

GUIDE SPECIFICATIONS FOR HOLLOW METAL DOORS AND FRAMES

FOURTH EDITION

This standard was developed by representative members of and approved by the Hollow Metal Manufacturers Association Division (HMMA) of the National Association of Architectural Metal Manufacturers (NAAMM) to provide their opinion and guidance on the specification and use of swinging sound control hollow metal doors and frames. This standard contains advisory information only and is published as a public service by NAAMM and its HMMA Division.

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FOREWORD

These specifications have been prepared in accordance with the 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 project specifications and must be edited to suit specific job requirements. Inapplicable provisions should be deleted, appropriate selections should be made where there are choices, and provisions applicable to the project should be added where necessary. Options are shown in brackets. Notes, recommendations and instructions to specifiers are given in italics directly following or at the start of the sections to which they apply. Notes that contain permissive language are not considered part of the standard. Dates given with ASTM and other standards were current at the time this specification was published. When a more recent standard is available, the specifier should verify applicability to this Guide prior to its inclusion. 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. Doors and frames 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 guide, are not meant to restrict the use of other materials and methods where it can be demonstrated through the specific 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 project specifications must always include the Testing and Performance requirements of Section 1.05 and the Quality Assurance 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 parenthesis for reference purposes only.

This guide specification addresses the requirements for welded steel stiffened hollow metal doors and frame product that are subject to lower frequency use than commercial and institutional applications. Also, for these lower frequency applications, give consideration to ANSI/NAAMM HMMA-867, "Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames".

For hollow metal doors and frame product intended for commercial and institutional applications, give consideration to ANSI/NAAMM HMMA 861, "Guide Specifications for Commercial Hollow Metal Doors and Frames". If security is a factor, there are two hollow metal standards available - ANSI/NAAMM HMMA 862, "Guide Specifications for Commercial Security Hollow Doors and Frames" and ANSI/NAAMM HMMA 863, "Guide Specifications for Detention Security Hollow Metal Doors and Frames". For acoustic applications consideration may be given to ANSI/NAAMM HMMA 865, "Guide Specifications for Swinging Sound Control Hollow Metal Doors and Frames". For situations where corrosion resistance, beyond that of typical commercial steel door and frame applications, or where specialized aesthetics are significant design criteria, consideration should be given to ANSI/NAAMM HMMA 866, "Guide Specifications for Stainless Steel Hollow Metal Doors and Frames".

The CSI Master Format '95, which placed Hollow Metal Doors and Frames in Section 08110, has been relocated in Master Format 2004. Section 08 11 13 is the new CSI location for hollow metal doors and frame products. This Specification presents the 2004 Format as its primary reference, with the '95 Format in parenthesis as a cross-reference. Specifiers can use either; however both systems should not be utilized within the same set of construction documents.

CSI BROAD SCOPE SECTION 08 11 13 [08110] HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

This Section includes hollow metal products, including doors, panels, frames, transom frames, sidelight and window assemblies as shown in the contract documents.

1.02 PRODUCTS PROVIDED UNDER THIS SECTION

- A. Hollow metal doors, swinging type, including [glass moldings and stops] [louvers] [louver inserts] [other] as shown in the approved submittal drawings.
- B. Hollow metal panels, fixed or removable, flush or rabbeted, similar in construction to hollow metal doors.
- C. Hollow metal frames, transom frames, sidelight and window assemblies, including [glass moldings and stops] [louvers] [louver inserts] [hollow metal in-fill panels] [other] as shown in the approved submittal drawings.

1.03 RELATED SECTIONS

- A. Section 01 56 00 [] - Site Protection of Materials
- B. Section 01 66 00 [] - Site Storage of Materials
- C. Section 05 10 00 [] - Lintels, Posts, Columns or Other Load Bearing Elements
- D. Section 06 10 00 [] - Installation of Commercial Hollow Metal Doors and Frames into Other than Steel Stud Partitions
- E. Section 08 11 19 [08130] - Stainless Steel Hollow Metal Doors and Frames
- F. Section 08 34 53 [08113] - Commercial Security Hollow Metal Doors and Frames
- G. Section 08 34 73 [08348] - Swinging Sound Control Hollow Metal Doors and Frames
- H. Section 08 71 00 [08700] - Builders Hardware
- I. Section 08 71 00 [08720] – Weather Stripping and Seals
- J. Section 08 80 00 [08800] - Glass and Glazing Material
- K. Section 09 20 00 [] - Installation of Commercial Hollow Metal Doors and Frames into Steel Stud Partitions.
- L. Section 09 90 00 [09900] - Field Painting
- M. Section 11 19 00 [11190] - Detention Security Hollow Metal Doors and Frames
- N. Section [] – Assembly of Knocked-Down or Slip-On Hollow Metal Frames
- O. Section [] – Field Measurements

This specification covers only those products listed in Section 1.02. Not included in Section 08 11 13 [08110] are builders or rough hardware of any kind, weather-stripping, gasketing, items furnished by others, field painting, and protection at the building site of products furnished under this Section.

1.04 REFERENCES

The Standards listed in this Guide are referenced by basic designation only. Use the edition of a Standard that is in affect on the publication date of this Guide, unless specifically noted otherwise. If a more recent standard is available, the specifier should verify its applicability to this Guide prior to its inclusion.

- A. ANSI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Hardware Reinforcements.
- B. ANSI A250.10, Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
- C. ANSI/NAAMM HMMA 801, Glossary of Terms for Hollow Metal Doors and Frames
- D. ANSI/NAAMM HMMA 866, Guide Specifications for Stainless Steel Hollow Metal Doors and Frames
- E. ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives
- F. ANSI/NFPA 105, Standard for the Installation of Smoke Door Assemblies
- G. ANSI/NFPA 252, Standard Methods of Fire Tests of Door Assemblies
- H. ANSI/NFPA 257, Standard on Fire Test for Window and Glass Block Assemblies
- I. ANSI/UL 9, Fire Test of Window Assemblies
- J. ANSI/UL 10B, Fire Tests of Door Assemblies, 9th edition
- K. ANSI/UL 10C, Positive Pressure Fire Test of Door Assemblies, 1st Edition
- L. ANSI/UL 1784, Air Leakage Tests of Door Assemblies, 3rd Edition
- M. ASTM A 653/A 653M, Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- N. ASTM A 1008/A 1008M, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- O. ASTM A 1011/A 1011M, Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability
- P. ASTM C 143/C 143M, Test Method for Slump of Hydraulic-Cement Concrete
- Q. CAN4-S104, Standard Method for Fire Tests of Door Assemblies
- R. CAN4-S106, Standard Method for Fire Tests of Window and Glass Assemblies
- S. NAAMM HMMA 802, Manufacturing of Hollow Metal Doors and Frames
- T. NAAMM HMMA 803, Steel Tables
- U. NAAMM HMMA 810, Hollow Metal Doors
- V. NAAMM HMMA 810 TN01, Defining Undercuts
- W. NAAMM HMMA 820, Hollow Metal Frames
- X. NAAMM HMMA 820 TN01, Grouting Hollow Metal Frames
- Y. NAAMM HMMA 820 TN03, Guidelines for Glazing Hollow Metal Transoms, Sidelights, and Windows
- Z. NAAMM HMMA 830, Hardware Selection for Hollow Metal Doors and Frames
- AA. NAAMM HMMA 831, Recommended Hardware Locations for Hollow Metal Doors and Frames

- AB. NAAMM HMMA 840, Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames
- AC. NAAMM HMMA 840 TN01, Painting Hollow Metal Products
- AD. NAAMM HMMA 850, Fire-Rated Hollow Metal Doors and Frames

The following standards are used only for neutral pressure fire test methods and should be deleted from project specifications when 'positive pressure' is required by the governing building code: ANSI/UL10B (H), CAN4-S104 (Q) and CAN4-S106 (R).

Conversely, ANSI/UL 10C (I) and ANSI/NFPA-252 (E), are used only for positive pressure fire tests and should be deleted from project specifications requiring 'traditional' (neutral pressure) fire tests.

ANSI/UL 9 (G) and ANSI/NFPA-257 (F), reference both neutral pressure and positive pressure fire test methods and as such should be included in all project specifications, except those requiring compliance with Canadian Building Codes.

Only project specifications requiring compliance with Canadian Building Codes should include CAN4-S104 (U) and CAN4-S106 (V).

Refer to Appendix 7 for a list of the Standards Writing Organizations referenced in Section 1.04.

1.05 TESTING AND PERFORMANCE

- A. Physical Endurance for Steel Doors and Hardware Reinforcing
 - 1. Test a 3 ft. x 7 ft. (914 mm x 2134 mm), 1-3/4 in. (44 mm) thick nominal size door, representative of the construction and material to be provided.
 - 2. Test in accordance with ANSI A250.4 Cycle and Twist Test procedures.
 - a. Cycle Test Acceptance Criteria: Test doors specified with 0.042 in. (1.0 mm) and thicker face sheets to Level B (500,000 cycles). Test doors specified with 0.032 in. (0.8 mm) face sheets to Level C (250,000 cycles).
 - b. Twist Test Acceptance Criteria: For doors specified with 0.042 in. (1.0 mm) and thicker face sheets, under a maximum load of 300 pounds (136.1 kg), do not exceed 1.25 in. (31.7 mm) and maximum permanent deflection of 0.125 in. (3.1 mm). For doors specified with 0.032 in. (0.8 mm) face sheets, under a maximum load of 300 pounds (136.1 kg), do not exceed 2.5 in. (63.5 mm) and maximum permanent deflection of 0.125 in. (3.1 mm).
 - 3. Provide Test Reports or Certificates of Compliance which include a description of the test specimen, procedures used in testing, and indicate compliance with the contract document specified acceptance criteria.
- B. Provide labeled Fire-Rated and/or Smoke and Draft Control Doors and Frame Product

1. Doors, frames, transom frames and sidelight assemblies provided for openings requiring fire protection, temperature rise, and/or smoke and draft control which are listed and/or classified and bear the label of a testing agency having a factory inspection service. Test the product in accordance with [ANSI/NFPA 252 or ANSI/UL-10B or CAN4-S104] [ANSI/UL-10C] [UL 1784 or in accordance with ANSI/NFPA 105] and constructed as listed or classified for labeling. The architect determines and schedules the Fire, temperature rise and/or smoke and draft control ratings.
2. Provide window frames for openings requiring fire protection ratings which are listed and bear the label of a testing agency having a factory inspection service. Test frames in accordance with ANSI/UL 9 or [ANSI/NFPA 257 or CAN4-S106] and construct frames as listed for labeling. The architect determines and schedules fire and/or smoke and draft control ratings.

UL 10C provides for positive pressure testing to accommodate the requirements of some jurisdictions and should be included only for such.

UL 1784 and ANSI/NFPA 105 provide for smoke and draft control assembly testing to accommodate these specific requirements, and should be included only when required.

Include CAN4-S104 and CAN4-S106 only for projects requiring conformance with Canadian Building Codes.

3. Advise the architect in the submittal documents if any door or frame product specified to be fire-rated cannot qualify for labeling because of design, hardware or any other reason. Advise the architect of hardware, glazing, or other options that affect the fire-rating and that were unknown at the time of submittal document preparation.

For additional information, refer to NAAMM HMMA 850, "Fire-Rated Hollow Metal Doors and Frames"

C. Prime Paint Performance (ANSI A250.10)

1. Test sheet steel specimens, with the product manufacturer's production primer, replicating Finish "as shipped" in accordance with ANSI A250.10
2. Meet the Performance Acceptance Criteria described in ANSI A250.10
3. Provide Test Reports or Certificates of Compliance which include a description of the test specimens, procedures used in testing, and indicate compliance with the contract document specified acceptance criteria.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Provide evidence of having personnel and plant equipment capable of fabricating hollow metal door and frame product of the types specified.
2. Provide evidence of having a written quality control system in place.

B. Quality Criteria

1. Meet the requirements of Section 1.05 of these specifications.
2. Fabricate assemblies in strict accordance with the approved submittal drawings.
3. Meet fabrication and quality 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.

1.07 SUBMITTALS

A. Submittal Drawings

1. Show dimensioned door and frame product elevations and sections.
 2. Show listing of opening descriptions including locations, material thicknesses, and anchors.
 3. Show location and details of openings.
- B. Samples (if required)
1. Door: 1 ft. x 1 ft. (305 mm x 305 mm) corner section with hinge preparation showing top and internal construction.
 2. Frame: 1 ft. x 1 ft. (305 mm x 305 mm) section showing assembled corner joint at head and jamb. Include hinge reinforcement [and grout guard] in one rabbet. When glazed frame product is specified, apply and install glazing stop as specified in the opposite rabbet. Apply glazing stop to both head and jamb section to show their intersection.
 3. All samples submitted must represent in all respects the minimum quality of work to be furnished by the manufacturer. Do not fabricate any work represented by the samples until the samples are approved and any degradation of fabrication quality compared to the approved samples is cause for rejection of the work.
- C. It is the responsibility of the installation contractor to coordinate and install products covered under this Section;
1. Verify and provide to the manufacturer, actual opening sizes and site conditions by field measurements before fabrication. Reflect the provided measurements and conditions in the submittal drawings and manufacture product accordingly. Coordinate field measurements with fabrication and construction schedules to avoid delay.
 2. Verify that substrate conditions, whether existing or installed under other Sections, are as detailed in the architect's drawings, and are acceptable for product installation in accordance with the manufacturer's instructions.
- D. Do not proceed with fabrication without receipt of approved submittal drawings and approved hardware schedules.
- The approved submittal drawings and the approved hardware schedules are the versions that have been provided to the hollow metal manufacturer at time of release for fabrication. These drawings and schedules are considered part of the project contract documents.*
- E. The contractor responsible for the coordination of procuring products provided under this Section and Section 1.03 - Related Sections is hereby instructed to comply with the hollow metal manufacturer's ordering instructions and lead time requirements to avoid delays.

PART 2 - PRODUCTS

2.01 HOLLOW METAL DOORS

A. Materials

1. Steel

ANSI and ASTM Standards no longer utilize 'gage' to define steel thickness. In this Specification steel is expressed in terms of minimum decimal inch (millimeter) thickness. Dimensions or sizes traditionally expressed in fractional inches are shown in decimal inches (millimeters). HMMA has developed a series of Tables, (NAAMM HMMA 803) included as Appendix 1 of this specification, to summarize the imperial standards and their corresponding metric values.

- a. Manufacture doors from cold-rolled steel conforming to ASTM A1008/A 1008M CS Type B, or galvaneal steel conforming to ASTM A 653/A 653M CS Type B Coating Designation A25 (ZF75), or hot-rolled, pickled and oiled (HRPO) 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.

- b. Interior Doors: Face sheets shall be [0.032 in. (0.08 mm)] [0.042 in. (1.0 mm)] [0.053 in. (1.3 mm)] minimum thickness.

For interior doors subject to corrosive conditions it is recommended that zinc-coated face sheets, as specified in 2.01.A.1.c, be used.

- c. Exterior Doors: Face sheets shall be [0.042 in. (1.0 mm)] [0.053 in. (1.3 mm)] minimum thickness zinc-coated steel conforming to ASTM A 653/A653M CS Type B, Coating Designation A60 (ZF180) or G60 (Z180).

For doors subject to severely corrosive conditions it is recommended that stainless steel products, as detailed in NAAMM's ANSI/NAAMM HMMA 866, "Guide Specifications for Stainless Steel Hollow Metal Doors and Frames", be utilized.

B. Construction

1. Construct doors of the types, sizes, and constructions, in accordance with the contract documents, and meet the performance requirements of Section 1.05. Prior to shipment mark each door with an identification number as shown on approved submittal drawings.
2. Visible seams on door faces are not acceptable.
3. Fabricate doors with minimum nominal door thickness of 1-3/4 in. (44 mm). Fabricate doors neat in appearance and free from warpage or buckle. Bend edges true and straight, and of minimum radius for the thickness of metal used.
4. Stiffen doors using continuous vertically formed steel sections which, upon assembly, span the full thickness of the interior space between door faces. Fabricate stiffeners from 0.026 in. (0.6 mm) minimum thickness steel and space them so that the vertical interior webs are no more than 6 in. (152 mm) apart. Securely fasten stiffeners to both face sheets by spot welds spaced a maximum of 5 in. (127 mm) on center vertically. Fill spaces between stiffeners with fiberglass or mineral rock wool batt-type material.
 - a. Where determined and scheduled by the Architect, sufficiently insulate temperature rise rated (TRR) fire doors in order to limit the temperature rise on the "unexposed" side of the door, as required by the governing building code requirements.
5. Door edges to be constructed in one of the following methods:
 - a. Join door face sheets of material thicknesses of 0.042 in. (1.0 mm) or thicker together at their vertical edges by a continuous weld extending the full height of the door. Grind, fill and dress all such welds smooth to make them not visible and provide a smooth flush surface, except for material thicknesses of less than 0.042 in. (1.0 mm).

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

- b. a continuous interlocking or lock-tab seam the full height of the door, resulting in a visible vertical seam at both edges of the door.
 - c. projection, spot or tack welds at their vertical edges, 6 in. (152 mm) on center maximum spacing, such that there are no visible welds or weld marking on the exposed door edges, presenting a [visible vertical seam][a seam that is filled and finished smooth such that it is not visible] at both edges of the door.
6. Close the top and bottom edges with a continuous steel channel, not less than 0.053 in. (1.3 mm) thickness, welded to both face sheets.

7. Close exterior doors, or doors where otherwise scheduled by the Architect, flush at the top edge. Where required for attachment for weather-stripping, provide a flush steel closure channel at the bottom edge. Provide openings in the bottom closure channel of exterior doors to permit the escape of entrapped moisture.
8. Provide edge profiles on both vertical edges of doors as follows, unless hardware dictates otherwise:
 - a. Single acting doors:
 - i. Hinge edge; beveled 1/8 in. in 2 in. (3.1 mm in 50.8 mm) or square edge
 - ii. Lock edge; beveled 1/8 in. in 2 in. (3.1 mm in 50.8 mm)
 - b. Double acting doors; rounded on 2-1/8 in. (54 mm) radius
9. Hardware Reinforcements and Preparations
 - a. Mortise, reinforce, drill and tap doors at the factory for templated hardware only, in accordance with the 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, reinforce doors only, with drilling and tapping done by others in the field.
 - b. Fabricate reinforcements from steel of minimum material thickness shall be as follows:
 - i. Full mortise hinges and pivots 0.167 in. (4.2 mm) or 0.123 in. (3.1 mm) angle shaped, channel shaped or full height edge channel reinforcement, 0.067 in. (1.7 mm) minimum material thickness, with extruded holes that provide the same number of threads as 0.123 in. (3.1 mm) thick material.
 - ii. Lock fronts, strikes,..... 0.067 in. (1.7 mm) or 0.053 in. (1.3 mm) unitized reinforcement with extruded tapped holes that provide equivalent number of threads as 0.067 in. (1.7 mm)
 - iii. Concealed holders0.093 in. (2.3 mm)
 - iv. Internal reinforcements for other surface applied hardware 0.053 in. (1.3 mm)
 - c. Where electronic hardware is indicated on the approved hardware schedule, provide wire access from hinge edge to device in accordance with the templates provided.
10. Glazing Moldings and Stops
 - a. Where specified or scheduled, provide doors with steel moldings to secure glazing materials furnished and installed in the field by others, in accordance with glazing sizes and thickness shown in the contract documents.
 - b. Provide fixed glass molding or integral stops, 0.032 in. (0.81 mm) minimum thickness, located on the secure side of the door, as designated on the Architect's drawings and/or door schedules.
 - c. Fabricate channel shaped removable glass stops not less than 0.032 in. (0.8 mm) material thickness, with tight fitting butt or mitered corners, and secure with #6 minimum, corrosion resistant countersunk sheet metal screws.
 - d. Treat metal surfaces to which glazing stops are applied, and the inside of the glazing stops, for maximum paint adhesion and paint with a rust inhibitive primer prior to installation in the door. Glazing stops fabricated from zinc-coated steel conforming to ASTM A 653/A 653M, A40 (ZF120) for interior doors, A60 (ZF180) or G90 (Z275) for exterior openings need not be primed on the inside.

- e. Prepare fire rated doors for listed glazing as required in accordance with the door manufacturer's fire rating procedure.
 - f. Design snap on moldings with a non-removable stop on the security side after glass installation.
11. Where specified in the contract documents, provide doors with louvers.
- a. For non-fire rated doors, provide doors with louvers that are welded inverted V type, Y type, face pierced construction or louver inserts.
 - b. Fabricate inverted V, Y and Z type vanes from 0.042 in. (1.0 mm) minimum material thickness steel. Material type must be the same as the door face sheets.
 - c. Prepare fire-rated doors for listed fire door louvers.
 - d. Provide louvers for exterior doors with insect and/or bird screens where shown on the contract documents.

2.02 HOLLOW METAL PANELS

- A. Fabricate hollow metal panels, 1-3/4 in. (44 mm) nominal thickness, of the same materials and construction as specified in Section 2.01 of this specification.
- B. Finish hollow metal panels as specified in Section 2.06 of this specification.

2.03 HOLLOW METAL FRAME PRODUCT

Provisions of Section 2.03 are applicable to frames, transom frames, sidelight and window assemblies, unless indicated otherwise.

- A. Materials
 - 1. Manufacture Frame product from cold-rolled steel conforming to A1008/A 1008M CS Type B, or galvanized steel conforming to ASTM A 653 CS Type B Coating Designation A25 (ZF75), or hot-rolled and pickled and oiled (HRPO) steel conforming to ASTM A 1011/A 1011M CS Type B.
 - 2. Interior Frame Product: Fabricate profiles from 0.053 in. (1.3 mm) minimum material thickness steel for frame product that will receive hollow metal or solid core wood doors [0.042 in. (1.0 mm) for frames that receive hollow core wood doors].

For interior areas subject to corrosive conditions and for interior masonry frame product or specifically identified frame product that is subject to other moderately corrosive conditions it is recommended that zinc-coated frame product, having a hot dipped coating designation and weight of A40 or greater be used.
 - 3. Exterior Frame Product: Fabricate profiles from 0.053 in. (1.3 mm) minimum material thickness, zinc-coated steel conforming to ASTM A 653/A 653M CS Type B, Coating Designation A60 (ZF180) or G60 (Z180).

For frame product subject to moderately corrosive conditions it is recommended that stainless steel products, as detailed in NAAMM's ANSI/NAAMM HMMA 866, "Guide Specifications for Stainless Steel Hollow Metal Doors and Frames", be utilized.
- B. Construction
 - 1. Fabricate frame units using the [welded] [or] [knocked-down] [or] [slip-on] fabrication technique. Weld transom, multi-opening, sidelight and window assemblies units. Fabricate all frame product of the sizes and types shown on the approved submittal drawings. Prior to shipment, mark each frame product with an identification number as shown on the approved submittal drawings. Construct frame product in accordance with the contract documents and meet the performance criteria specified in Sections 1.05.B and 1.05.C. Construct frame product in accordance with NAAMM HMMA 820 with regard to joint designs and welding techniques.

2. Fabricate frame product neat in appearance, square, and free of defects, warps or buckles. Press or roll form steel member profiles straight and uniform throughout their lengths.
3. Fabricate jamb, header, mullion and sill profiles in accordance with the frame schedule and as shown on the approved submittal drawings.
4. Fabricate corner joints with all contact edges closed tight, with faces mitered, and with stops mitered or butted.
 - a. Welded Frame Product
 - i. continuously weld perimeter face joints (flush or indented) internally or externally, and finish smooth with seamless faces.
 - ii. continuously weld internal flush face joints and finish smooth with seamless faces.
 - iii. securely weld members at internal indented intersections in order to conceal reinforcements, and have hairline face seams.
 - iv. Hairline seams are required on all other intersecting elements.

See NAAMM HMMA 820, "Hollow Metal Frames", and Figure 1 of this guide, for further details on frame welding.
 - b. Knocked-Down and Slip-On Frames
 - i. Furnish Components unassembled.
 - ii. factory prepare flush corner joints with steel reinforcing gussets not less than 0.032 in (0.8mm) material thickness, and/or with integral tabs and slots which securely interlock upon assembly.
 - iii. Design corner joint in order to assure component profile alignment and frame performance when field assembled by others, in accordance with the manufacturer's installation instructions.
5. Thermally Broken Frame Product
 - a. Where indicated in the contract documents, provide thermally broken frame product.
 - b. Separate interior and exterior sections by a continuous thermal break.
 - c. Factory insulate closed sections.
 - d. The installer on site provides insulation for open sections.

Thermally broken frame products are utilized in applications where energy conservation and extreme temperature differences between the building interior and exterior are design factors. The use of insulated hollow metal doors and glazing materials are recommended.
6. At drywall partitions, welded, knocked-down or slip-on frames may be furnished. At all other partition types, provide welded or knocked-down frames. Install frames of the pressure fit type after the partition is in place.
7. Fabricate frame product with stop heights of 0.625 in. (15.8 mm) minimum.
8. Cap cut-off stops, where specified, at heights as shown on the approved submittal drawings [, and weld and finish smooth so that there are no visible seams jamb joints below cut-off stops].

It is recommended that cut-off stops not be used at exterior, lead-lined, double egress or gasketed openings.
9. Prepare each door opening for single stud, resilient door silencers, three (3) per strike jamb for single door openings, two (2) per head for pairs, except on gasketed frame product. Supply silencers for installation by others.

10. When shipping limitations or site access so dictate, or when advised by the contractor responsible for coordination or installation, fabricate frame product for large openings in sections designated for assembly in the field by others. Install alignment plates or angles at each joint. Fabricate such components from the same material and material thickness as the frame. Fabricate field joints in accordance with approved submittal drawings for field welding by others.
11. Hardware Reinforcements and Preparations
 - a. Mortise, reinforce, drill and tap frame product at the factory for all templated hardware only, in accordance with the 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, reinforce frame product for drilling and tapping to be done by others in the field.
 - b. Fabricate reinforcements from steel of minimum material thickness as follows:
 - i. Full mortise hinges
and pivots 0.167 in. x 1.25 in. x 10 in. length (4.2 mm x 31.7 mm x 254 mm) or 0.123 in. (3.1 mm) thickness angle or channel shaped type
 - ii. Strikes 0.093 in. (2.3 mm) or 0.053 in. (1.3 mm) unitized reinforcement with extruded tapped holes that provide equivalent number of threads as 0.093 in. (2.3 mm)
 - iii. Flush bolts, closers, hold open arms and other surface applied hardware 0.093 in. (2.3 mm)
 - c. Furnish frame product that receives 1-3/8 in. (35 mm) thick hollow core wood doors with the following:
 - [i. One (1) pair of 3-1/2 in. (89 mm) welded-on hinges. One leaf to be welded to frame with door leaf and pin shipped loose for installation on the wood doors by others.]
 - [or]
 - [ii. Factory mortised and reinforced, drilled and tapped for templated hinges furnished by others.]
12. In cases where electrically or electronically operated hardware is required, and indicated on the approved hardware schedule, conduit, provide hardware enclosures and/or junction boxes. Fabricate access plates, where required, from the same material and material thickness as the frame product and fasten with not less than four (4) #8-32 machine screws or #6 sheet metal screws at a spacing not to exceed 12 in. (305 mm) on center.
13. Floor Anchors
 - a. For welded and knocked-down frame product, securely weld floor anchors inside jambs, and provide two holes for fasteners supplied and installed by others. For slip-on frames, provide base anchor clips or face screw preparations and screws for base anchoring.
 - b. Where specified or scheduled, securely weld adjustable floor anchors, providing not less than 2 in. (50.8 mm) height adjustment, inside jambs.
 - c. For applications that do not permit the use of a floor anchor, substitute an additional jamb anchor at a location not to exceed 8 in. (204 mm) from the base of the jamb.
 - d. Fabricate floor anchors from 0.042 in. (1.0 mm) minimum material thickness steel.
14. Jamb Anchors

- a. Provide frame product with anchorage appropriate to frame and wall construction.
- b. Masonry Type

Provide frame product for installation in new masonry walls with steel adjustable jamb anchors of the T-strap, stirrup or wire type, not less than 0.053 in. (1.3 mm) thickness or 0.156 in. (3.9 mm) diameter wire. Fabricate straps not less than 2 in. x 10 in. (50.8 mm x 254 mm) in size, corrugated and/or perforated. Place jamb anchors at a maximum of 18 in. (457 mm) from top and bottom of openings. Provide the minimum number of anchors, spaced at maximum 32 in. (812 mm) on center, on each jamb, based on the over-all frame height, as follows:

 - i. Up to 60 in. (1524 mm) 2 anchors
 - ii. Greater than 60 in. (1524 mm)
up to 90 in. (2286 mm) 3 anchors
 - iii. Greater than 90 in. (2286 mm)
up to 96 in. (2438 mm) 4 anchors
 - iv. Greater than 96 in. (2438 mm) .. 4 anchors plus one for each 24 in. (610 mm)
or fraction thereof spaced at 24 in. (610 mm)
maximum between anchors
- c. Dry Wall Type

Provided welded and knocked-down frame product for installation in drywall partitions with steel jamb anchors of suitable design, not less than 0.042 in. (1.0 mm) thickness, inside each jamb. Place jamb anchors a maximum of 18 in. (457 mm) from top and bottom of openings. Provide the minimum number, spaced at maximum 32 in. (812 mm) on center, on each jamb, based on the over-all frame height, as follows:

 - i. Up to 60 in. (1524 mm) 2 anchors
 - ii. Greater than 60 in. (1524 mm)
up to 90 in. (2286 mm) 4 anchors
 - iii. Greater than 90 in. (2286 mm)
up to 96 in. (2438 mm) 5 anchors
 - iv. Greater than 96 in. (2438 mm) .. 5 anchors plus one for each 24 in. (610 mm)
or fraction thereof spaced at 24 in. (610 mm)
maximum between anchors
- d. Compression Type

Provide slip-on frames for installation in stud partitions with an adjustable compression anchor in each jamb and provide for secure attachment of each jamb base to stud runners.
- e. Expansion Bolt Type

Prepare welded or knocked-down frame product for installation in existing masonry or concrete walls for expansion bolt type anchors. Fabricate the preparation such that it consists of a countersunk hole for a 0.375 in. (9.5 mm) diameter bolt, and a spacer within the jamb profile. Place anchors a maximum of 6 in. (152 mm) from the top and bottom of the frame, with intermediate spacing at a maximum of 26 in. (660 mm) on center. Provide bolts and shields for such anchors for installation by others.
- f. Other Anchor Types

Provide frame product to be installed in pre-finished concrete, masonry or steel openings with anchoring systems of suitable design and quantity, as shown on the approved submittal drawings. Provide fasteners for such anchors for installation by others.

A pre-finished opening may be one that is constructed as part of another assembly or system (e.g.; precast concrete panel) and which requires anchors similar in performance to those covered by 2.03.B.14.

15. Provide frame product for installation in masonry walls with door openings greater than 48 in. (1219 mm) in width with a steel angle or channel stiffener factory welded into the head, when the head is to be grouted. Fabricate stiffeners from not less than 0.093 in. (2.3 mm) thick steel, not longer than the door opening width. Stiffeners are not to be used as lintels or load bearing members.
16. Provide grout guards fabricated from not less than 0.016 in. (0.4 mm) thick steel at all hardware mortises on frame product to be grouted.
17. Provide all door openings in welded frame product with a temporary steel spreader welded to the feet of the jambs or mullions to serve as bracing during shipping and handling, and which are not to be used for installation.
18. In-Fill Panels
 - a. Where specified or scheduled, provide frame product with in-fill panels secured to frame sections with removable steel stops.
 - b. For non-labeled frame product, construct in-fill panels from 0.032 in. (0.8 mm) minimum thickness steel, of the same type specified for the frame product, laminated to each face of the manufacturer's standard solid backing.
 - c. For fire-rated frame product, construct in-fill panels from 0.032 in. (0.8 mm) minimum thickness steel, of the same type specified for the frame product, laminated to each face of a solid approved backing.

Refer to NAAMM HMMA 850, "Fire-Rated Hollow Metal Doors and Frames", for additional information.
19. Removable Glazing Stops
 - a. Where specified, provide frame product with removable stops to secure glazing materials or in-fill panels. Glazing materials are furnished and installed in the field by others, in accordance with glazing sizes and thickness shown in the contract documents.
 - b. Fabricate removable steel channel glazing stops from not less than 0.032 in. (0.8 mm) thick steel, butted at corners and secured to the frame section using cadmium or zinc-plated #6 minimum countersunk sheet metal screws.
 - c. Treat the frame section underneath the glazing stops and the inside of the glazing stops for maximum paint adhesion and painted with a rust inhibitive primer prior to installation, or fabricated from zinc-coated steel conforming to ASTM A 653, A40 (ZF120) for interior applications, A60 (ZF180) or G60 (Z180) for exterior units.
 - d. Interior frame product may be provided with snap on glazing stops.

2.04 MANUFACTURING TOLERANCES

The manufacturer of hollow metal door and frame product is responsible only for the manufacturing tolerances listed in 2.04.A. The final clearances and relationship between door and frame depend on the setting of the frame (see Figure 4), and the hanging and adjustment of the door and hardware. See Sections 3.02 and 3.03.

- A. Maintain manufacturing tolerances within the following limits:
 1. Frame Product for Singles or Pairs 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 $\pm 3/64$ in. (1.2 mm)
- c. Cross sectional profile dimensions (See Figure 2):
 - i. Face $\pm 1/32$ in. (0.8 mm)
 - ii. Stop $\pm 1/32$ in. (0.8 mm)
 - iii. Rabbet $\pm 1/32$ in. (0.8 mm)
 - iv. Depth $\pm 1/32$ in. (0.8 mm)
 - v. Throat $\pm 1/16$ in. (1.5 mm)

Frame product overlapping walls (except slip-on construction) to have throat dimension 1/8 in. (3.1 mm) greater than dimensioned wall thickness to accommodate irregularities in wall construction.

2. Doors

Tolerances for actual hollow metal door sizes are as follows:

- a. Width $\pm 3/64$ in. (1.2 mm)
- b. Height $\pm 3/64$ in. (1.2 mm)
- c. Thickness $\pm 1/16$ in. (1.5 mm)
- d. Edge Flatness 1/16 in. (1.5 mm) maximum

- e. Surface Flatness 1/8 in. (3 mm) maximum

Hollow metal doors are undersized to fit the frame's door opening. Edge clearances are based upon individual manufacturer's designs.

3. Hardware

- a. Cutouts Template dimensions, + 0.015 in. (0.38 mm), - 0
- b. Location $\pm 1/32$ in. (0.8 mm)
- c. Between hinge centerlines $\pm 1/64$ in. (0.4 mm)

2.05 HARDWARE LOCATIONS

- A. The required locations of hardware on doors and frame product are listed below. All dimensions, except the hinge locations, are referenced from the floor, as defined in Section 3.03.B.3.

When hollow metal frame products are specified for use with doors to be furnished by others, hardware preparations on the doors are normally governed by the location on the frames, as stated in 2.05.A.

1. Hinges

- a. Top 5 in. (127 mm) from underside frame rabbet at door opening to top of hinge
- b. Bottom 10 in. (254 mm) from floor to bottom of hinge
- c. Intermediate centered between top and bottom hinges
- d. On dutch doors 5 in. (127 mm) from underside of frame rabbet at door opening, to top of upper hinge; 10 in. (254 mm) from floor to bottom of lower hinge and; 5 in. (127 mm) from split line to top and bottom of upper and lower intermediate hinges, respectively

- 2. Locks and latches 38 in. (965 mm) to centerline of knob or lever shaft

3. Deadlocks 46 in. (1168 mm) to centerline of cylinder
4. Exit hardware 38 in. (965 mm) to centerline of cross bar or as shown on hardware template
5. Door pulls 42 in. (1066 mm) to center of grip
6. Push/pull bars 42 in. (1066 mm) to centerline of bar
7. Arm pulls 46 in. (1168 mm) to centerline
8. Push plates 46 in. (1168 mm) to centerline of plate
9. Roller latches 45 in. (1143 mm) to centerline of latch

See NAAMM/HMMA 830 and 831 for additional information.

2.06 FINISH

- A. After fabrication, fill and sand all tool marks and surface imperfections as required to make face sheets, continuously welded vertical door edges and weld joints free from irregularities and dressed smooth. Exposed vertical door edges in accordance with Sections 2.01.B.5.b and 2.01.B.5.c are permitted.
- B. Fully Primed Surfaces
After appropriate metal preparation to ensure maximum paint adhesion, provide a factory applied rust inhibitive primer coating to all exposed surfaces of door and frame product manufactured from cold-rolled, hot-rolled, A25 (ZF75), or A60 (ZF180) zinc-coated. Meet the performance requirements of Section 1.05.C.
- C. Unprimed Galvanneal Surfaces
Touch-up all exposed surfaces of door and frame product manufactured from A40 (ZF120) or heavier zinc-coated galvanneal steel where zinc coating has been removed during fabrication with a zinc-rich rust inhibitive primer or provide a factory applied full-coat rust inhibitive primer coating.

All primer and finish paint must be formulated for Direct to Metal (DTM) application.
- D. Fully cure primer prior to shipment.

PART 3 - EXECUTION

3.01 SITE STORAGE AND PROTECTION OF MATERIALS; Responsibilities of the contractor responsible for receiving hollow metal door and frame product:

Correct site storage and protection are essential to the proper performance of doors and frame product. The requirements for proper storage are given in the following Section. However, it is important to recognize that these are not the responsibility of the hollow metal manufacturer. For this reason the requirements for storage and protection of hollow metal doors and frame product should be included in the Section of the specifications where installation work is specified. For additional information regarding installation see NAAMM HMMA 840, "Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames".

- A. Remove wraps or covers upon delivery at the building site and ensure that any scratches or disfigurement caused by shipping or handling are promptly cleaned and touched up with a rust inhibitive 'Direct to Metal' (DTM) primer.
- B. Ensure that materials are properly stored on planks or dunnage in a dry location. Store doors and frame product in a vertical position, spaced by blocking. Figure 3 illustrates the recommended storage positioning. Cover materials to protect them from damage but in such a manner as to permit air circulation.

3.02 INSTALLATION

Correct installation is essential to the proper performance of doors and frame product. The requirements for proper 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 requirements for installation should be included in the Section of the specifications where installation work is specified. The general contractor is responsible for performing the work, using experienced personnel, to perform the work outlined below. For additional information regarding installation see NAAMM HMMA 840, "Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames".

- A. The installer is responsible for performing the following:
1. Prior to installation, check the area of floor on which the frame is to be installed, and within the path of door swing, for flatness.
 2. Prior to installation, remove temporary spreaders. Check doors and frame product for correct size, swing, fire-rating, and opening number.
 3. Prior to installation, isolate and protect all interior surfaces of perimeter frame product sections to be installed in masonry or concrete walls from grout and antifreeze agents.

The drawbacks and benefits associated with the use of water based masonry grouts, with or without antifreeze agents, should be carefully weighed during the detailing and specification process. Grouting of mullions and other closed sections is not recommended, and plaster based grouts should not be used. Refer to NAAMM's HMMA TechNote, HMMA-820 TN01-03, "Grouting Hollow Metal Frames", in Appendix 2 for further guidance.

4. During the setting of the frame product, check and correct as necessary for opening width, opening height, squareness, alignment, twist and plumbness. Maintain installation tolerances within the following limits:
 - a. Opening width measured from rabbet to rabbet at top, middle and bottom of frame; + 1/16 in. (1.5 mm), - 1/32 in. (0.8 mm)
 - b. Opening height ... measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and across the head; $\pm 3/64$ in. (1.2 mm)
 - c. Squareness measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 1/16 in. (1.5 mm)
 - d. Alignment measured at jambs on a horizontal line parallel to the plane of the face; not to exceed 1/16 in. (1.5 mm)
 - e. Twist measured at opposite face corners of jambs on parallel lines perpendicular to the plane of the door rabbet; not to exceed 1/16 in. (1.5 mm)
 - f. Plumbness measured at jambs on a perpendicular line from the head to the floor; not to exceed 1/16 in. (1.5 mm)

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

5. The details in Figure 4 illustrate the method of measuring the above specified tolerances.

6. Grout guards and junction boxes are intended to protect hardware mortises and tapped holes from masonry grout of 4 in. (101 mm) maximum slump consistency that is hand troweled in place. If a lighter consistency grout (greater than 4 in. (101 mm) slump, when tested in accordance with ASTM C 143/C 143M) is to be used, special precautions must be taken in the field by the installer to protect the aforementioned.
7. Frame products are not intended or designed to act as forms for grout or concrete. Grout hollow metal sections in "lifts" or take precautions otherwise to ensure that frames are not deformed or damaged by the hydraulic forces that occur during this process.
8. Keep hollow metal surfaces free of grout, tar, and/or other bonding materials or sealers. Promptly clean grout, tar, and/or other bonding materials or sealers off of frame product and doors.
9. Finish and touch-up marks caused by spreader removal.
10. Promptly finish smooth and clean all exposed hollow metal surfaces which have been scratched or otherwise marred during installation. Treat repaired surfaces for maximum paint adhesion and touch up with a rust inhibitive primer comparable to and compatible with the factory applied primer and finish paint specified in Section 09 90 00 [09900]. All touch-up primer and finish paint must be formulated for Direct to Metal (DTM) application.
11. Install labeled fire doors and frame product in accordance with the terms of their listings, ANSI/NFPA 80 or the local Authority Having Jurisdiction.
12. Maintain proper door edge clearances in accordance with Section 3.03, except for special conditions otherwise noted. Where necessary, metal hinge shims, furnished by the installer, are permitted to maintain clearances.
13. Apply hardware in accordance with hardware manufacturer's templates and instructions.
14. Finish paint in accordance with Section 09 90 00 [09900].
15. Install door silencers.
16. Install glazing materials in accordance with Section 08 80 00 [08800].

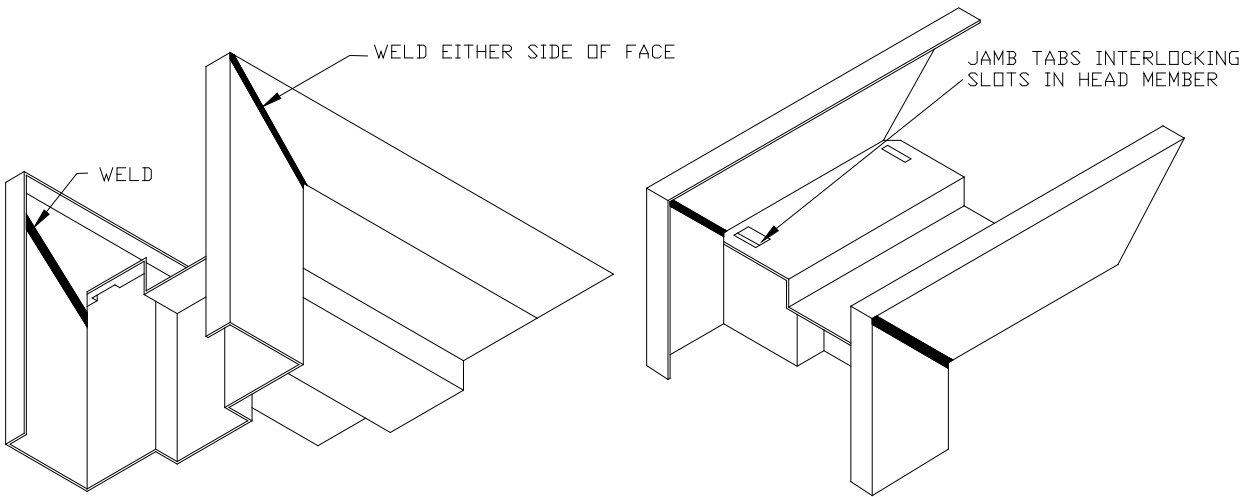
3.03 CLEARANCES

- A. Ensure that the edge clearance for swinging hollow metal doors provides for the functional operation of the assembly and does not exceed the following:
 1. Between doors and frame product at head and jambs 3/16 in. (4.7 mm)
 2. Between edges of pairs of doors 3/16 in. (4.7 mm)
- B. Ensure that the floor clearance for swinging hollow metal doors does not exceed the following:
 1. At bottom of door where a threshold is used 3/8 in. (9.5 mm) from bottom of door to top of threshold
 2. At bottom of door where no threshold is used 3/4 in. (19.1 mm) above floor
 3. Between bottom of door and nominal surface of floor coverings at fire-rated openings, as provided in ANSI/NFPA 80 1/2 in. (12.7 mm)

The Architect must define the distance from the top of the floor/finished floor to top of floor covering so appropriate undercuts can be provided. Floor/Finish 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

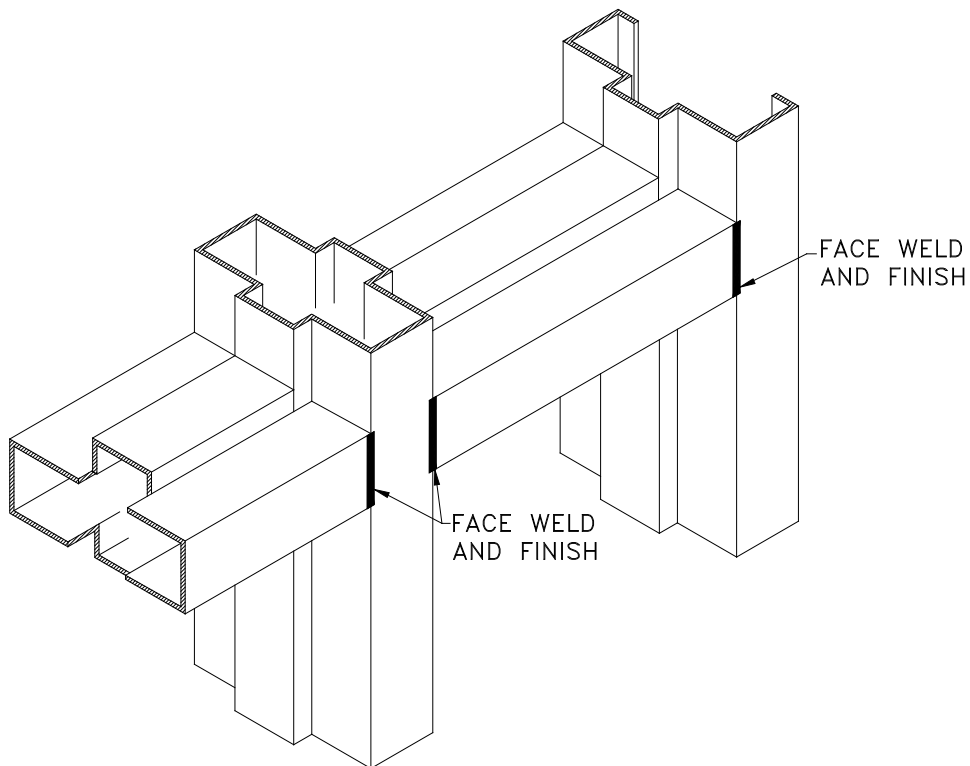
'nominal surface of floor covering'. Refer to HMMA's TechNote, HMMA-810 TN01-03, "Defining Undercuts", in Appendix 3 for further guidance.

END OF SECTION



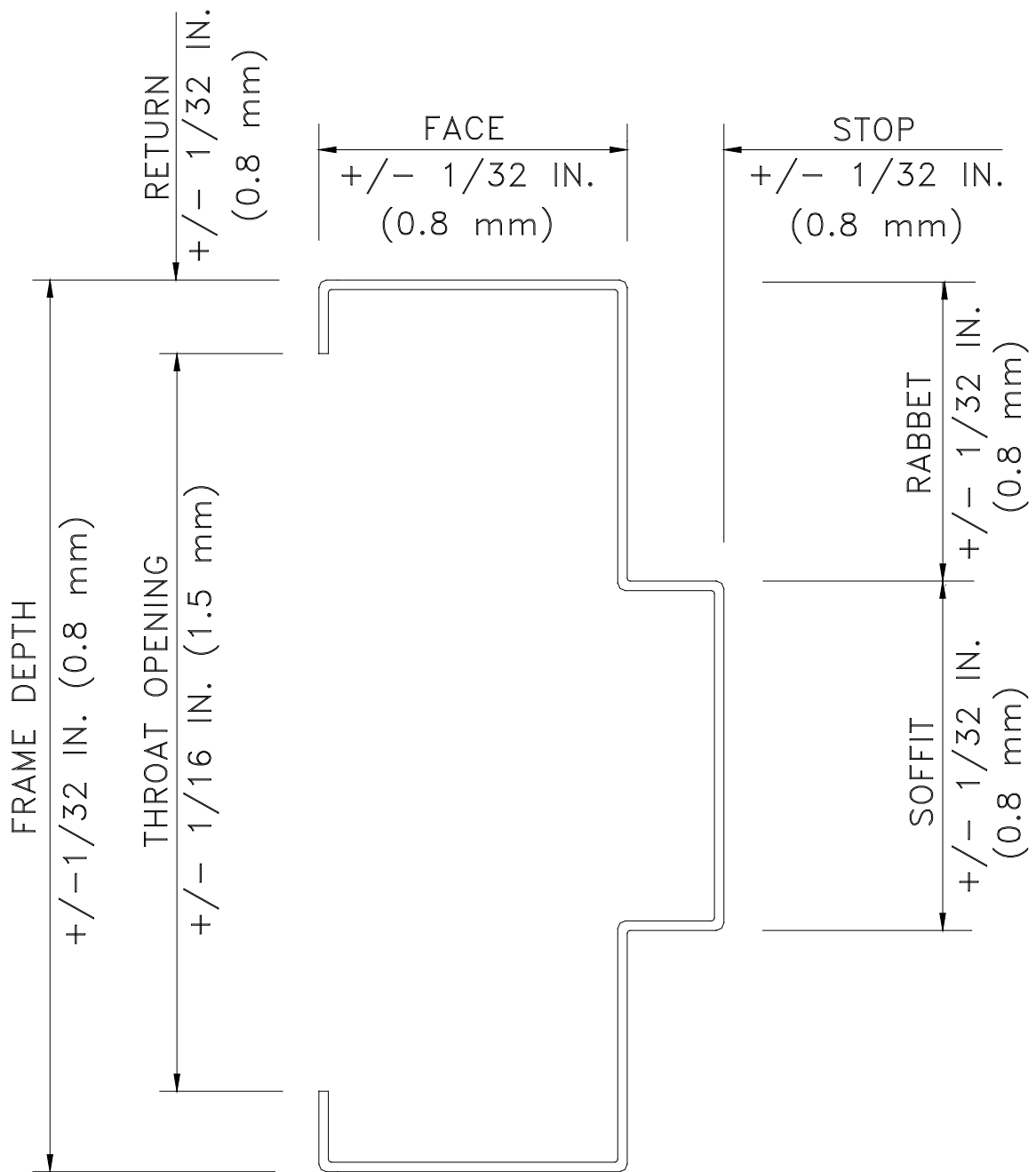
FACE WELDED CORNER JOINT

NOTE: Joint design may vary, see HMMA-820, "Hollow Metal Frames" for representative corner joint details



BUTTED AND FACE WELDED JOINTS

Figure 1



SECTIONAL PROFILE TOLERANCES

Figure 2

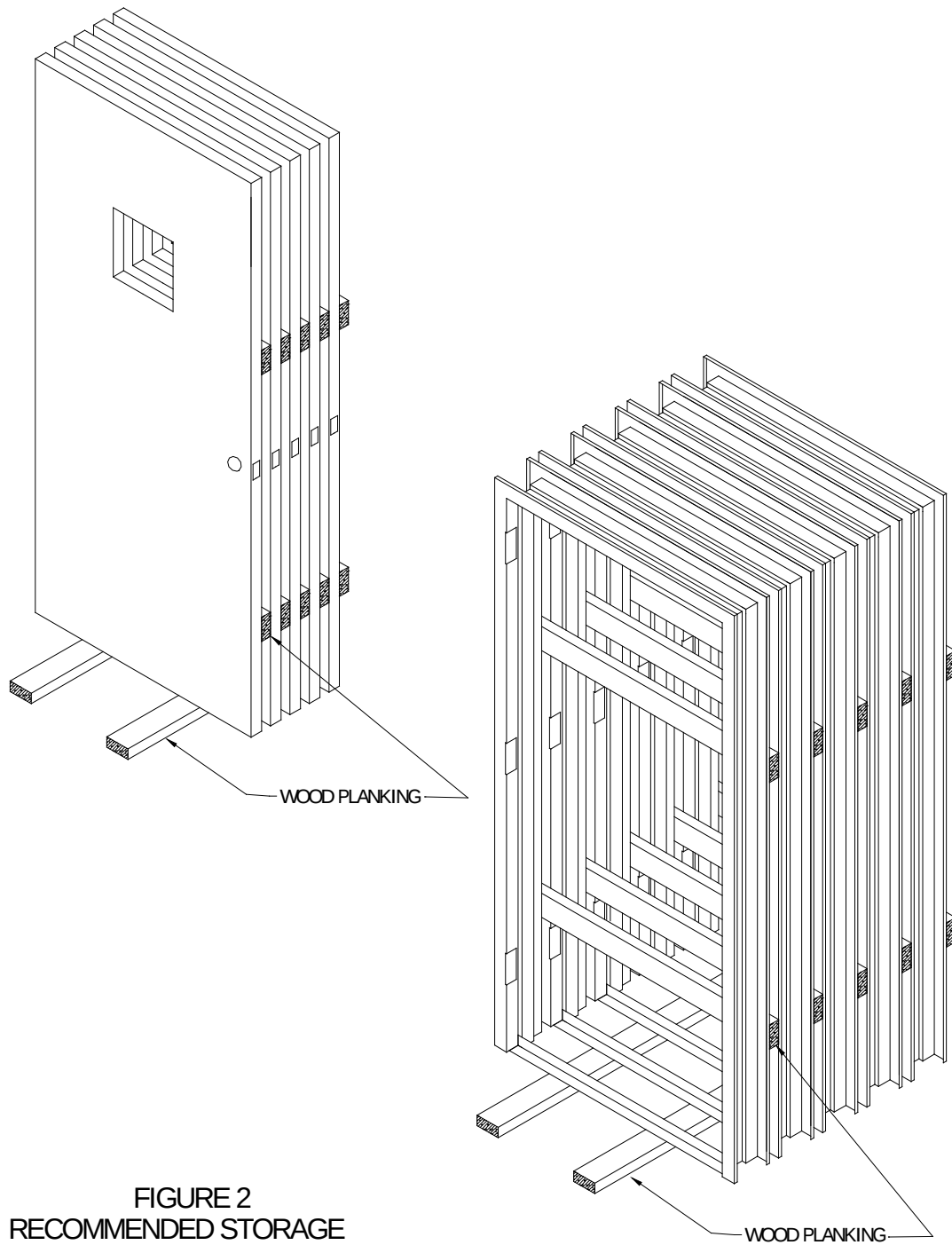


FIGURE 2
RECOMMENDED STORAGE

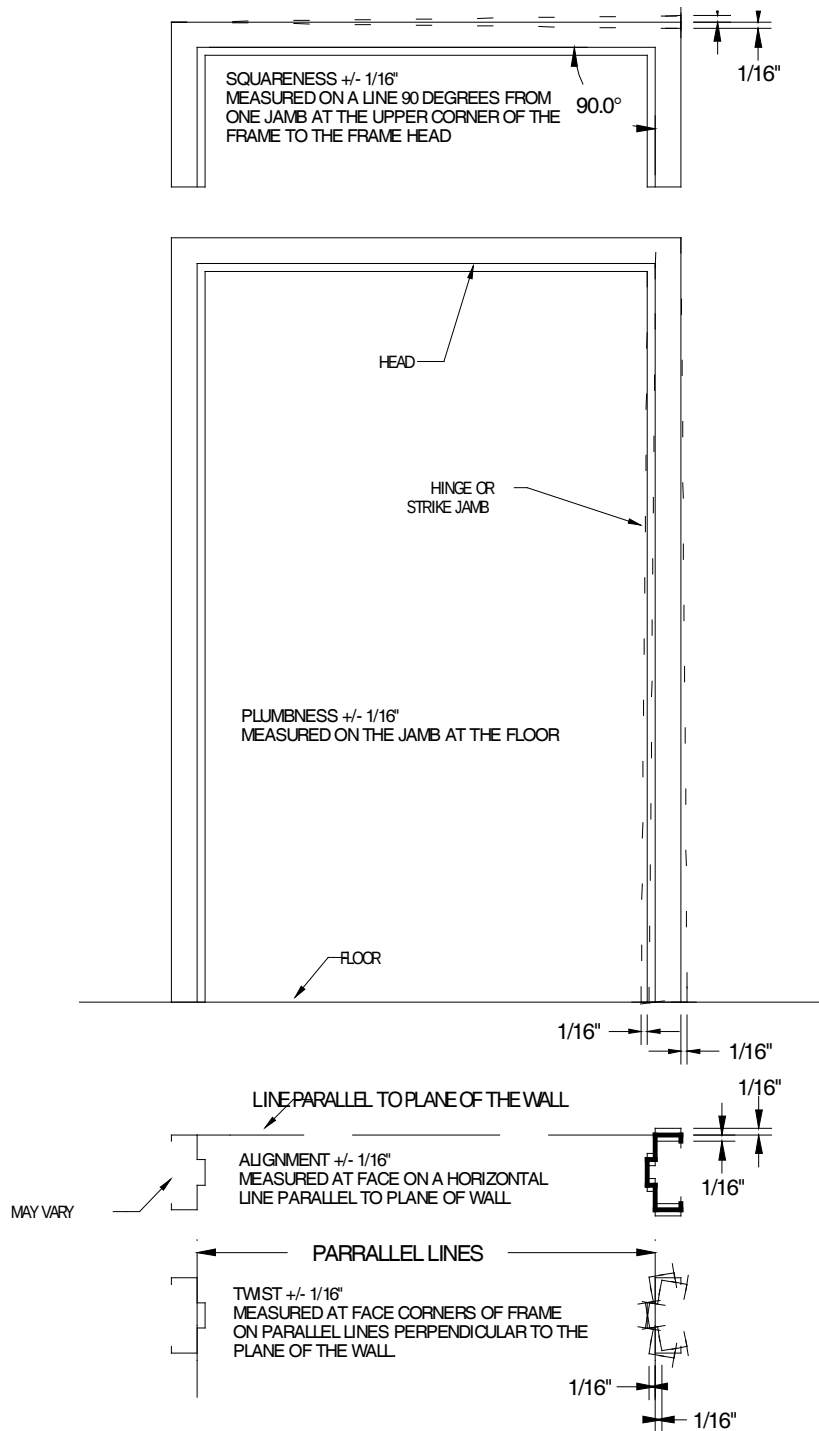


FIGURE 3
INSTALLATION TOLERANCES

APPENDIX 4

(Not part of the Standard)

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 decimal inch values shown were taken from the Underwriters Laboratories, Inc. publication for gage number and equivalent thickness. Corresponding metric values are included for reference purposes only.

MINIMUM THICKNESS		
Uncoated Steel Sheet		
Gage	Decimal	mm
4	0.214	5.43
5	0.199	5.05
6	0.184	4.67
7	0.167	4.24
8	0.152	3.86
10	0.123	3.12
12	0.093	2.36
14	0.067	1.70
16	0.053	1.34
18	0.042	1.06
20	0.032	0.81
22	0.026	0.66
24	0.02	0.50
26	0.016	0.40
28	0.013	0.33

CONVERSION		
Fraction	Decimal	mm
	1.000	25.40
15/16	0.937	23.81
7/8	0.875	22.22
13/16	0.812	20.63
3/4	0.750	19.05
11/16	0.687	17.46
5/8	0.625	15.87
9/16	0.562	14.28
1/2	0.500	12.70
7/16	0.437	11.11
3/8	0.375	9.52
5/16	0.312	7.93
1/4	0.250	6.35
3/16	0.187	4.76
1/8	0.125	3.17
1/16	0.062	1.58

DISCLAIMER

This sheet was developed by representative members of the Hollow Metal Manufacturers Association Division (HMMA) of the National Association of Architectural Metal Manufacturers (NAAMM) to provide their opinion and guidance on minimum thickness and metric equivalents used for hollow metal doors and frames. This sheet contains advisory information only and is published as a public service by the HMMA Division. NAAMM and its HMMA DIVISION DISCLAIM ALL LIABILITY OF ANY KIND FOR THE USE, APPLICATION OR ADAPTATION OF MATERIAL SHOWN ON THIS SHEET.

APPENDIX 5

(Not part of the Standard)

GROUTING HOLLOW METAL FRAMES

HMMA-820 TN01-03

Grout when used in accordance with industry guidelines, can improve frame durability, sound deadening and, depending on wall construction, increase frame anchorage strength. Grouting of the frame does not increase door durability, nor is it required for fire-rated frames. For most commercial applications, grouting of mullions and other closed sections is not recommended.

For applications covered by ANSI/NAAMM HMMA 862, "Guide Specifications for Commercial Security Hollow Metal Doors and Frames", and ANSI/NAAMM HMMA 863, "Guide Specifications for Detention Security Hollow Metal Doors and Frames", the standards require that "frame jambs shall be fully grouted to provide added security protection against battering, wedging, spreading, and other means of forcing open the door"

Grout is a water-based product. If not used properly, it can destroy the opening in a very short time. Grout can be either "mortar", which is a masonry mixture of lime, cement, sand and water, or "plaster", a gypsum-based product.

Plaster grout dries with exposure to air. When a frame member is filled solid with plaster grout, only those areas exposed to air will dry and harden, while the center remains wet (uncured). The water remaining in the plaster grout can rust the frame from the inside.

Mortar grout cures by chemical reaction and hardens throughout. Use mortar grout.

Frames are not designed to act as forms for grout. Grout must have a maximum 4 in. slump and be hand troweled in place. Bracing of the frame may be necessary prior to grouting to prevent sagging of the header or bowing of the jamb due to weight or pressure of the grout. Grout should not be installed after gypsum wallboard is installed, as the liquid within the grout will deteriorate the wallboard.

When dictated by temperatures, anti-freezing agents for mortar may be recommended by specifications. These agents can adversely affect metal and all surfaces in contact with grout must be coated with a corrosion resistant material.

It is recommended that the contractor responsible for the grouting and for any additional barrier coating. It is also the contractor's responsibility to use care in the application of the grout.

APPENDIX 6

(Not part of the Standard)

DEFINING UNDERCUTS

HMMA-810 TN01-03

Review of established definitions.

1. **“ACTUAL DOOR HEIGHT”** - The door opening height minus top clearance and undercut.
2. **“DOOR OPENING HEIGHT”** - The distance measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension.
3. **“FINISHED FLOOR”** - See “Floor”
4. **“FLOOR”** - The top of the concrete or structural slab.
5. **“FLOOR CLEARANCE”** - The distance between the bottom of the door and the top of the material directly below the door. This varies with application, such as concrete, any floor covering and/or a threshold.
6. **“FLOOR COVERING”** - Any material applied on top of the floor that extends under the door in its closed position or under the door as it swings to its fully open position.
7. **“UNDERCUT”** - The distance between the bottom of door and the bottom of frame. The formula in which to determine Undercut is derived by adding the total sum of the following (Floor Clearance + Floor Covering Thickness + Threshold Height (assuming the threshold is mounted on top of the floor covering) + Jamb Extensions Height).
8. **“JAMB EXTENSIONS”** - That portion of a jamb or mullion which extends below the level of the floor.

Typically frames are intended to be installed directly on the floor. When no floor coverings or thresholds are used, the dimension for “Undercut” is the same as for “Floor Clearance”. See Figure # 1.

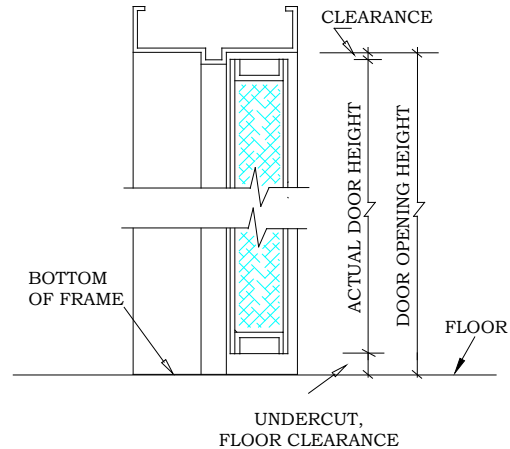


Figure # 1

Floor coverings; such as carpet, resilient or ceramic tile, are typically installed on top of the floor, fitted around the frame, and under the door. In this situation, the formula for figuring Undercut is the total of the Floor Clearance + Floor Covering Thickness. See Figure # 2.

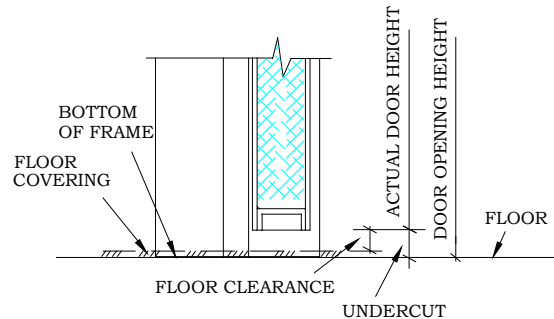


Figure # 2

When a threshold is used, it is installed on top of the floor or floor covering, fitted around the frame and under the door. Again the formula for figuring “Undercut” changes. Undercut is the total of the Floor Clearance + Threshold Height + Floor Covering Thickness. See Figure # 3.

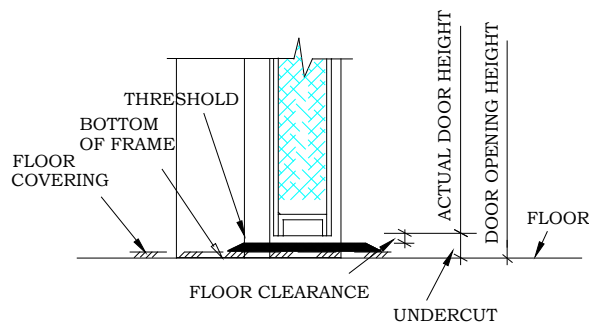


Figure # 3

In situations with specialized floors such as thick ceramic tile or terrazzo, the frame is typically installed prior to the installation of the floor.

One method is to install the frame with adjustable floor anchors or for the frame to be installed on a block or shim. This allows the frame to be positioned, as required, to accommodate the floor height. See Figures # 4A and 4B. Both illustrate a raised frame condition in which the bottom of frame is positioned to be directly on top of the floor after the floor is installed. In this situation, the dimension measured for Undercut is also the same as Floor Clearance.

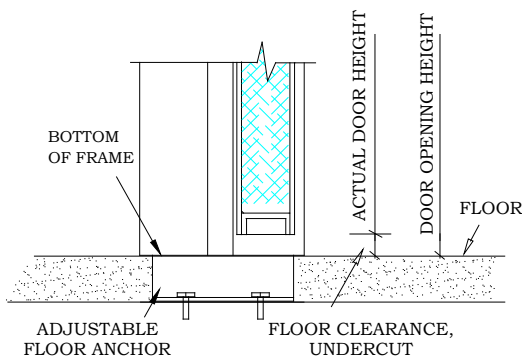


Figure # 4A

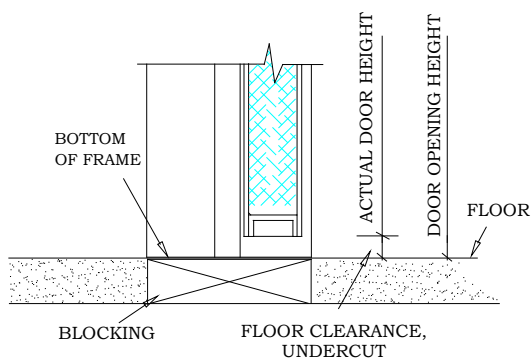


Figure # 4B

Another method, called "below floor installation", is to install the frame directly on the rough slab. After the frame is installed, the floor is then

installed around the frame. That portion of the frame is covered by the floor and is called jamb extensions. The formula for figuring "Undercut" is the total of the Floor Clearance + Jamb Extensions. See Figures # 5A and 5B.

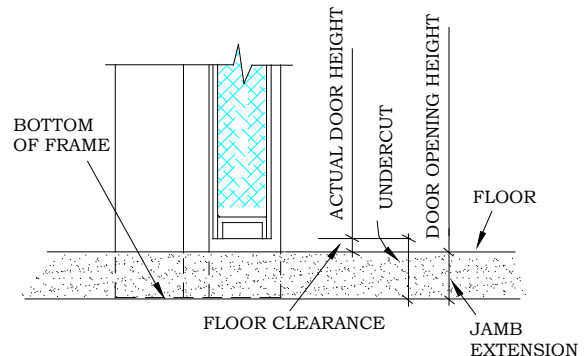


Figure # 5A

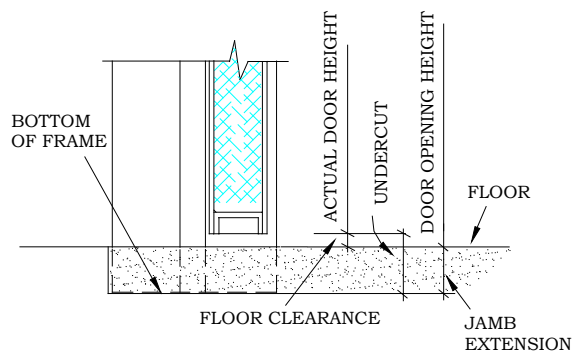


Figure # 5B

The Architect/Designer must be very specific within specifications and contract drawings, which should include detailed drawings illustrating conditions for each floor, including thicknesses and materials. These drawings should designate the height at which the hollow metal frame should be set. Thresholds and hardware items requiring specific floor clearances shall be listed in the hardware schedule, which allows the door and frame manufacturer to properly size each opening.

Within the door and frame industry, both the Hollow Metal Manufacturers Association (HMMA) a division of the National Association of Architectural Metal Manufacturers (NAAMM) and the Steel Door Institute (SDI), publish recommended clearances. In addition, the National Fire Protection Association (NFPA) Publication 80, "Standard for Fire Doors and Fire Windows", regulates the installation and maintenance of labeled openings, and lists several different scenarios consisting of different floor materials and the maximum clearance under the bottoms of doors.

APPENDIX 7

(Not part of the Standard)

STANDARDS DEVELOPMENT ORGANIZATIONS

ANSI	American National Standards Institute, Inc. 11 West 42 nd Street New York, NY 10036 Tel: (212) 642-4900 Website: www.ansi.org
ASTM	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 Tel: (610) 832-9585 Website: www.astm.org
ICC	International Code Council 500 New Jersey Avenue NW 6 th Floor Washington, DC 20001-2070 Tel: 1 (888) 422-7233 Website: www.iccsafe.org
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Road Building C, Suite 312 Glen Ellyn, IL 60137 Tel: (630) 942-6591 Website: www.naamm.org
NFPA	National Fire Protection Association 1 Batterymarch Park P.O. Box 9101 Quincy, MA 02269 Tel: (617) 770-3000 Website: www.nfpa.org
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, Illinois 60062 Tel: (847) 272-8800 Website: www.ul.com

RECOMMENDED GUIDE SPECIFICATIONS FOR HOLLOW METAL DOORS AND FRAMES

HMMA 860 - Hollow Metal Doors and Frames

ANSI/NAAMM

HMMA 861 - Commercial Hollow Metal Doors and Frames

ANSI/NAAMM

HMMA 862 - Commercial Security Hollow Metal Doors and Frames

ANSI/NAAMM

HMMA 863 - Detention Security Hollow Metal Doors and Frames

NAAMM

HMMA 865 - Sound Control Hollow Metal Door and Frame Assemblies

ANSI/NAAMM

HMMA 866 - Stainless Steel Hollow Metal Doors and Frames

ANSI/NAAMM

HMMA 867 - Commercial Laminated Core Hollow Metal Doors and Frames

RELATED HMMA DOCUMENTS

HMMA 800 - Introduction to Hollow Metal

ANSI/NAAMM

HMMA 801 - Glossary of Terms for Hollow Metal Doors and Frames

HMMA 802 - Manufacturing of Hollow Metal Doors and Frames

HMMA 803 - Steel Tables

HMMA 810 - Hollow Metal Doors

HMMA 820 - Hollow Metal Frames

HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames

HMMA 831 - Recommended Hardware Locations for Hollow Metal Doors and Frames

HMMA 840 - Installation and Storage of Hollow Metal Doors and Frames

ANSI/NAAMM

HMMA 841 - Tolerances and Clearances for Commercial Hollow Metal Doors and Frames

HMMA 850 - Fire-Rated Hollow Metal Doors and Frames

HMMA 890 - Technical Summary

HMMA 810-TN01 - Defining Undercuts

HMMA 820-TN01 - Grouting Hollow Metal Frames

HMMA 820-TN02 - Continuously Welded Frames

HMMA 820-TN03 - Guidelines for Glazing Hollow Metal Transoms, Sidelights and Windows

HMMA 840-TN01 - Painting Hollow Metal Products

HMMA 840-TN02 - Maintenance of Installed Hollow Metal Products