

A summary of the differences between the following standards
HOLLOW METAL MANUFACTURER ASSOCIATION (HMMA 861)
HOLLOW METAL MANUFACTURER ASSOCIATION (HMMA 867)
STEEL DOOR INSTITUTE (SDI 100/ANSI A250.8)

Respectively guide specifications for:

COMMERCIAL HOLLOW METAL DOORS AND FRAMES
COMMERCIAL LAMINATED CORE HOLLOW METAL DOORS AND FRAMES
STANDARD STEEL DOORS AND FRAMES

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Table of contents

1	INTRODUCTION	3
2	TESTING AND PERFORMANCE	4
3	HOLLOW METAL DOORS MINIMUM STEEL THICKNESS.....	5
4	DOOR CONSTRUCTION	7
5	DOOR HARDWARE REINFORCEMENT AND PREPARATION.....	11
6	FRAME CONSTRUCTION	12
7	FRAME HARDWARE REINFORCEMENT AND PREPARATION.....	14
8	FRAME ANCHORS	15
9	GLAZING MOLDINGS AND STOPS	17
10	MANUFACTURING TOLERANCES.....	18

1 Introduction

This document is intended for all sales agents, specification writers, architects and distributors, who would like to have a better overview and understanding of specifications. This document regroups significant differences between the three standards enlisted above.

Dotted boxes will indicate 861 references and standard boxes will represent 867 references. Double line boxes will represent SDI100 references when available.

In case of discrepancies, the official documents have precedence over this document.

2 Testing and performance

According to HMMA 861, the cycle test must achieve at least 4,000,000 cycles for 0.053 in [1.3 mm] and thicker face compare to 867 and SDI 100 which cycle test criteria is set up to 1,000,000 cycles.

1.05 TESTING AND PERFORMANCE

A. Physical Endurance for Steel Doors and Hardware Reinforcing

2. The specimen shall be tested in accordance with the ANSI A250.4, Cycle and Twist Test procedure.

a. Cycle Test Acceptance Criteria: Doors specified with 0.053 in. (1.3 mm) and thicker face sheets shall be tested to 4,000,000 cycles. Doors specified with 0.042 in. (1.0 mm) – 0.053 in. (1.3 mm) thick face sheets shall be tested to 1,000,000 cycles Level (A).

b. Twist Test Acceptance Criteria: Maximum deflection under 300 pound (136.1 kg) load.

i. 4,000,000 cycle-tested doors shall not exceed 0.625 in. (15.8 mm) deflection and maximum permanent deflection shall not exceed 0.062 in. (1.5 mm).

ii. 1,000,000 cycle-tested doors shall not exceed 1.25 in. (31.7 mm) deflection and maximum permanent deflection shall not exceed 0.125 in. (3.1 mm).

861

1.05 TESTING AND PERFORMANCE

A. Physical Endurance Performance Test for Commercial Laminated Core Hollow Metal Doors

2. The specimen shall be tested in accordance with the ANSI A250.4 Cycle and Twist Test procedures.

a. Cycle Test Acceptance Criteria: Doors specified with 0.042 in. (1.0 mm) and thicker face sheets shall be tested to Level A (1,000,000 cycles). Doors specified with 0.032 in. (0.8 mm) face sheets shall be tested to Level C (250,000 cycles).

b. Twist Test Acceptance Criteria: Maximum deflection under 300 pound (136.1 kg) load for doors specified with 0.042 in. (1.0 mm) and thicker face sheets shall not exceed 1.25 in. (31.7 mm) and maximum permanent deflection shall not exceed 0.125 in. (3.1 mm). Maximum deflection under 300 pound (136.1 kg) load for doors specified with 0.032 in. (0.8 mm) face sheets shall not exceed 2.5 in. (63.5 mm) and maximum permanent deflection shall not exceed 0.125 in. (3.1 mm).

867

Level A doors are Extra Heavy-duty 1-3/4 in [44.4 mm] and 0.053 in [1.3 mm] material. Maximum duty 1-3/4 in [44.4 mm] and 0.067 in [1.7 mm] material.

Duration of the test shall be 250,000 cycles with latching for Level C doors; 500,000 cycles with latching for Level B doors; and 1,000,000 cycles with latching for Level A doors. A general inspection of the door shall be made at 25,000 cycle intervals for the first 100,000 cycles and at 50,000 cycles thereafter. A mechanical counter or equivalent shall be used to record the cycles.

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3 Hollow metal doors minimum steel thickness

For interior doors, 0.032 in [0.8 mm] steel thickness is not allowed in 861.

a. Interior doors: Face sheets shall be 0.042 in. (1.0 mm) minimum thickness and shall be manufactured from cold-rolled steel conforming to ASTM A 1008/A 1008M, 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 or surface blemishes, buckles, waves or other defects.

861

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.

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SDI 100 (Table 2) specifies the same minimum thickness as HMMA 867 for steel sheets.

Table 1: Steel thickness/door faces

Level	Model	Minimum Thickness		MSG No. ⁽¹⁾
		Inches	mm	
1	1	0.032	0.8	20
	2	0.032	0.8	20
2	1	0.042	1.0	18
	2	0.042	1.0	18
3	1	0.053	1.3	16
	2	0.053	1.3	16
	3	See Sec. 2.3.3 Construction Features		16
4	1	0.067	1.7	14
	2	0.067	1.7	14

⁽¹⁾ MSG No. to be used for reference purposes only.

For exterior doors

b. Exterior Doors: Face sheets shall be 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).

861

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).

867

2.1.1.3 When specified, hot dipped zinc coated steel shall be of the alloyed type and comply with ASTM A924, "Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process" and A653, "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process." The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 oz/ft² (122 g/m²), total both sides, i.e., A40 (ZF120). See SDI-112 "Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames" for further information.

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A40 steel is acceptable on exterior openings in SDI 100. However 861 and 867 requires A60 material.

4 Door construction

4.1 Door thickness

Minimum door thickness shall be 1-3/4 in [44.4 mm] per NAAMM standards. SDI 100 accepts a 1-3/8 in [34.9 mm] door for a level C performance test (500,000 cycles). The physical performance levels are determined by testing assemblies in accordance with ANSI/SDI A250.4, "Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings."

B. Construction

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.

861

B. Construction

4. Minimum nominal door thickness shall be 1-3/4 in. (44 mm). Edge bends shall be true and straight and of minimum radius for the thickness of metal used.

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1.4 Classification – Level, performance, Model

*Level 1 and Physical Performance Level C
Standard-duty 1-3/8" (34.9 mm) **and** 1-3/4" (44.5 mm)*

*Model 1 – Full Flush
Model 2 – Seamless*

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4.2 Door cores

Standard 861 requires steel stiffeners assembled by spot welding compare to Standard 867 which does not describe the type of assembly for stiffeners (glued stiffeners are acceptable). This standard allows laminated cores. SDI 100 accepts spot welded and glued stiffeners as long as the manufacturer meets the performance standard per ANSI A250.4.

4. Doors shall be stiffened by continuous vertically formed steel sections which, upon assembly, shall span the full thickness of the interior space between door faces. These stiffeners shall be 0.026 in. (0.6 mm) minimum thickness, spaced so that the vertical interior webs shall be no more than 6 in. (152 mm) apart and securely fastened to both face sheets by spot welds spaced a maximum of 5 in. (127 mm) o. c. vertically. Spaces between stiffeners shall be filled with fiberglass or mineral rock wool batt-type material.

861

a. Interior doors shall be stiffened with a [honeycomb] [or] [polyisocyanurate] [or] [polystyrene] [or] [polyurethane] [or] [steel stiffened] [or] [other] core, spanning the full thickness of the interior of the door, laminated under pressure to each face sheet.

b. Exterior doors shall be stiffened with a [honeycomb] [or] [polyisocyanurate] [or] [polystyrene] [or]

867

[polyurethane] [or] [steel stiffened] [or] [other] core, spanning the full thickness of the interior of the door, laminated under pressure to each face sheet.

e. Steel Stiffened: Continuous vertical formed steel sections, 0.026 in. (0.6 mm) minimum thickness, spaced with interior webs not more than 6 in. (152 mm) apart, which upon assembly, span the full thickness of the interior of the door. Voids between stiffeners shall be filled with fiberglass or mineral rock-wool batt-type material.

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2.3.2 Core Construction

*The core design shall be **at the discretion of the manufacturer**. Doors of the following core designs have met the performance requirements of the documents listed under Section 2.1.7:*

- KraftPaper Honeycomb, Polystyrene, Polyurethane, Mineral Board or Vertical Steel Stiffeners*

This shall not restrict the development of alternate core materials that meet the performance requirements specified above.

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4.3 Door edges

Continuously welded doors shall be provided for products respecting HMMA 861..

2. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door. With no visible seams on their faces or vertical edges.

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

861

3. Door Edges

[a. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door, filled and sanded, with no visible seam at their vertical edges.] [or]

[b. Door face sheets shall be joined at their vertical edges by a continuous interlocking or locktab seam the full height of the door, with [a visible] [no visible] seam at their vertical edges.] Interlocking and lock-tab doors with no visible edge seam can be used for aesthetic appearance as a design consideration. [or]

[c. Door face sheets shall be joined by 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 markings on the exposed door edges, presenting a visible vertical seam at both door edges.] Not all doors edges are available with all core materials, or from all member manufacturers. Specifiers should consult member manufacturers to determine availability.

867

2.3.1.2 Seamless

In addition to the requirements for full flush doors, no visible seams are permitted along the vertical edges. One of the following methods, at the **discretion of the manufacturer***, shall be used when a seamless door is specified:

- vertical seam edge filled, dressed smooth
- intermittently welded seams, edge filled, dressed smooth
- continuously welded seam dressed smooth

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SDI 100 permits vertical seams on the edge of the door.

2.3.1.1 Full Flush

Each door face shall be formed from a single sheet of steel of a thickness as defined by Table 2. There shall be no visible seams on the surface of the faces. A full height vertical seam is permitted on door edges.

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* We highly recommend to clearly describing the door edge requirements in the specifications. Since the price is different for both methods, it will make sure everybody is quoting the same product.

4.4 Door end channels

Assembly of end channels (top/bottom) are also taken into account in door construction.

5. The top and bottom edges shall be closed with a continuous steel channel, not less than 0.053 in. (1.3 mm) thickness, welded to both face sheets.

861

6. The top and bottom edges shall be closed with a continuous steel channel not less than 0.053 in. (1.3 mm) thickness spot welded or laminated to both face sheets.

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General note for NAAMM 861 and 867: *Exterior doors, and where otherwise scheduled by the Architect, shall be closed flush at the top edge. Where required for the attachment of weatherstripping, a flush steel closure channel shall be provided at the bottom edge. Openings shall be provided in the bottom closure channel of exterior doors to permit the escape of entrapped moisture.*

2.3.1.4 End Channels or Closures

The top and bottom of the door shall be closed with either flush or inverted channels or closures. The channels or closures shall have a minimum material thickness of 0.042" (1.0 mm).

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The assembly method for end channels is not specified in SDI 100. The specifier should clarify this information since welded compare to laminate is not the same price.

5 Door Hardware Reinforcement and Preparation

- b. Minimum steel thickness for hardware reinforcements shall be as follows:
- i. Full mortise hinges and pivots: 0.167 in. (4.2 mm)
 - ii. Lock fronts, strikes, concealed holders, or surface mounted closers: 0.093 in. (2.3 mm)
 - iii. Internal reinforcements for other surface applied hardware: 0.067 in. (1.7 mm)

861

- b. Minimum steel thickness for hardware reinforcements shall be as follows:
- i. Full mortise hinges and pivots: 0.167 in. (4.2mm) or 0.123 in. (3.1 mm) angle or channel shaped type
 - ii. Lock fronts and 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 holders 0.093 in. (2.3 mm)
 - iv. Internal reinforcements for other surface applied hardware 0.053 in. (1.3 mm)

867

Table 2: Minimum hardware reinforcing thickness for SDI 100

Hardware Item	Door			Frame		
	inches	mm	MSG No. ⁽⁶⁾	inches	mm	MSG No. ⁽⁶⁾
Mortise Hinge 1-3/8" [34.9 mm] Door ⁽¹⁾	0.093	2.3	12	0.093	2.3	12
Mortise Hinge 1-3/4" [44.5 mm] Door ^{(1) (2)}	0.123	3.1	10	0.123	3.1	10
Mortise Lock or Deadbolt ⁽¹⁾	0.067	1.7	14	0.067	1.7	14
Bored Lock or Deadbolt ⁽¹⁾	0.067	1.7	14	0.067	1.7	14
Flush Bolt Front ⁽¹⁾	0.067	1.7	14	0.067	1.7	14
Surface Bolt ⁽³⁾	0.067	1.7	14	0.067	1.7	14
Surface Applied Closer ⁽⁴⁾	0.067	1.7	14	0.067	1.7	14
Hold Open Arm ⁽³⁾	0.067	1.7	14	0.067	1.7	14
Pull Plates and Bar ⁽³⁾	0.053	1.3	16	0.053	1.3	16
Surface Exit Device ⁽³⁾	0.067	1.7	14	0.067	1.7	14
Floor Checking Hinge	0.167	4.2	7	0.167	4.2	7
Pivot Hinge	0.167	4.2	7	0.167	4.2	7
Continuous Hinges ⁽⁵⁾	Not Required			Not Required		
Kick / Push Plate	Not Required			Not Required		

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6 Frame construction

6.1 Frame thickness

Specific minimum thickness required for openings exceeding 4 ft, this is not mentioned in SDI 100.

Profiles shall be 0.053 in. (1.3 mm) minimum thickness. Frame product shall be 0.067 in. (1.7 mm) minimum thickness for single door openings exceeding 4 ft. (1219 mm) in width, and pairs with either door exceeding 4 ft. (1219 mm) in width.

861

Profiles shall be not less than 0.053 in. (1.3 mm) thickness for frame product that receive hollow metal or solid core wood doors [, 0.042 in. (1.0 mm) for frames that receive hollow core wood doors].

867

6.2 Frame assembly

Knocked-down or slip-on frames are forbidden in HMMA 861. Integral welded units must be provided.

1. Frame product shall have integral stops and be welded units of the sizes and types shown on approved submittal drawings. Frame product shall be constructed in accordance with the contract documents and meet the performance criteria specified in Section 1.05.B and 1.05 C. Knock down frames are not acceptable. Frame product shall be constructed in accordance with NAAMM HMMA 820 with regard to joint designs and welding techniques. Prior to shipment mark frame product with an identification number as shown on approved submittal drawings.

861

1. Frames shall be [welded] [or] [knocked-down] [or] [slip-on] units. Transom, multi-opening, sidelight and window assemblies shall be welded units. All frame product shall be 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. Frame product shall be constructed in accordance with the contract documents and meet the performance criteria specified in Sections 1.05.B and 1.05.C. Frame product shall be constructed in accordance with NAAMM HMMA 820 with regard to joint designs and welding techniques.

867

Thermally broken frames are not mentioned in NAAMM 861 and SDI 100.

5. Thermally Broken Frame Product

- a. Where indicated in the contract documents, thermally broken frame product shall be provided.*
- b. Interior and exterior sections shall be separated by a continuous thermal break.*
- c. Closed sections shall be factory insulated.*
- d. Insulation for open sections shall be provided by the installer on site.*

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.

867

7 Frame Hardware Reinforcement and Preparation

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

i. Full mortised hinges and pivots :

0.167 in. x 1.25 in. x 10 in. length (4.2 mm x 31.7 mm x 254 mm)

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)

861

c. Minimum steel thickness of hardware reinforcing shall be 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)

867

For SDI 100, please refer to Table 2 on page 11.

8 Frame Anchors

11. Floor Anchors	
a. Floor anchors shall be provided with two holes for fasteners and shall be secured inside jambs with at least four (4) spot welds per anchor.	
d. Floor anchor shall be of same material and thickness as frame.	861

13. Floor Anchors	
a. For welded and knocked-down frame product, floor anchors shall be securely welded inside jambs, and provided with two holes for fasteners supplied and installed by others.	
d. Minimum thickness of floor anchors shall be 0.042 in. (1.0 mm).	867

2.4.4.2 Base Anchors	
Provide frames, other than slip-on drywall type, with base anchors that are not less than 0.042" (1.0 mm) in thickness for attachment to the floor. For wall conditions that do not allow for the use of a floor anchor, an additional jamb anchor shall be specified.	100

For masonry anchor, there are no significant differences between NAAMM 861 & 867.

b. Masonry Type	
Frame product for installation in new masonry walls shall be provided 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. Straps shall be not less than 2 in. x 10 in. (50.8 mm x 254 mm) in size, corrugated and/or perforated. Jamb anchors shall be placed at a maximum of 18 in. (457 mm) from top and bottom of openings. The minimum number, spaced at maximum 32 in. (812 mm) on center, provided on each jamb, based on the overall frame height, shall be 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	

Drywall type anchors shall be securely welded inside frame according to 861.

Standard 867 does not require welded anchors. SDI 100 requires anchors to suit the wall construction only.

2.4.4 Frame Anchors for Wall Conditions

Provide frames, other than slip-on drywall type, with a minimum of three anchors per jamb suitable for the adjoining wall construction. Provide anchors of not less than 0.042" (1.0 mm) in thickness or 0.167" (4.2 mm) diameter wire. Frames OVER 7'6" (2286 mm) shall be provided with an additional anchor.

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2.03 B.12.c Dry Wall Type (861)

2.03 B.14.c Dry Wall Type (867)

Frame product for installation in dry-wall partitions shall be provided with steel jamb anchors of suitable design, not less than 0.042 in. (1.0 mm) thickness, securely welded inside each jamb. Jamb anchors shall be placed a maximum of 18 in. (457 mm) from top and bottom of openings.

861+867

9 Glazing Moldings and Stops

9.1 Doors

For HMMA 867, moldings or stop can be screwed on secure side. Security screws should be used if they are exposed to vandalism or robbery.

9. b) *Fixed glass molding shall be welded to the secure side.* 861

10. b) *Fixed moldings or integral stops, not less than 0.032 in. (0.8 mm) thickness, shall be provided on the secure side of the door.*

10. c) *Removable or snap-on stops shall be not less than 0.032 in. (0.8 mm) thickness, with tight fitting butt or mitered corners.* 867

2.3.4 Vision Lites

When doors are specified to contain glazed openings, the manufacturer's standard light kit shall be supplied.

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9.2 Frames

17. b) *Removable steel channel glazing stops shall be not less than 0.032 in. (0.8 mm) thick, butted at corners and secured to the frame section using #6 minimum, corrosion resistant countersunk sheet metal screws.* 861

19. b) *Removable steel channel glazing stops shall be not less than 0.032 in. (0.8 mm) thick, butted at corners and secured to the frame section using cadmium or zinc-plated #6 minimum countersunk sheet metal screws.* 867

2.4.5 *On frame assemblies that incorporate glazed openings, the frame shall be provided with glazing beads designed to receive the glazing materials specified. The glazing beads shall be butted at the corners. Glazing beads shall be of snap-on or screw-applied design.* 100

10 Manufacturing tolerances

Table 3: Manufacturing tolerances according to each standard

FRAMES			
DIMENSIONS	NAAMM 861	NAAMM 867	SDI 117
Frame Width, measured between rabbets	+1/16", - 1/32"	+1/16", - 1/32"	+1/16", - 1/32"
Height, total height of rabbets	+1/16", - 1/32"	± 3/64"	+1/16", - 1/32"
Frame face	± 1/32"	± 1/32"	± 1/32"
Frame stop	± 1/32"	± 1/32"	± 1/32"
Frame Rabbet	± 1/32"	± 1/32"	±1/64
Frame depth	± 1/16"	± 1/32"	± 1/16"
Frame throat	± 3/32"	± 1/16"	± 3/32"

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

DOORS			
Door width	± 3/64"	± 3/64"	± 3/64"
Door height	± 3/64"	± 3/64"	± 3/64"
Door thickness	± 1/16"	± 1/16"	± 1/16"
Door edge flatness	+ 1/16"	+ 1/16"	+ 3/16"
Door surface flatness	+ 1/8"	+ 1/8"	+ 1/16"

Table 4: Design clearances according to each standard

CLEARANCES			
	861	867	SDI 117
Between doors and frame at head and jambs	1/32" to 3/16"	3/16"	1/8"
Between edges of pairs of doors	1/32" to 3/16"	3/16"	3/16", 1/16" (F)
Floor clearance w/ threshold	3/8"	3/8"	N/A
Floor clearance w/o threshold	3/4"	3/4"	3/4"
Floor clearance for Listed doors (NFPA 80)	1/2"	1/2"	1/2"

* No minimum clearance specified in NAAMM 867

** All SDI clearances are subject to a tolerance of ±1/32"