and 0.187 in. x 2 in. x 2 in. (4.7 mm x 50.8 mm x 50.8 mm) angle anchors 4 in. (102 mm) long spaced as described in Section 2.03.B.11.a. The frame anchors shall be located to coincide with matching embedded anchors to be provided for installation in the wall.

ii. Embedded wall anchors shall consist of a 0.187 in. (4.7 mm) x 4 in. (102 mm) wide x 6 in. (152 mm) plate with 0.187 in. x 2 in. x 2 in. (4.7 mm x 50.8 mm x 50.8 mm) angle anchors 4 in. (102 mm) long welded in place at locations to match angle anchors in frames. The embedded plate shall be provided with two (2) #4 re-bar wall anchors 10 in. (254 mm) long minimum, with 2 in. (50.8 mm) x 90 degree turn down on ends continuously welded in place, and spaced as described in Section 2.03.B.10.a. Embedments shall be prime painted in accordance with Section 2.03.B.14.

iii. Angle anchors shall each be fastened to jamb and to embedded plate with two (2) 1 in. (25.4 mm) long arc welds at each end of the anchor. Anchors shall be shipped loose.

iv. Anchorage systems that require removable jamb faces shall be disassembled in the field by the contractor responsible for installation. The installer is responsible for shimming at the anchor contact points prior to welding, using steel shims, to assure that the frame meets installation tolerance requirements specified in Section 3.02.A. The frames shall 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.

d. Expansion Bolt Type

i. 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 0.5 in. (12.7 mm) diameter bolt and a spacer from the unexposed surface of the frame to the wall. The spacer shall be welded to the frame and the preparation spaced as described in Section 2.03.B.11.a. Fasteners for such anchors shall be provided by others.

ii. After sufficient tightening of the bolt, the bolt head shall be welded by the installation contractor so as to provide a non-removable condition. The welded bolt head shall be ground, dressed, and finished smooth.

e. 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. Grout guards shall be provided at all hardware preparations, glazing stop screws, and silencer preparations on frames to be set in masonry or concrete openings. Grout guards shall be sufficient to protect preparations from grout of a 4 in. (102 mm) maximum slump consistency which is hand troweled in place.

a. Grout guards for glazing stop screws shall be factory installed and shall cover 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 grout guards.

b. Silencer preparations shall be protected by grout guards where accessible from the frame throat. Silencers shall be furnished and installed by the contractor responsible for frame installation.

13. Door frames shall be provided with two (2) temporary steel spreaders welded to the bottom of the jambs to serve as bracing during shipping and handling. The installation contractor shall be responsible for finishing and touch-up of marks caused by spreader removal.

14. Removable glazing stops:

    a. In openings where non-security glazing is specified, loose channel type glazing stops shall be cold rolled steel, not less than 0.067 in. (1.7 mm) thickness, butted at corner joints and secured to the frame using #8-32 countersunk tamper resistant machine screws, spaced 2 in. (50.8 mm) maximum from each end and 9 in. (228 mm) o.c. maximum.

    b. In openings where security glazing is specified and where shown on the approved submittal drawings, pressed steel angle glazing stops, not less than 0.123 in. (3.1 mm) thick, shall be provided. Angle stops shall be mitered or butted and tight fitting at the corner joints, and secured in place using machine screws of the size and spacing necessary to satisfy the performance criteria outlined in Section 1.05.D, spaced 2 in. (50.8 mm) maximum from each end and 9 in. (228 mm) o.c. maximum.

    Note: It is recommended that view window stop heights be specified to provide 1 in. (25.4 mm) security glazing engagement.

    c. The surface underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the frame.

2.04 MANUFACTURING TOLERANCES

Note: The manufacturer of the doors and frames is responsible only for the manufacturing tolerances listed in 2.04. The final clearances and relationships between door and frame depends on the setting of the frame (see Figure 12) and the hanging and adjustment of the door and hardware (see Sections 3.02 and 3.03).

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

1. Frames for single door or pair of doors:

    a. Width, measured between rabbets at the head: Nominal opening width + 1/16 in. (1.5 mm), - 1/32 in. (0.8 mm)

    b. Height (total length of jamb rabbet): Nominal opening height + 1/16 in. (1.5 mm),. - 0

2. Cross sectional frame profile dimensions: (see Figure 9)

    a. Face . . . . . ± 1/32 in. (0.8 mm)

    b. Stop . . . . . ± 1/32 in. (0.8 mm)

    c. Rabbet . . . . . ± 1/32 in. (0.8 mm)

    d. Depth . . . . . ± 1/32 in. (0.8 mm)

    e. Throat . . . . . ± 1/16 in. (1.5 mm)

    Note: Frames overlapping walls to have throat dimension 1/8 in. (3.1 mm) greater than dimensioned wall thickness to accommodate irregularities in wall construction.

3. Flatness of large frames: 1/8 in (3.1 mm) in 10 ft (3048 mm) of length or width

4. Doors - Doors are undersized to fit the frame. Edge clearances are based upon individual door manufacturer's designs. Tolerance on actual door sizes are as follows:

    a. Width . . . . . ± 3/64 in. (1.2 mm)

    b. Height . . . . . ± 3/64 in. (1.2 mm)

    c. Thickness . . . . . ± 1/16 in. (1.5 mm)

    d. Bow/flatness . . . . . ± 1/8 in. (3.2 mm)

5. Hardware
   a. Cutout and template dimensions . . . . . + 0.015 in. (0.38 mm), - 0
   b. Location . . . . . ± 1/32 in. (0.8 mm)
   c. Between hinge centerlines . . . . . ± 1/64 in. (0.4 mm)

2.05 HARDWARE LOCATIONS

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 Section 3.03

A. 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 . . . . . Equally spaced between top and bottom hinges
B. Locks and latches . . . . . 38 in. (965 mm) to centerline of knob or lever shaft
C. Deadlocks . . . . . 46 in. (1168 mm) to centerline of cylinder
D. Exit hardware . . . . . 38 in. (965 mm) to centerline of cross bar or as shown on hardware template
E. Door pulls . . . . . 42 in. (1066 mm) to centerline of grip
F. Push/pull bars . . . . . 42 in. (1066 mm) to centerline of bar
G. Arm pulls . . . . . 46 in. (1168 mm) to centerline
H. Push plates . . . . . 46 in. (1168 mm) to centerline of plate
I. Intercoms . . . . . 48 in. (1219 mm) to centerline of intercom push button

2.06 FINISH

After fabrication, all tool marks and surface imperfections shall be filled and sanded as required to make face sheets, vertical edges and weld joints 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 A 250.10 Test Procedures and Acceptance Criteria for Prime Painting Steel Surfaces for Steel Doors and Frames. For stainless steel finishes refer to ANSI/NAAMM HMMA 866.

PART 3 – EXECUTION

Note to Architect: Proper storage and installation is essential to the proper performance of doors and frames. The requirements for proper storage and installation are given in the following sections. However, it is important to recognize that installation is not the responsibility of the hollow metal manufacturer. For this reason the following requirements shall be referenced in that section of the specifications where installation of work is specified. (Reference: HMMA 840, "Installation and Storage of Hollow Metal Doors and Frames")

3.01 SITE STORAGE AND PROTECTION OF MATERIALS

A. The contractor responsible for installation shall remove wraps or covers from doors and frames upon delivery at the building site. The contractor responsible for installation shall ensure 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 installation shall ensure that materials are properly stored on planks or dunnage in a dry location. Doors shall be stored in a vertical position and spaced by blocking. Figure 10 illustrates recommended storage positioning. 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 shall perform the following:

A. Prior to installation, all frames shall be checked for size, and swing, and with temporary spreaders removed, corrected for squareness, alignment, twist and plumb. Permissible installation tolerances shall not exceed 1/16 in. (1.5 mm):

1. Squareness . . . . . Measured at rabbet on a line from jamb, perpendicular to frame head
2. Plumbness. . . . . Measured at jambs on a perpendicular line from the head to floor
3. Alignment . . . . . Measured at jambs on a horizontal line parallel to the plane of the face
4. Twist . . . . . Measured at opposite face corners of jambs on parallel lines, perpendicular to the plane of the door rabbet

The details in Figure 12 illustrate methods of measuring the above-specified tolerances.

Note: The above tolerances provide a reasonable guideline for proper installation of hollow metal frames. However, it should be noted that the cumulative affect of the installation tolerances at their maximum levels could result in sufficient misalignment to prevent the door from functioning properly. Installers should be careful not to create an installation tolerance buildup. Tolerance buildup occurs when several tolerances are at or near their maximum.

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, exposed removable screws, and tapped mounting holes from masonry grout of 4 in. (102 mm) maximum slump consistency which is hand troweled in place. If a lighter consistency grout (greater than 4 in. (127 mm) slump in accordance with ASTM C 143) is to be used, special precautions shall be taken in the field by the installation contractor to protect tapped holes, electrical knock-outs, lock pockets, grout guards, junction boxes, etc. in the frames.

C. Frames are not intended or designed to act as forms for grout or concrete. Grouting of hollow metal sections shall be done in “lifts” or precautions shall be otherwise taken by the contractor to insure that frames are not deformed or damaged by the hydraulic forces that occur during this process.

D. Any grout or other bonding material shall be cleaned off of frames or doors immediately following installation. Exposed hollow metal surfaces shall be kept free of grout, tar, or other bonding material or sealer.

E. Exposed field welds shall be finished smooth and touched up with a rust inhibitive primer.

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 comparable to and compatible with the shop applied primer and finish paint specified in Section 09900. All finish paint must be formulated for Direct To Metal (DTM) application.

3.03 CLEARANCES

A. Doors shall be hung and hardware installed in accordance with hardware manufacturer’s templates and instructions. Doors shall be adjusted using metal hinge shims, furnished by the contractor responsible for installation, to provide the following clearances. Edge clearances for swinging doors shall not exceed the following:

1. Between doors and frames at head and jambs . . . . . 3/16 in. (4.7 mm)
2. Between edges of pairs of doors . . . . . 3/16 in. (4.7 mm)
3. At doorsills 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. (19.0 mm)

5. Between door bottom and nominal surface of floor coverings at fire-rated openings as provided in ANSI /NFPA 80 . . . . . 1/2 in. (12.7 mm)

B. Proper door clearances shall be maintained in accordance with Section 3.03 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.

C. Hardware shall be applied in accordance with hardware manufacturer's templates and instructions.

Note: Floor/Finished floor is defined as the top of the concrete or structural slab. HMMA uses the term 'top of floor covering' to describe the NFPA term 'nominal surface of floor covering'. The Architect must define the distance from the top of the floor/finished floor to the top of the floor covering so appropriate undercuts can be provided. (see Figure 11)

The final clearances and relationship between door and frame depend on the setting of the frame and the hanging and adjusting of the door and hardware. If everything is perfect in the setting of the frame, and the manufacturing of the doors and frames, the clearances should be as shown in 3.03. However, if the frame is set to its maximum allowable tolerances, and the doors and frames are manufactured to their maximum allowable tolerances, the clearances could be greater.

All clearances are subject to change depending upon the requirements of specified hardware.

Table 1

SECURITY RATING	FORCED ENTRY										STATIC LOAD						IMPACT				EDGE CRUSH			JAMB/WALL STIFFNESS	
CLASSIFICATION	TOOL CATEGORY	TEST LEVEL SPECIFICATION IN MINUTES	ACTIVE TEST PERSONNEL	INDIVIDUAL SYSTEMS		MULLED SYSTEMS	DOUBLE DOOR SYSTEMS				AT CORNER POINTS		BETWEEN LOCK POINTS		AT LOCK POINTS		AT HINGE POINTS	AT LOCK POINTS	AT MULLED SYSTEMS	AT GLAZING POINTS	AT DOOR EDGE			JAMB TO JAMB SPREAD RESISTANCE	
				MOST VULNERABLE LOCATIONS	SELECTED LOCATIONS	EACH MULLION	SEAMS BETWEEN DOORS	HINGE OF ACTIVE DOOR	HINGE OF INACTIVE DOOR	SELECTED LOCATIONS	LOAD	MAXIMUM DEFLECTION	LOAD	MAXIMUM DEFLECTION	LOAD	MAXIMUM DEFLECTION					LOAD	MAXIMUM DEFLECTION	MAXIMUM LOAD WITHOUT COLLAPSE	LOAD	MAXIMUM DEFLECTION
											lbf (kn)	IN (mm)	lbf (kn)	IN (mm)	lbf (kn)	IN (mm)	FT lbf (J)	FT lbf (J)	FT lbf (J)	FT lbf (J)	lbf (kn)	IN (mm)	lbf (kn)	lbf (kn)	IN (mm)
1	A	5	2	5	5	5	5	5	5	5	662 (1.5)	1.181 (30)	662 (1.5)	1.181 (30)	1325 (3)	.394 (10)	CLASSES 1 - 2 - 3 USE SOFT BODY IMPACTING				1325 (3)	.25 (6.4)	2000 (4.5)	1350 (3.1)	.375 (9.5)
																	2 BLOWS @ 59 (80)	2 BLOWS @ 59 (80)	2 BLOWS @ 59 (80)	2 BLOWS @ 59 (80)					
TEST METHOD PARAGRAPH																									
2	B	10	4	10	10	10	10	10	10	10	662 (1.5)	1.181 (30)	662 (1.5)	1.181 (30)	1325 (3)	.394 (10)	CLASS 1+ 2 BLOWS @ 89 (120)	CLASS 1+ 2 BLOWS @ 89 (120)	CLASS 1+ 2 BLOWS @ 89 (120)	CLASS 1+ 2 BLOWS @ 89 (120)	1325 (3)	.25 (6.4)	2000 (4.5)	1850 (4.1)	.375 (9.5)
TEST METHOD PARAGRAPH																									
3	C	15	6	15	15	15	15	15	15	15	1325 (3)	.787 (20)	1325 (3)	.787 (20)	2645 (6)	.394 (10)	CLASS 2+ 2 BLOWS @ 118 (160)	CLASS 2+ 2 BLOWS @ 118 (160)	CLASS 2+ 2 BLOWS @ 118 (160)	CLASS 2+ 2 BLOWS @ 118 (160)	1985 (4.5)	.25 (6.4)	4000 (9)	3600 (8.2)	.50 (13)
TEST METHOD PARAGRAPH																									
4	D	20	6	20	20	20	20	20	20	20	2645 (6)	.394 (10)	2645 (6)	.394 (10)	4410 (10)	.394 (10)	CLASSES 4 - 5 - 6 USE HARD BODY IMPACTING				3500 (7.9)	.25 (6.4)	6000 (13.6)	4950 (11.2)	.50 (13)
																	30 BLOWS @ 148 (200)	100 BLOWS @ 148 (200)	30 BLOWS @ 148 (200)	30 BLOWS @ 148 (200)					
TEST METHOD PARAGRAPH																									
5	E	40	6	40	40	40	40	40	40	40	4410 (10)	.394 (10)	4410 (10)	.394 (10)	6615 (15)	.394 (10)	CLASS 4+ 75 BLOWS @ 200 (271.2)	CLASS 4+ 200 BLOWS @ 200 (271.2)	CLASS 4+ 30 BLOWS @ 200 (271.2)	CLASS 4+ 30 BLOWS @ 200 (271.2)	5750 (13)	.25 (6.4)	10000 (22.7)	6000 (13.6)	.50 (13)
TEST METHOD PARAGRAPH																									
6	F	60	6	60	60	60	60	60	60	60	4410 (10)	.394 (10)	4410 (10)	.394 (10)	6615 (15)	.394 (10)	CLASS 5+ 100 BLOWS @ 200 (271.2)	CLASS 5+ 300 BLOWS @ 200 (271.2)	CLASS 5+ 30 BLOWS @ 200 (271.2)	CLASS 5+ 30 BLOWS @ 200 (271.2)	8000 (18.1)	.25 (6.4)	15000 (34)	7500 (17)	.50 (13)
TEST METHOD PARAGRAPH																									

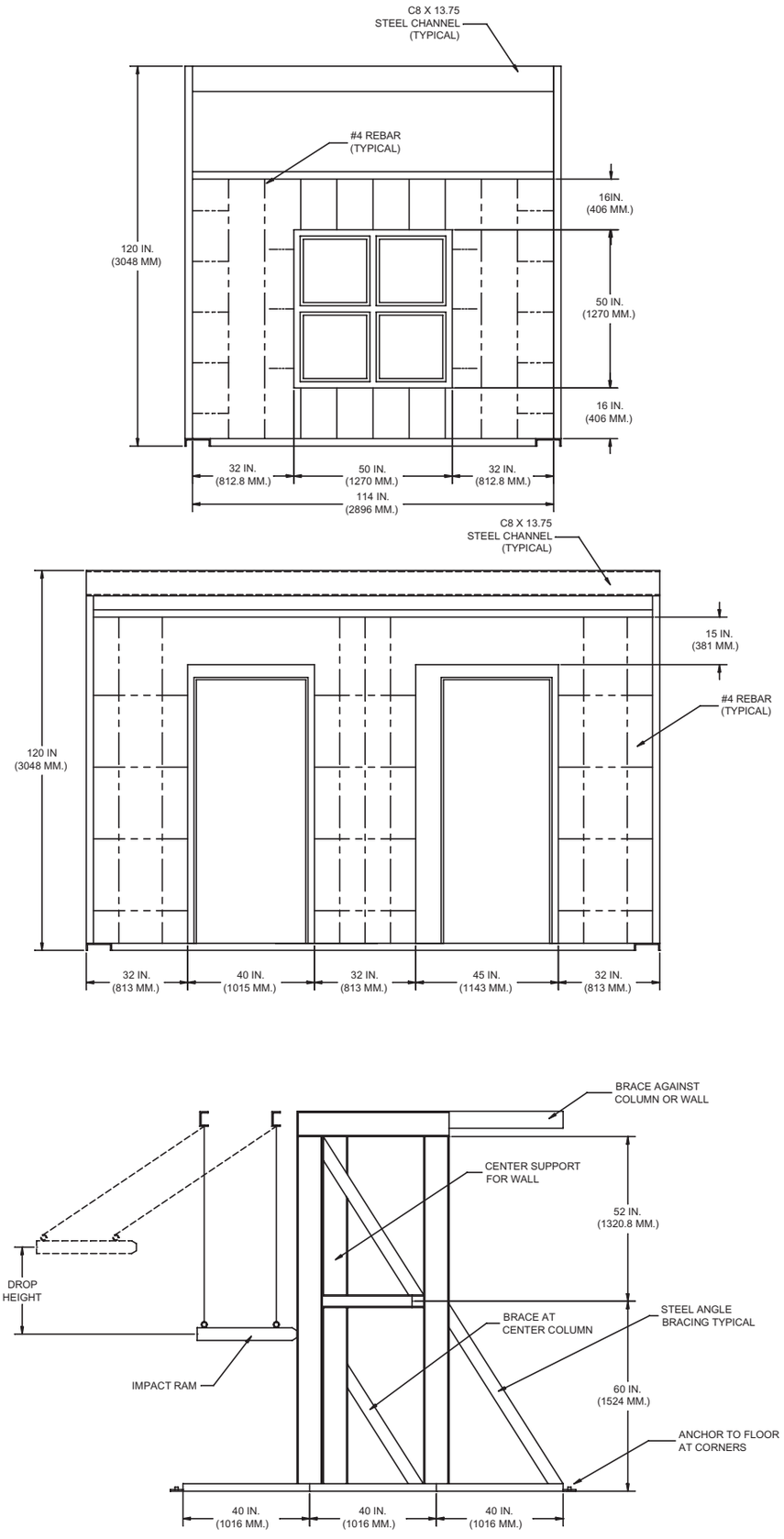
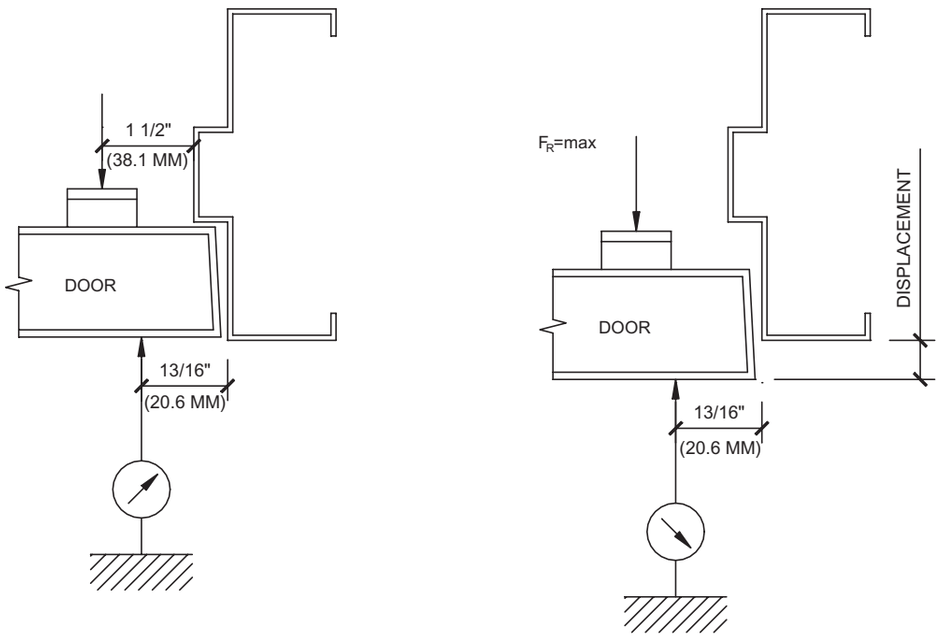


FIGURE 1 Test Wall



BEFORE LOADING

AFTER LOADING FOR
1 MINUTE AT F_R=MAX

MEASUREMENT OF DISPLACEMENT

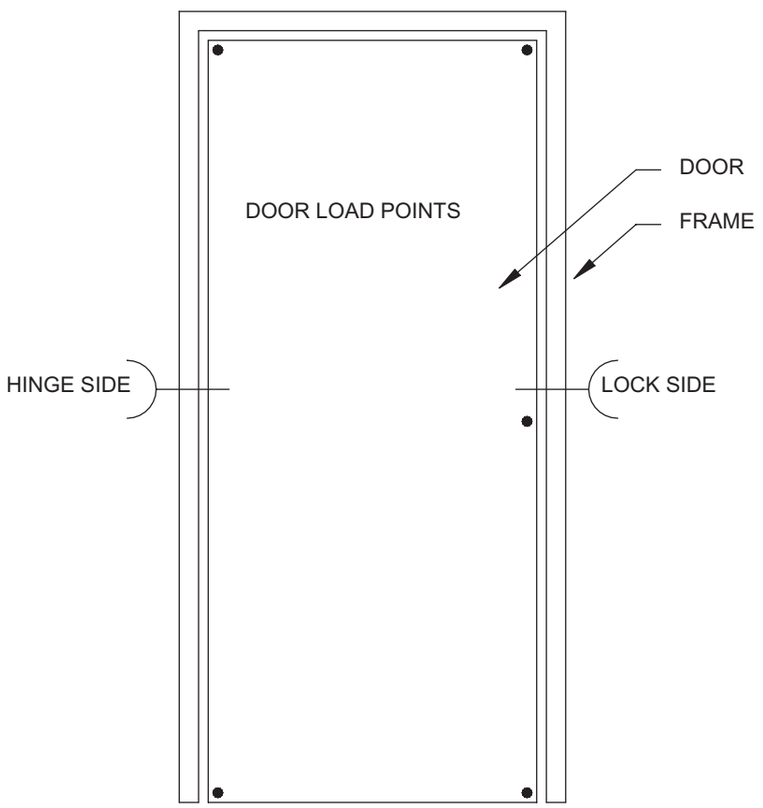
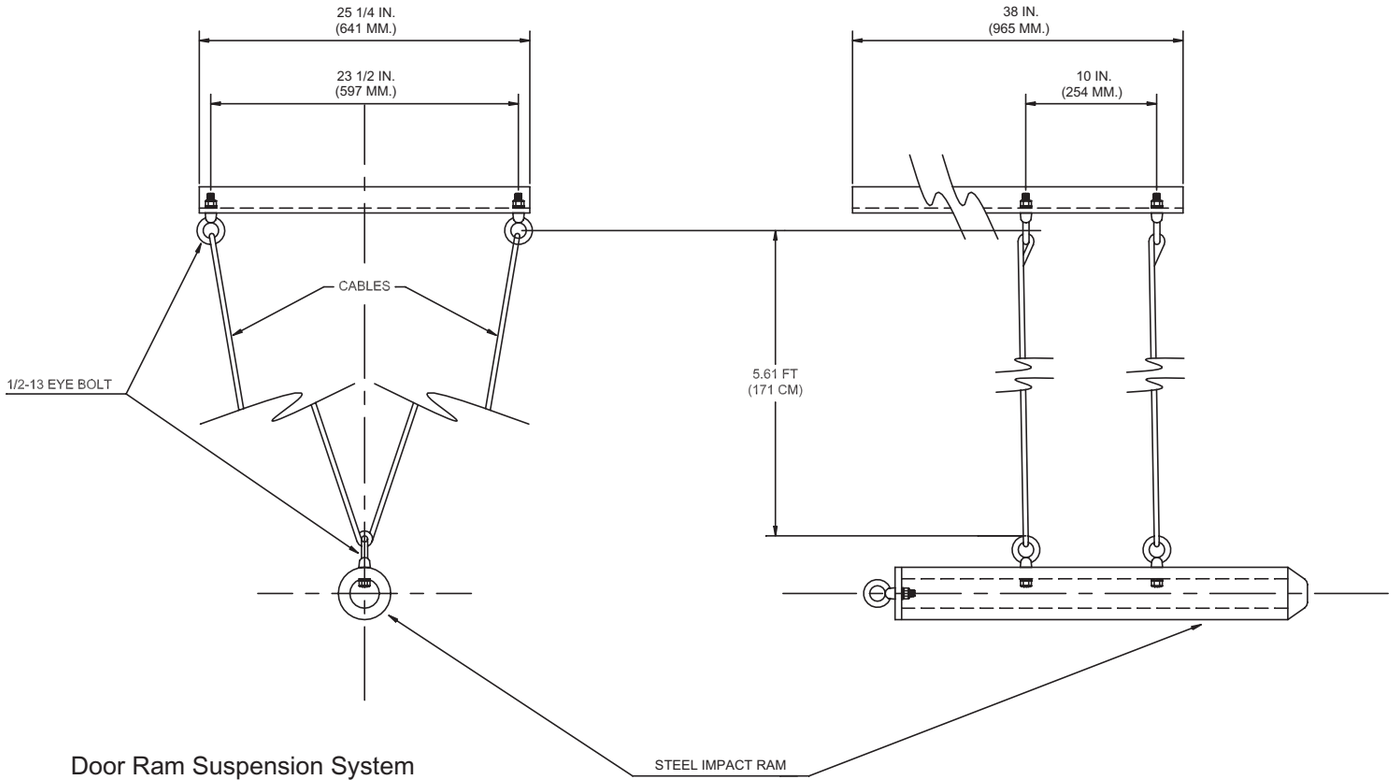
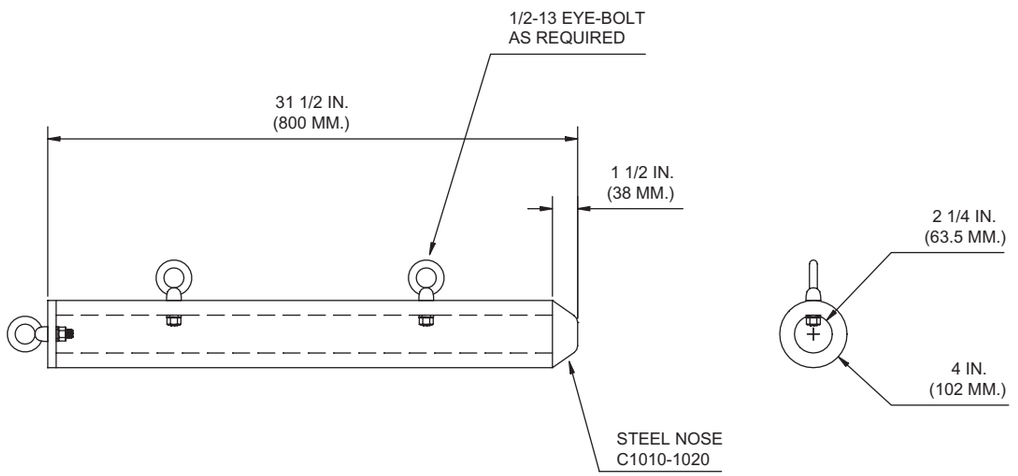


FIGURE 2



Door Ram Suspension System



WEIGHT: 80 LB (36.3 KG) + or - 0.25 Lb. (0.10 Kg)

NOTE: Any material applied to or inside the ram to satisfy weight requirement shall be rigidly attached to prevent shifting during test procedures.

FIGURE 3 Steel Impact Ram for Hollow Metal Systems

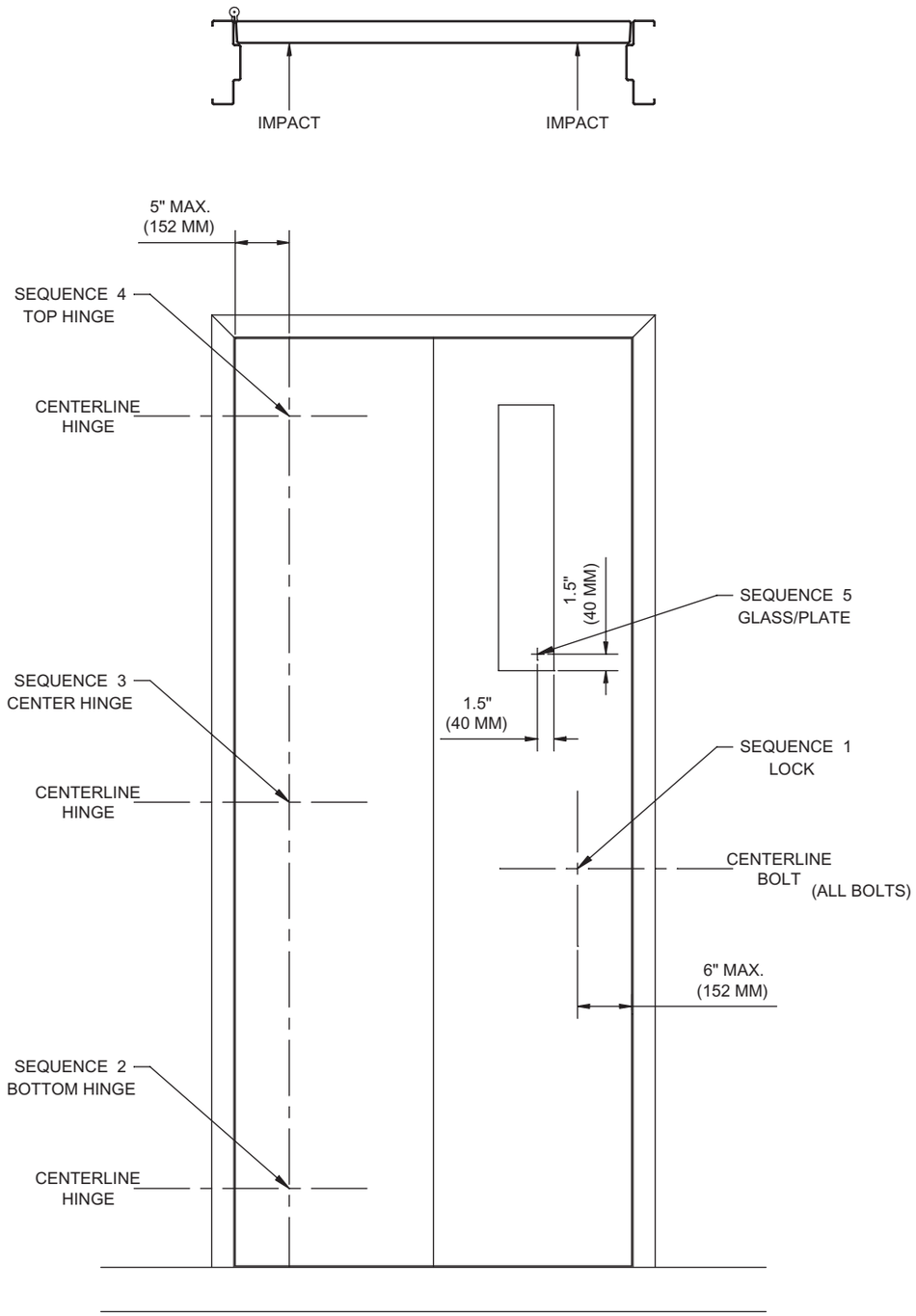
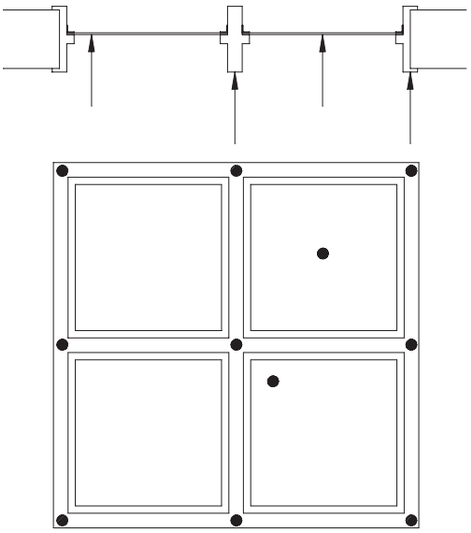


FIGURE 4 Test Assembly Elevation Location of Impact Points Described in Table 1



Test Assembly Elevation Location of Impact Points

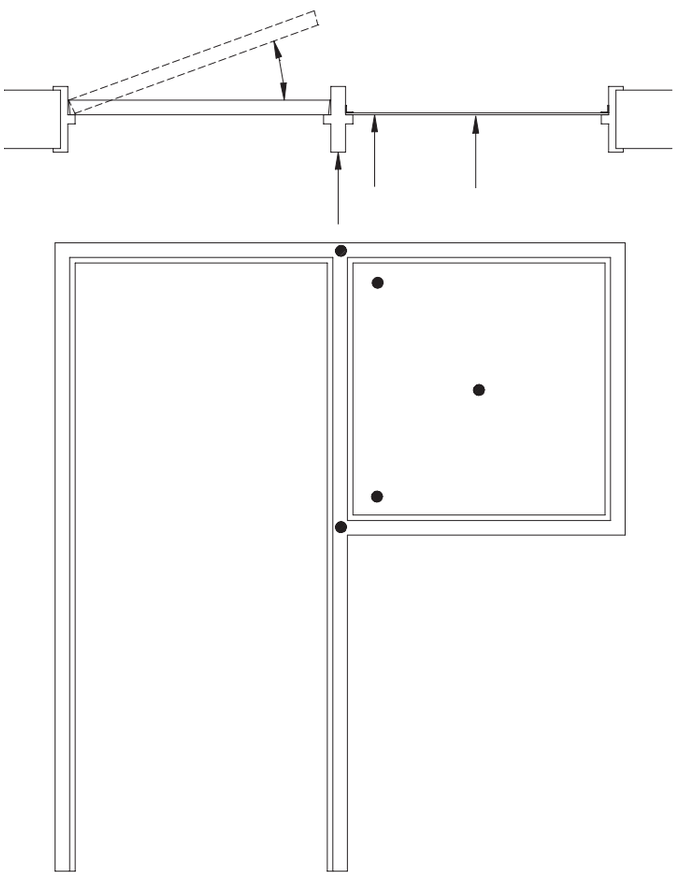
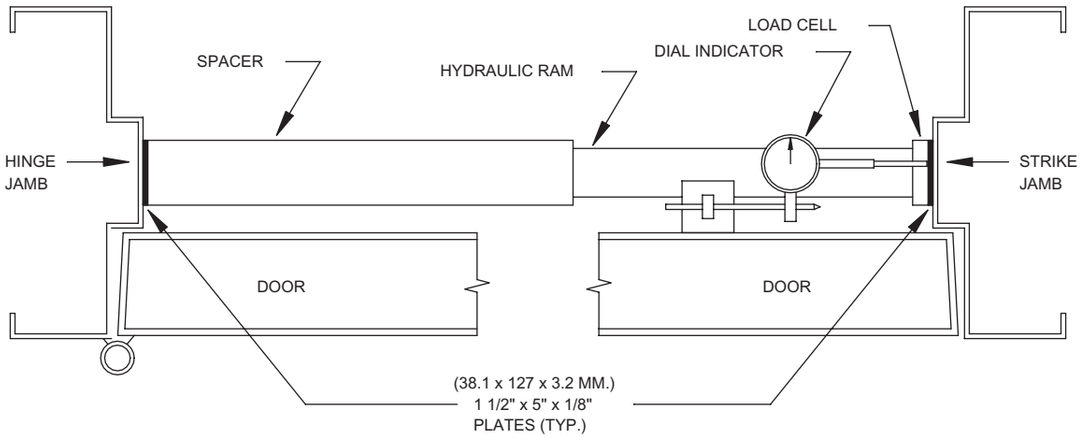


FIGURE 5 Test Assembly Elevation Location of Impact Points



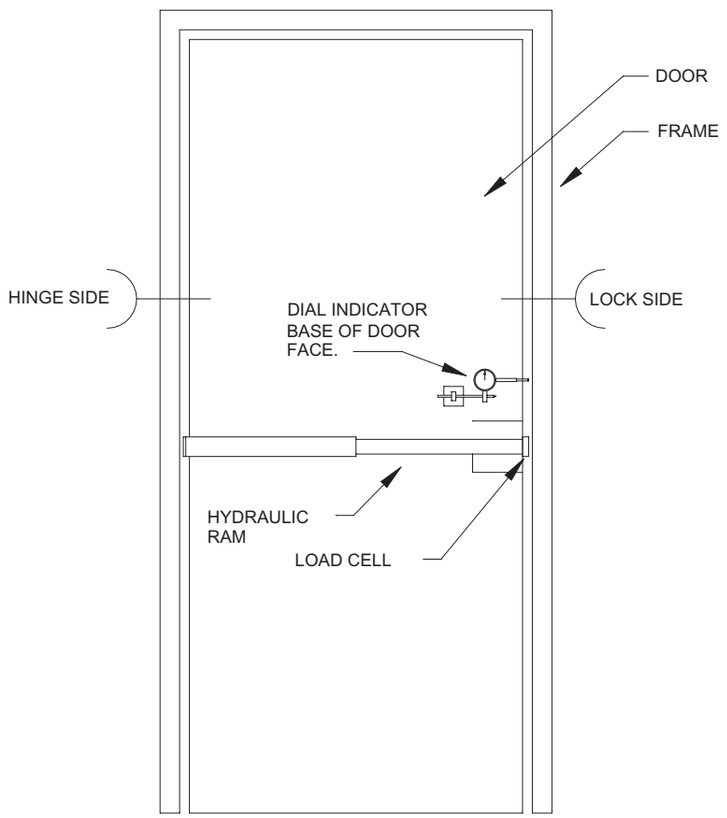


FIGURE 6

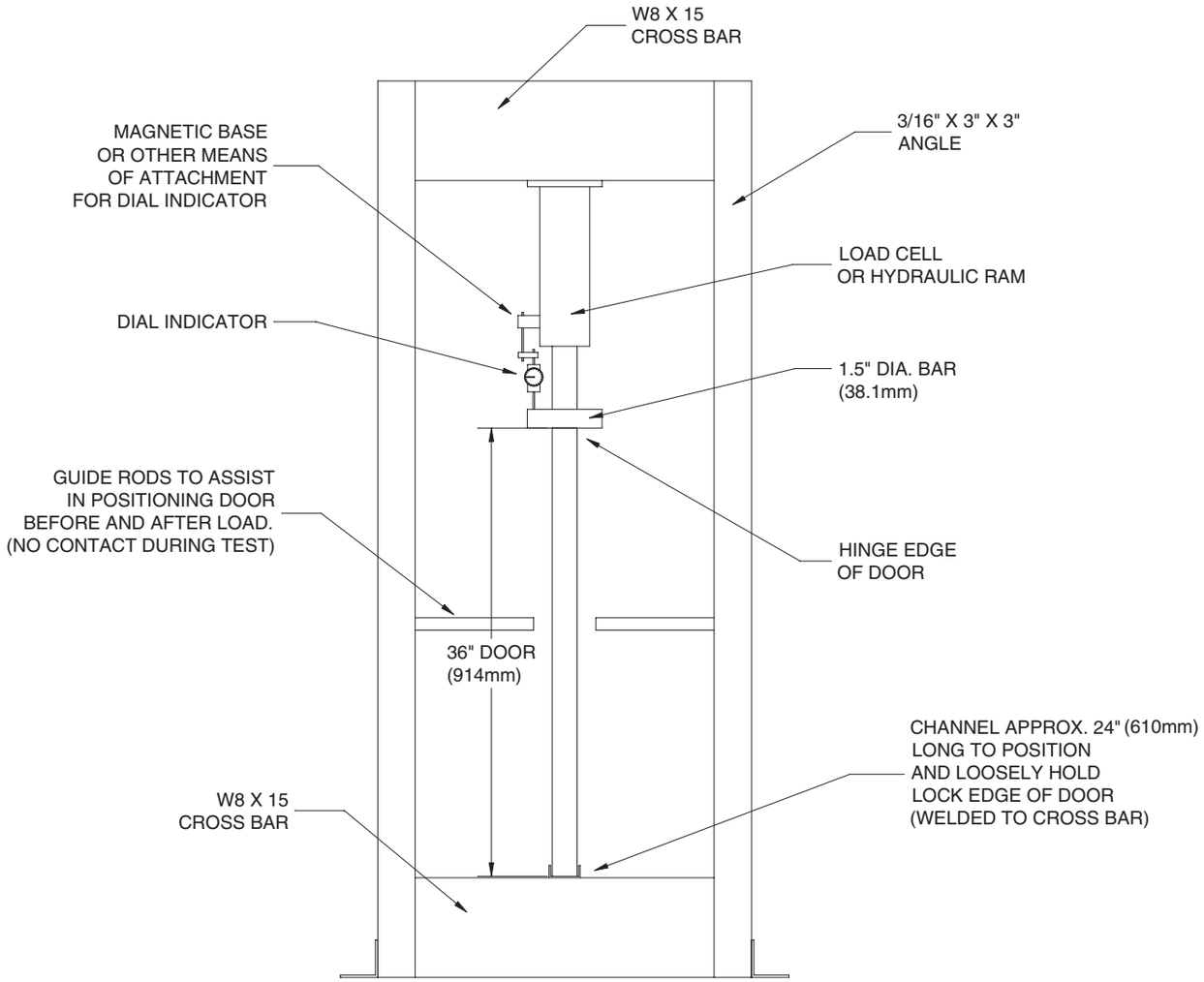


FIGURE 7 Edge Crush Test Fixture (End View)

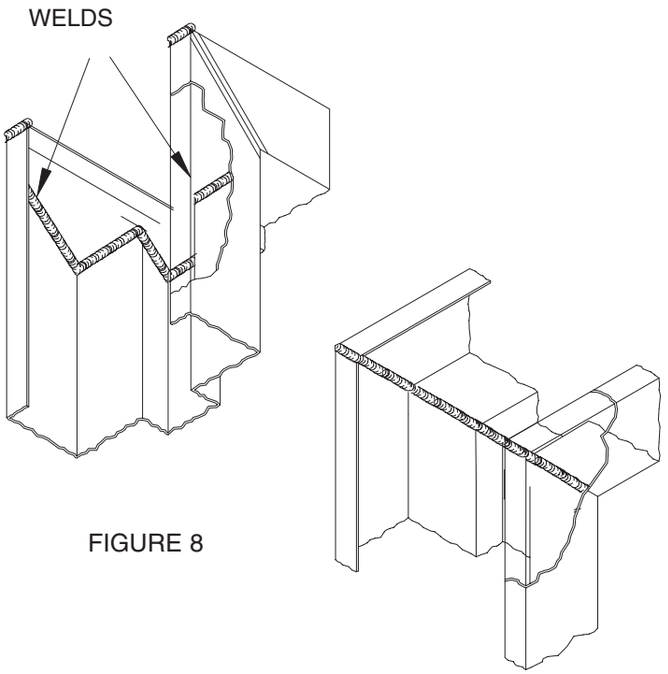


FIGURE 8

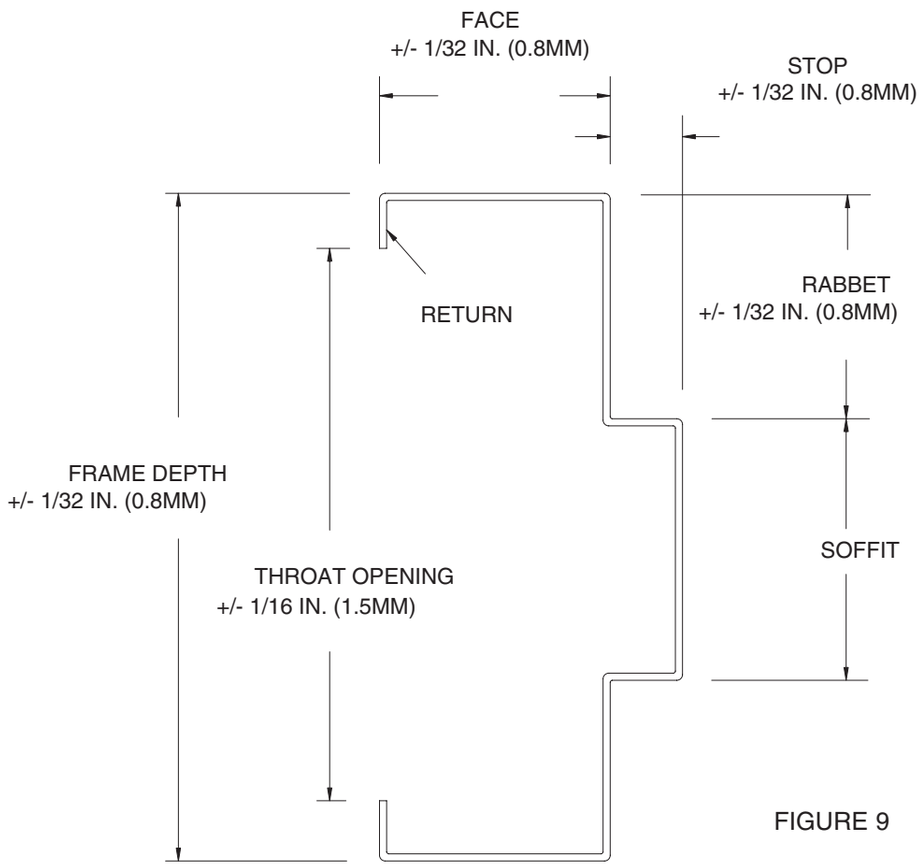
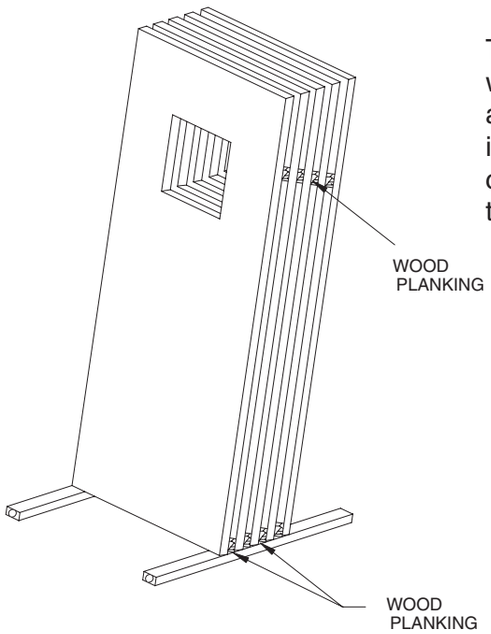


FIGURE 9



The contractor responsible for installation shall remove wraps or covers from doors and frames upon delivery at the building site. The contractor responsible for installation shall ensure that scratches or disfigurements caused in shipping or handling are promptly cleaned and touched up with a rust inhibitive primer.

The contractor responsible for installation shall ensure that materials are properly stored on planks or dunnage in a dry location. Doors shall be stored on their heads in a vertical position, to protect sound gasketing at the door bottom, and shall be spaced by blocking. Materials shall be covered to protect them from damage but in such a manner as to permit air circulation.

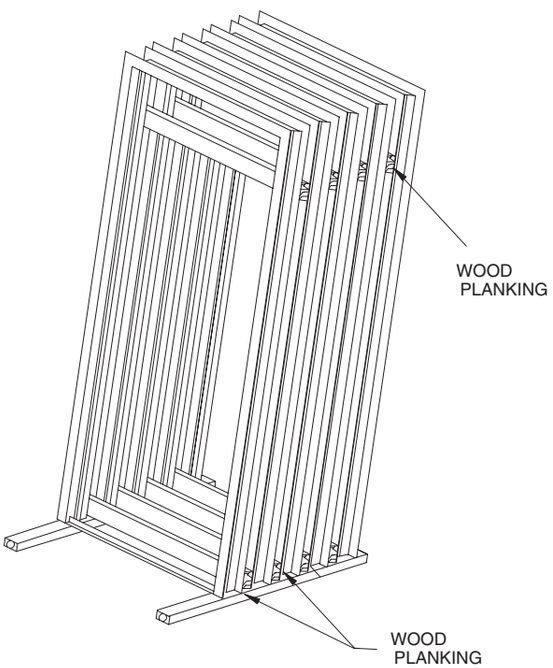


FIGURE 10
Recommended Storage

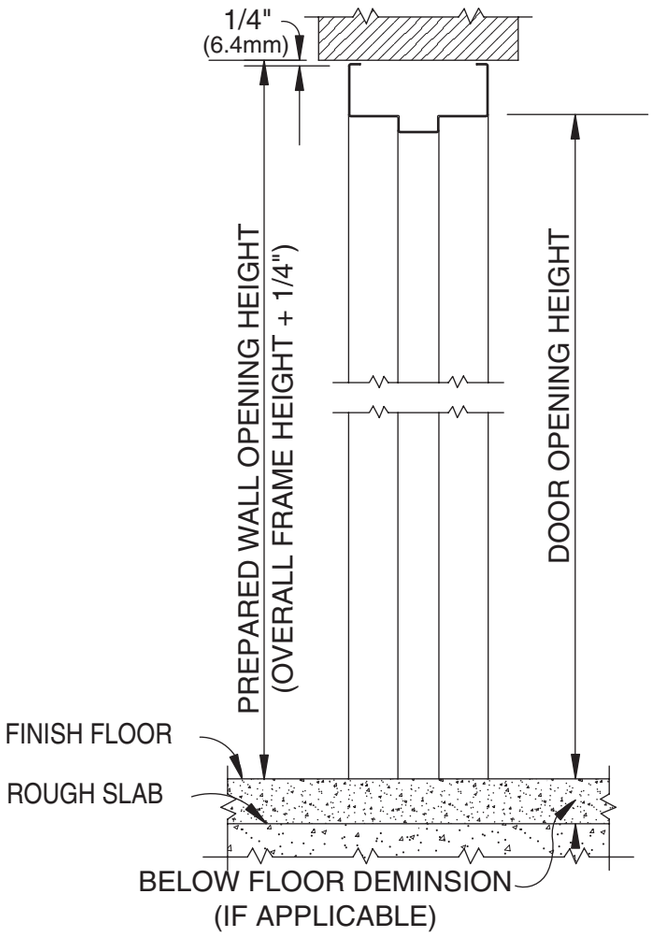


FIGURE 11

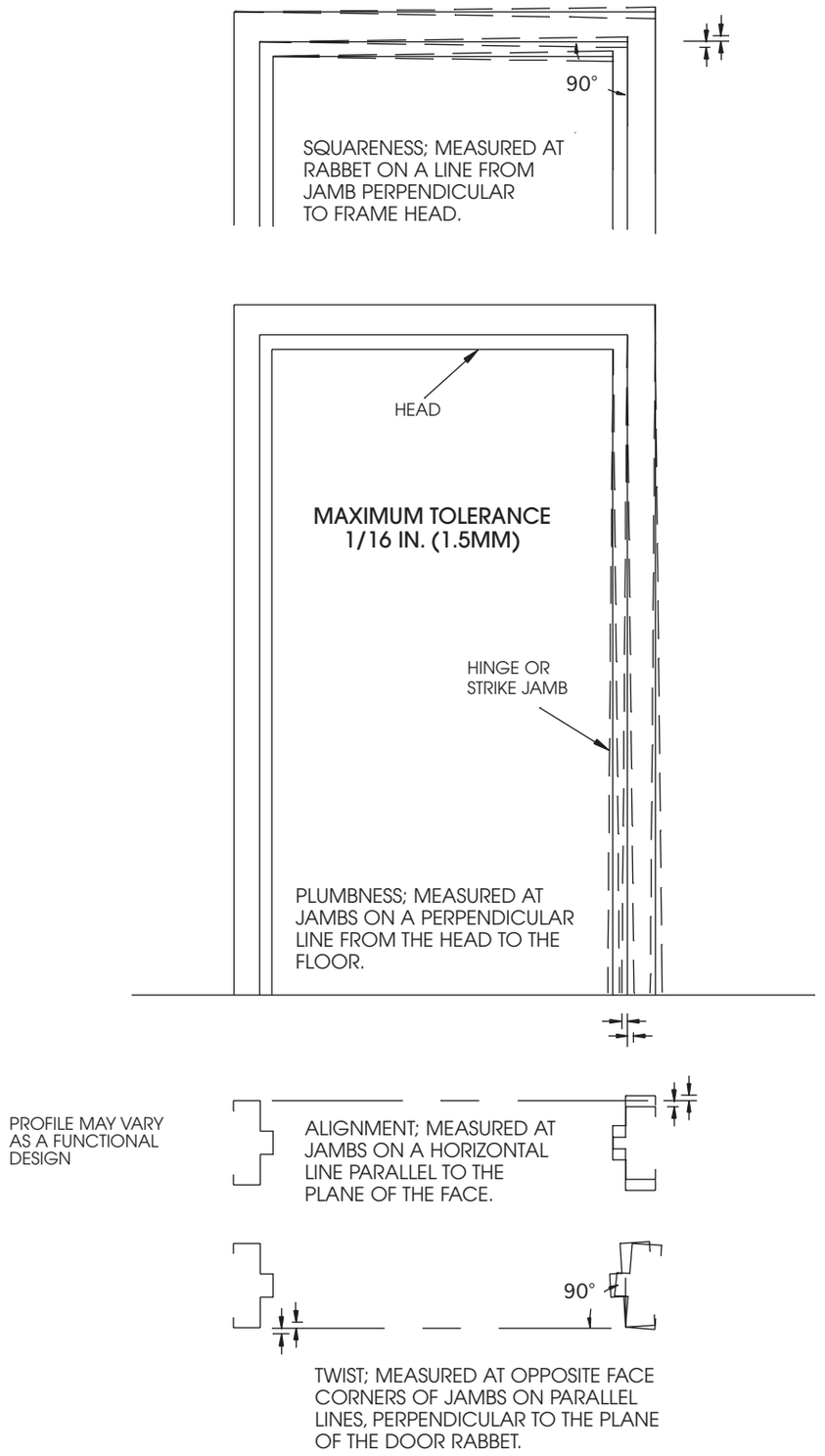


FIGURE 12
Installation Tolerances

APPENDIX

(Not part of the Standard)

NAAMM HMMA 803 STEEL TABLES

Prior to 1970, sheet steel was referred to by gage. ASTM and ANSI currently do not list gage numbers in their standards. Like many generic terms, gage (or gauge) is ingrained in many vocabularies and is misunderstood as a term for thickness. NAAMM is publishing this minimum thickness table to be used instead of discontinued gage numbers.

The values shown were taken from the Underwriters Laboratories, Inc. publication for gage number and equivalent thickness.

MINIMUM THICKNESS		
Uncoated Steel Sheet		
Gage	Decimal	mm
4	0.214	5.4
5	0.199	5.0
6	0.184	4.6
7	0.167	4.2
8	0.152	3.8
10	0.123	3.1
12	0.093	2.3
14	0.067	1.7
16	0.053	1.3
18	0.042	1.0
20	0.032	0.8
22	0.026	0.6
24	0.020	0.5
26	0.016	0.4
28	0.013	0.3

CONVERSION		
Fraction	Decimal	mm
	1.000	25.4
15/16	0.937	23.8
7/8	0.875	22.2
13/16	0.812	20.6
3/4	0.750	19.0
11/16	0.687	17.4
5/8	0.625	15.8
9/16	0.562	14.2
1/2	0.500	12.7
7/16	0.437	11.1
3/8	0.375	9.5
5/16	0.312	7.9
1/4	0.250	6.3
3/16	0.187	4.7
1/8	0.125	3.1
1/16	0.062	1.5

DISCLAIMER

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National Association of Architectural Metal Manufacturers NAAMM

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Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

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RECOMMENDED USAGE GUIDE FOR HMMA HOLLOW METAL DOORS AND FRAMES

HMMA 860 — Hollow Metal Door and Frames
Apartment Buildings; Dormitories; Military Barracks; and Motels

ANSI/NAAMM
HMMA 861 — Commercial Hollow Metal Doors and Frames
Schools; Hospitals; Industrial Buildings; Office Buildings; Hotels; Nursing Homes; Airports; and Convention Centers

ANSI/NAAMM
HMMA 862 — Commercial Security Hollow Metal Doors and Frames
Exterior Doors to Schools: Warehouses. Industrial Buildings; or Strip Stores

ANSI/NAAMM
HMMA 863 — Detention Security Hollow Metal Doors and Frames
Jails; Prisons; Detention Centers and Secured Areas in Hospitals; or Courthouses

ANSI/NAAMM
HMMA 865 — Swinging Sound Control Hollow Metal Doors and Frames
TV; Radio, Recording and Sound Studios; Theaters; and Music Rooms

ANSI/NAAMM
HMMA 866 — Stainless Steel Hollow Metal Doors and Frames
Type 304 or 316 Stainless Steel for highly corrosive, moderately corrosive or aesthetic applications