

Recommended selection and Usage Guide for

Hollow Metal Doors & Frames

By Rachel S. Smith

THE BUILDING PLANS CALL FOR A HOLLOW METAL door, the width has been determined by usage and occupancy of the building as per NFPA 101, *Life Safety Code*, and the height is either by function (such as in a factory) or aesthetics. Now comes the hard part: it may not seem like there is much left to specify on the door, but in actuality, there are a lot of options, such as gage, core, material, and considerations such as sound transmission (STC) and fire labels. Typically a 12-gage door is not used for a broom closet, and an 18-gage door is not used in a prison. But from there, where do you go to determine appropriate options for the hollow metal opening?

Recommended Selection and Usage Guide for Hollow Metal Doors and Frames was developed by the Hollow Metal Manufacturers Association (HMMA) to help solve these dilemmas. The first part of this standard, HMMA 805-12, reviews different criteria for each opening. The second part details openings in different International Building Code (IBC) occupancy buildings and defines how these criteria affect each

opening. It also lists recommended HMMA doors that would be applicable. The document can be found at www.hollowmetal.org in the technical literature portion of the website. It is highly recommended that you bookmark this standard or print it out and keep it handy at all times for reference.

The guide looks at the whole picture, from construction standards and specification to target application requirements. The goal is to ensure a long-term life cycle for each opening. Proper selection and correct installation and maintenance are the integral formula for ensuring that the opening reaches its full life.

Construction Standards and Specifications

The *Selection and Usage Guide* (HMMA 805-12) does not address the selection, use and application of door openings designed to resist the ravages of severe wind storm damage. An industry standard for these openings has not yet been published.

All charts and HMMA logo are courtesy of NAAMM.

The sections of the *Hollow Metal Manual* presented by HMMA that are used in this *Selection and Usage Guide* are the following guide specifications:

HMMA 860 *Hollow Metal Doors and Frames* – low-frequency usage and low-impact probability with less rigorous uses such as bathrooms, closets and offices in light commercial occupancy

ANSI/HMMA 861 *Commercial Hollow Metal Doors and Frames* – used in commercial work with continuously welded edge seam construction for use in entrances, meeting rooms, corridors and similar applications

ANSI/HMMA 862 *Commercial Security Hollow Metal Doors and Frames* – used where security against vandalism or break-ins is a major concern, such as exterior entrances, institutional, pharmaceutical and security locations

ANSI/HMMA 863 *Detention Security Hollow Metal Doors and Frames* – as stated, for security locations in detention facilities, along with

certain military installations
ANSI/HMMA 865 *Swinging Sound Control Hollow Metal Doors and Frames* – used where sound control is a factor, such as band rooms, auditoriums, areas near airports and secure government rooms
ANSI/HMMA 866 *Stainless Steel Hollow Metal Doors and Frames* – when stainless steel is required for corrosion resistance or aesthetics. Typical applications are aquatic centers, operating rooms and food processing facilities.

ANSI/HMMA 867 *Commercial Laminated Core Hollow Metal Doors and Frames* – for doors with laminated cores such as polystyrene and mineral coreboard. These can be used in most openings, including temperature rise doors for stairwells, entrances, corridors and meeting rooms.

HMMA 850 *Fire Rated Hollow Metal Doors and Frames* – This document is a summary of various configurations of fire-rated doors and frames available from HMMA members,

along with general information about fire-rated openings.

Performance Levels (Table 1)

Performance expectations include frequency of use, impact probability, abuse and maintenance. The lowest is Performance Level 1, Light Duty, and this covers building areas exposed to low-frequency usage and low probability of impact and abuse, such as closets and office doors. At this level, the minimum recommended gages are 18-gage frames with 20-gage doors. At the other end of the spectrum is Performance Level 6, Commercial Security. Here, the minimum recommended gages are 14-gage frames and 14-gage doors, although at this level we often see 12-gage frames with either 12- or 14-gage doors. These are for building areas exposed to elevated threat of intrusion, forced entry or ballistic attack, such as at government facilities.

There are other factors that will determine material thickness, such

Table 1

Performance Levels	Duty Minimum Thickness	Application & Description
1	Light Duty Frame = 18 gage 0.042" (1.06) Door = 20 gage 0.032" (0.81)	Building areas exposed to low frequency of usage and low probability of impact and abuse (i.e., closets, offices)
2	Moderate Duty Frame = 16 gage 0.053" (1.34) Door = 18 gage 0.042" (1.06)	Building areas exposed to moderate frequency of usage and moderate probability of impact and abuse (i.e., stairwells, classrooms, meeting rooms)
3	Heavy Duty Frame = 16 gage 0.053" (1.34) Door = 16 gage 0.053" (1.34)	Building areas exposed to high frequency of usage and high probability of impact and abuse (i.e., exterior and service entrances, recreational areas, health care)
4	Maximum Duty Frame = 14 gage 0.067" (1.70) Door = 14 gage 0.067" (1.70)	Building areas exposed to high frequency of usage and very high probability of impact and abuse (i.e., exterior and service entrances, recreational areas, psychiatric clinics, pharmaceutical)
5	Detention Security Frame = 14 gage 0.067" (1.70) Door = 14 gage 0.067" (1.70)	Building areas required to assure the containment of individuals in designated areas (i.e., cells, control and day rooms in detention and correctional facilities)
6	Commercial Security Frame = 14 gage 0.067" (1.70) Door = 14 gage 0.067" (1.70)	Building areas exposed to elevated threat of intrusion, forced entry or ballistic attack (i.e., infrastructure and government facilities)

as width, height, glass lites being used, or applications such as sound detention or radiation shielding.

The "Applications & Description" column in Table 1 defines when zinc-coated or stainless steel are appropriate and refers to other considerations that affect material thickness. It should also be noted that while gage is used in this document, the specifications should be

written with the decimal equivalent for each steel thickness (i.e., 16-gage should be specified as 0.053").

Frequency of Use (Table 2)

Cycling of a door (opened and closed) is the measure of frequency of use. These are categorized into three levels: low, moderate, and high. The frequency is an estimate

of the number of times the opening will be cycled per hour, and this varies greatly depending on the type of building and occupancy rate. The cycles are based on an eight-hour day, five days a week, 52 weeks per year. Obviously this will have to be modified for a store that is open 24/7 (such as a Walmart) or for a facility such as a camp that is only open during the summer. Doors can be tested and rated for their life cycle expectancy. For instance, a door that is rated for 500,000 cycles (Moderate Usage, Level B) could last a minimum of five years with 48 cycles per hour or 30 years with a usage of eight cycles per hour on average.

Table 2

Frequency of Use	ANSI A250.4 Minimum Cycles	Estimated cycles/hr. based on life cycle years					
		5 yrs.	10 yrs.	15 yrs.	20 yrs.	25 yrs.	30 yrs.
Low Usage	250,000 cycles (Level C)	24	12	8	6	5	4
Moderate Usage	500,000 cycles (Level B)	48	24	16	12	10	8
High Usage	1,000,000 cycles (Level A)	96	48	32	24	19	16

Table 3

Abuse Probability	Abusive Contact/Situation	Opening Examples
Low	<ul style="list-style-type: none"> • Periodic bumping by elbows, knees or shoulders • Typical manual opening and closing of the door • Cleaning equipment • Foreign objects holding door open 	<ul style="list-style-type: none"> • Offices • Dressing rooms • Private bathrooms • Closets (mechanical, plumbing, electrical)
Moderate	<ul style="list-style-type: none"> • Aggressive opening and closing • Moderate wind and weather exposure • Propping automatic doors open • Excessive slamming • Wheelchairs • Luggage • Maintenance carts 	<ul style="list-style-type: none"> • Stairwells • Corridors • Public bathrooms • Emergency exit doors • Janitor closets
High	<ul style="list-style-type: none"> • Potential forced entry • Automatic door operators • Access control • High wind and weather exposure • Gurneys, material handling equipment • Opening doors with body parts other than hand • Bodily impact • Hanging on doors 	<ul style="list-style-type: none"> • Main entrances • Classroom entrances • High-volume public access • Kitchens • Mechanical rooms • Medical exam rooms • Operating rooms • Factory, production, warehouse openings • Schools • Interior and service entrances to retail, financial institutions, government facilities

Normal Use and Operations

The industry standard performance test for evaluating hollow metal doors is performed under laboratory conditions and includes some periodic twisting as defined in accordance with ANSI A250.4. However, improper installation, inadequate maintenance or improper hardware adjustment will add significantly to the abuse factors. This will, in turn, reduce long-term functionality of all openings.

Abuse Probability (Table 3)

Abuse can cover a wide range of physical contact to the door by people or by foreign objects. Abuse probability is not just intentional abuse to a door, such as an angry person slamming a door shut or trying to break in. It is also more common abuse, such as hitting a door with luggage or the use of foreign objects to hold a door open. The abuse probability goes from low to very high and is another

factor in determining the correct door and frame for an opening.

Even the periodic bumping of doors with elbows, knees or shoulders factors into this category; these are typical of low abuse probability, and doors in this category are often found in offices, dressing rooms, and mechanical or electrical closets.

Wheelchairs, luggage and maintenance carts hitting doors all fall into moderate abuse probability, as evidenced by the doors at most airports.

The highest two levels of abuse include forced entry, high winds, people hanging on doors and vandalism.

Building Occupancy and Applications

In order to determine the applications, the occupancy of the building needs to be taken into consideration. Access control requirements must

also be addressed during the door, frame and hardware specifications development. In addition, it is critical to look at future occupancy of a building if it is being remodeled, such as an old mill building being turned into tenant condominiums or office spaces.

The next consideration is door construction from architectural requirements, application requirements and aesthetic requirements. Sometimes aesthetic requirements override the other choices, which can mean that the wrong door type is chosen for looks instead of for durability and usage.

Frame construction has similar requirements, but typically the aesthetics are a bit simpler and involve profile, elevation (such as transom frames) or materials (such as stainless steel). Like doors, frame construction and material thickness will depend on building occupancy and required performance levels.

IBC Occupancy Groups

The selection of hollow metal products is based on the IBC occupancy groups. These groups include everything from a low density of occupancy to the high occupancies of arenas and concert halls. For clarity and simplicity, HMMA targeted typical building examples in select IBC occupancy groups. The building examples in this document are:

- **Group A – Assembly**
- **Group B – Business**
- **Group E – Educational**
- **Group F – Factory**
- **Group H – High Hazard**
- **Group I – Institutional**
- **Group M – Mercantile**
- **Group R – Residential**
- **Group S – Storage**
- **Group U – Utility and Miscellaneous**

The durability of openings in any type of building construction depends on a number of variables to

Table 4

IBC OCCUPANCY Group E – Educational

Sample Listing of Opening Types Within this Occupancy

Typical Building Type E: High Schools

Ref. No.	Typical Building Openings	Special Notes	Frequency of Use	Abuse Probability	Door Performance Level						Recommended HMMA Construction Specification						Special Conditions & Options	
					1	2	3	4	5	6	860	861	862	863	865	866		867
1	Main Entrance	1, 2	High	High			○	●		+		①	④		②	③	①	2-way vision
2	Service Entrance	1, 2, 3	High	High			○	●		+		①	④		②		①	2-way vision
3	Stairwells	1, 4	Moderate	Moderate		○	●					①					①	2-way vision
4	Cross Corridors	4, 8	Moderate	Moderate		○	●					①					①	2-way vision
5	Public Restrooms	7	High	Moderate		○	●					①					①	

Door Performance Level Guide:

Door performance levels vary with the building's location and designed function.

To help the architect and specification writer, the following variations can be followed:

- = Consideration for areas of low-intensity occupation and minor risk of intrusion
- = Consideration for areas of typical to high risk of abuse, intrusion and/or vandalism
- +

+= Consideration for areas of very high risk of abuse, intrusion and/or vandalism

HMMA Construction Specification Guide:

The following is a guide to the proper selection and specification of hollow metal construction:

- ① = Recommended door and frame construction options
- ② = Acoustical requirements should be considered.
- ③ = Stainless steel could be used based on function or aesthetics.
- ④ = Commercial security construction is recommended in areas with very high risk of intrusion or severe vandalism.

The HMMA Selection and Usage Guide narrows down the options for each type of occupancy and the various opening types found within each building type.

accommodate the building function, the aesthetics and the increasingly important variable of occupancy security. All opening options must be in according with the IBC, local building codes and the Authority Having Jurisdiction (AHJ).

Within each occupancy group, anywhere from seven to 22 differ-



HOLLOW METAL MANUFACTURERS
ASSOCIATION

The Hollow Metal Manufacturers Association

(HMMA) is one of six divisions of NAAMM, the National Association of Architectural Metal Manufacturers. The other divisions are Metal Bar Grating (MBG), the Detention Equipment Manufacturers Association (DEMA), Architectural Metal Products (AMP), the Expanded Metal Manufacturers Association (EMMA) and the Expanded Metal Lath Association (EMLA). Literature for HMMA and a member directory can be found online at www.hollowmetal.org. More information about the other divisions can be found at www.naamm.org.

ent typical building openings have been defined. For this article we will use Group E, Educational, as an IBC occupancy group example. Part of the chart is shown in Table 4, with the key to the chart. Typical openings in this category include main entrances, stairwells, public restrooms, pool areas, gymnasiums, locker rooms, staff offices, cafeterias/lunch rooms, classrooms, band rooms and exit-only functions. In all, this category has 20 different typical building openings.

Each type of opening is analyzed for frequency of use, abuse probability and door performance level, and then a "Recommended HMMA Construction Specification Type" is assigned to the opening with options. There are also notes regarding special conditions and options. For instance, the band room has a note specifying acoustical openings, and the entrance doors have a note regarding two-way vision.

There are also sub-groups to this occupancy group based on type of school; day care facilities, elementary schools, middle schools and high schools all have different design considerations. For instance, the product abuse suffered in middle and high schools is not encountered in day care facilities.


Frame Selection Guide

Frame selection varies with wall details such as whether the masonry wall will be butted or

wrapped around with the frame or if there is a wood or steel stud wall. Existing block walls require different considerations. Frame construction is covered in detail in the NAAMM Standard HMMA 820, *Hollow Metal Frames*. This selection in the usage guide details typical jamb depths for various wall conditions and recommended anchoring.

This section also details wall stud sizes for drywall slip-on frames and jamb depths required depending on the number of layers of drywall on each side of the wall (one, two or three layers). Note that all of the jamb depths specified in the drywall slip-on section are based on 1/2" returns so that the throat is 1" less than the jamb depth.

Conclusion

Studies have shown that when people are overwhelmed with possibilities, they have trouble reviewing the options and making an informed decision. The *HMMA Selection and Usage Guide* narrows down the options for each type of occupancy and the various opening types found within each building type. This makes the selection process less daunting and becomes a matter of reviewing the selection criteria and picking an appropriate option. 

About the Author: Rachel S. Smith is president of Karpen Steel Custom Doors & Frames and has been in the industry more than 25 years, never missing a DHI Convention during that time. She is a frequent contributor to Doors & Hardware, has been a DHI instructor, and has presented a number of topics at DHI chapter meetings and DHI Industry Marketplace sessions. Rachel is also a member of the Promotions and Education Committee of HMMA. She can be reached at rachel@karpensteel.com.