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UNLOCKING THE SECRETS OF DOOR HARDWARE

Contents

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Unlocking the Secrets of Door Hardware

Part One

Understanding the New Accessibility Requirements for Doors

BY LORI GREENE, AHC/CDC, CCPR, FDAI

Understanding the **New Accessibility** Requirements for Doors

All images courtesy Allegion

THE 2010 *AMERICANS WITH DISABILITIES ACT* (*ADA*) STANDARDS FOR ACCESSIBLE DESIGN WENT INTO EFFECT IN MARCH 2012, BUT THERE ARE SEVERAL REQUIREMENTS THAT CONTINUE TO SURPRISE ARCHITECTS AND SPECIFIERS.

This article examines four particular changes related to doors on an accessible route:

- door hardware must now operate with 22.2 N (5 lb) of force—a limit most panic hardware does not meet;
- any low-energy automatic operators actuated by a motion sensor must meet the safety requirements for a full-powered automatic operator—possibly including safety mats and guide rails;
- the bottom rails of manual swinging doors must be at least 254 mm (10 in.) high, and no hardware may protrude from the push side within the bottom 254 mm; and
- automatic operators on doors that do not provide proper egress-side maneuvering clearance for a manual door must have standby power.

Some of these issues are specific to the 2010 *ADA*, while others are also addressed by International Code Council (ICC) A117.1, *Accessible and Usable Buildings and Facilities*. This standard is referenced by the *International Building Code* (*IBC*), *International Fire Code* (*IFC*), and National Fire Protection Association (NFPA) 101, *Life Safety Code*, for doors on an accessible route.

Operable force for door hardware

An editorial change was made to the 2010 *ADA* to limit the operable force for door hardware to 22.2 N (5 lb). Editorial changes are normally used to address errors or make clarifications that do not affect the scope or application of the code requirements. These changes do not go through the

A change submitted for the next edition of International Code Council (ICC) A117.1, *Accessible and Usable Buildings and Facilities*, would limit rotational force to 3 N-m (28 inch-pounds), and operation by a pushing/pulling motion to 66 N (15 lb).

normal code development process (*i.e.* committee hearings and opportunities for public comment). In other words, this change was unexpected.

In the 1991 edition of *ADA*, door hardware was required to have:

> a shape that is easy to grasp, and does not require tight grasping, tight pinching, or twisting of the wrist to operate.

This is the same language currently included in A117.1. No force limitation was mentioned with regard to the operation of hardware.

The 2010 edition of *ADA* changed the section that applies to door hardware, by referring to Paragraph 309.4–Operation:

> Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum.

By referencing Paragraph 309.4, a limit for the operable force of hardware was established.

Conflicts and clashes

This change created conflicts with other codes and standards, and even within the 2010 *ADA* standards. For example, in *ADA*, Section 404.2.9 addresses door and gate opening force—the force required to physically open the door. This section states the 22.2-N (5-lb) limit on opening force does not apply to the force required to release the latchbolts. This implies the allowable force required to release latchbolts could be greater than the 22.2-N (5-lb) opening force. The U.S. Access Board unofficially acknowledged that there was a conflict between the opening force section and the operable force required by reference, but to date the standards have not been modified.

Another conflict lies with *IBC*, *IFC*, and NFPA 101, for which panic hardware is required to operate with a maximum of 66 N (15 lb) of force to release the latch. In an attempt to establish a level of operable force aligned with other codes and standards, a change proposal was submitted for the 2015 edition of ICC A117.1. If approved, the proposal would establish a limit of 66 N (15 lb) maximum for hardware operated by a forward, pushing, or pulling motion, and 3 N-m (28 in.-lbs) maximum for hardware operated by a rotational motion.

Additionally, the 2013 *California Building Code* (*CBC*) includes language virtually identical to the 2010 *ADA* operable force requirements, and requires hardware to operate with 22.2 N (5 lb) of force, maximum. However, the code contains conflicting language in Section 1008.1.10–Panic and Fire Exit Hardware, which requires panic hardware to operate with a maximum of 66 N (15 lb) of force.

Given the change to *CBC* and the delay in addressing the conflict within the 2010 *ADA* standards, there are projects where the 22.2-N (5-lb) limit is being enforced for both lever-operated and panic hardware. For each project, a decision must be made regarding whether to use hardware meeting the requirements of *IBC* (and its referenced standard, ICC A117.1), or whether to specify hardware that meets the 22.2-N limit to avoid a conflict with *ADA* standards.

Actuators for automatic operators

From a codes and standards perspective, there are three basic types of automatic operators for swinging doors:

- power-assist;
- low-energy; and
- full-power.

Power-assist operators reduce the opening force so the door can be manually opened more easily, but some manually applied force is still necessary. These operators are usually activated by pushing or pulling the door, although occasionally a wall-mounted actuator is employed to reduce the force only for users who need that feature.

Low-energy operators are often used when the door will be opened manually by some users and automatically by others. The doors are subject to limitations on opening speed and force to curtail the generation of kinetic energy and the potential for injury. Further, they must be operated by a 'knowing act,' as described later in this article.

Due to these limits, most doors with low-energy operators are not required to have safety sensors, control mats, or guide rails. Both power-assist and low-energy operators must comply with American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156.19, *Power-assist and Low-energy-operated Doors.*

Full-power operators are typically found on high-use openings like the entrance to a grocery store or department store. These operators are not subject to the same restrictions on speed and force, and safety sensors or control mats and guide rails are required to prevent the doors from opening if someone is in the path of the door swing. Full-power operators must comply with ANSI/BHMA A156.10, *Standard for Power-operated Pedestrian Doors.*

The 2007 edition of ANSI/BHMA A156.19 introduced a requirement for power-assist and low-energy power-operated doors to be activated by a 'knowing act,' and this requirement carries forward to the 2013 standard. The 'knowing act' method may be:

- a push-plate actuator or non-contact switch mounted on the wall or jamb;
- the act of manually pushing or pulling a door; or
- an access control device like a card reader, keypad, or keyswitch.

The A156.19 standard also makes recommendations regarding the mounting location of a knowing act switch. Actuator switches should be located:

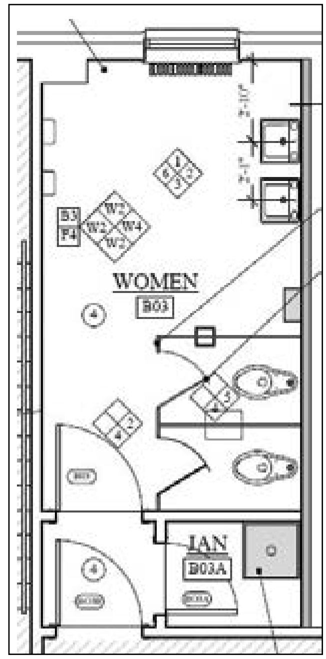
- a maximum of 3.7 m (12 ft) from the center of the door (0.3 to 1.5 m [1 to 5 ft] is preferred)—when further, the recommended increased hold-open time is one additional second per 0.3 m (1 ft) of distance;
- where the switch remains accessible when the door is opened, and the user can see the door when activating the switch;
- in a location where the user would not be in the path of the moving door; and
- at an installation height of 864 mm (34 in.) minimum and 1219 mm (48 in.) maximum above the floor.

The 2010 *ADA* and ICC A117.1 contain requirements pertaining to the actuators for automatic doors in addition to what is included in the referenced standard. Clear floor space for a wheelchair must be provided adjacent to the actuator, and beyond the arc of the door swing. The mounting height is variable, depending on the reach range associated with the switch location. However, the range that is recommended by ANSI/BHMA standards is acceptable for most applications. Actuators must not require tight grasping, pinching, or twisting of the wrist to operate, and the operating force is limited to 22.2 N (5 lb) maximum.

Stepping into the field of a motion sensor is not considered a knowing act. If automatic operation via a motion sensor is desired, automatic doors must comply with the standard for full power operators—ANSI/BHMA A156.10, instead of A156.19. This

A low-energy automatic operator must be actuated by a knowing act (*e.g.* this wall-mounted push button), or must comply with the requirements of the relevant Builders Hardware Manufacturers Association (BHMA) standard.

If a motion sensor is used to actuate a door with an automatic operator, then guide rails and safety sensors are typically required.



This door lacks proper maneuvering clearance on the egress side. If an automatic operator were to be installed to overcome this issue, the 2010 *ADA* requires standby power for the operator.

means that even though the door may have a low-energy operator, it has to meet the same requirements as a full-power operator, including the safety sensors or control mats and guide rails.

Typically 762 mm (30 in.) high, guide rails are required on the swing side of each door. For some locations, the need for guide rails may mean motion sensor operation is not feasible. When certain criteria are met, walls may be used in place of guide rails. When doors are installed across a corridor, guide rails are not required if the distance between the wall and the door in the 90-degree open position does not exceed 254 mm (10 in.).

The 2013 *California Building Code* requires two push-plate actuators at each actuator location—one mounted between 178 and 203 mm (7 and 8 in.) from the floor to the centerline, and the other mounted between 762 and 1118 mm (44 in.) above the floor. Vertical actuation bars may be used in lieu of two separate actuators, with the bottom of the bar at 127 mm (5 in.) maximum above the floor and the top at 889 mm (35 in.) minimum above the floor.

Actuators must be in a conspicuous location, with a level and clear ground space outside of the door swing. The minimum size for push plates is 102 mm (4 in.) in diameter or 102 mm square, and the minimum operable portion for vertical actuation bars is 51 mm (2 in.) wide. Both types of actuators must display the International Symbol of Accessibility.

While all these requirements have the same basic intent, it is best to check state and local codes to see which standard has been adopted, and what the specifics are in reference to actuators for automatic operators. It is important to verify the actuator type/quantity, location, and any additional requirements. Further, one must keep in mind additional safety features—including sensors and guide rails—may be required for low-energy operators actuated by a motion sensor.

Standby power for automatic door operators

The 2010 *Americans with Disabilities Act* includes revisions to the section on automatic doors with regard to clear width and maneuvering clearance. (These have not been included in A117.1 to date.) The *ADA* standards read:

404.3.1 Clear Width. Doorways shall provide a clear opening of 32 inches (815 mm) minimum in power-on and power-off mode. The minimum clear width for automatic door systems in a doorway shall be based on the clear opening provided by all leaves in the open position.

404.3.2 Maneuvering Clearance. Clearances at power-assisted doors and gates shall comply with 404.2.4. Clearances at automatic doors and gates without standby power and serving an accessible means of egress shall comply with 404.2.4. EXCEPTION: Where automatic doors and gates remain open in the power-off condition, compliance with 404.2.4 shall not be required.

According to both accessibility standards and egress requirements, most doors have to provide at least 815 mm (32 in.) of clear opening width. (For pairs of doors, at least one leaf has to provide this.) The aforementioned Paragraph 404.3.1 states that the required clear opening width must be provided "in power-on and power-off mode." The clear opening's full width is considered—for example, a 1.5-m (5-ft) pair of automatic doors would provide sufficient clear width even though neither leaf meets the minimum clear width for a manual door.

Maneuvering clearance for manual doors is addressed in Section 404.2.4 of the 2010 *ADA*. This section establishes the minimum space around the door needed by a wheelchair user to manually operate the door. The previously cited Paragraph 404.3.2 requires power-assisted doors and gates (manually operated but with reduced opening force) to have the same maneuvering clearance as manual doors. Automatic doors and gates serving an accessible means of egress without standby power would also need the required maneuvering clearance. Therefore, automatic doors and gates with standby power do not need the maneuvering clearance that would be required for a manual door.

If an existing door serving an accessible means of egress does not have the required maneuvering clearance and an auto operator is added to overcome that problem, the operator needs to have standby power (unless the door stands open on power failure per the exception). This applies to doors part of a means of egress that must be accessible in an emergency, and is intended to avoid entrapment of a person with a disability if there is a power failure. The standard does not include a requirement for how much standby power must be provided.

It is important to keep in mind automatic operators on fire-rated doors are required to be deactivated upon fire alarm. Therefore, an automatic operator with standby power should not be used on a fire-rated door to overcome maneuvering clearance problems because it will not be functional when the fire alarm is sounding.

Some jurisdictions require actuators mounted in two positions, or a vertical bar actuator that will allow the door to be operated by a hand/arm or a crutch, cane, or wheelchair footrest.

Manual doors on an accessible route must have a smooth surface on the push side with no protruding hardware within 254 mm (10 in.) of the floor or ground. In the photo above, these components could inhibit passage through a door opening by catching a crutch, cane, walker, or wheelchair.

Flush bottom rails

For many years, ICC A117.1 has included a requirement for a 254-mm (10-in.) high flush bottom rail on manual doors, and this requirement is now included in the *ADA* standards. The text of both standards is similar, except *ADA* also addresses existing doors. (This requirement appears in the "Manual Doors" section of both publications, so it does not apply to automatic doors.)

The purpose is to avoid projections that could catch a cane, crutch, walker, or wheelchair and inhibit passage through the door opening, so the requirement applies to the push side of the door only. The 254-mm (10-in.) measurement is taken from the floor or ground to the top of the horizontal bottom rail, extending the full width of the door. Prior to the 2003 edition of A117.1, the required dimension was 305 mm (12 in.).

The standards require the surface of swinging doors and gates within 254 mm (10 in.) of the finish floor or ground to have a smooth surface on the push side that extends the full width of the door or

Manual doors on an accessible route must have a smooth surface on the push side with no protruding hardware within 254 mm (10 in.) of the floor or ground. In the photo at right, these components could inhibit passage through a door opening by catching a crutch, cane, walker, or wheelchair.

gate. Narrow bottom rails and protruding surface bolts, surface vertical rods, kick-down stops, and full-height door pulls installed on the push side of the door would not comply with this requirement for a 254-mm (10-in.) high smooth surface. Horizontal or vertical joints in this surface must be within 1.6 mm ($^1/_{16}$ in.) of the same plane. If a kick plate is added to a door with a narrow bottom rail to resolve this problem, the cavity between the kickplate and the glass or recessed panel must be capped.

There are several exceptions to this requirement. For example, sliding doors are not required to comply. Tempered glass doors without stiles are not required to have a 254-mm (10-in.) bottom rail (if the top of the bottom rail tapers at 60 degrees minimum from the horizontal), but protruding hardware is not allowed in the 254-mm (10-in.) high area. Doors that do not extend to being within 254 mm (10 in.) of the finish floor or ground are also exempt.

As outlined in *ADA*, existing doors are not required to provide the 254-mm smooth surface, but if kick plates are added to widen the bottom rail, the gap between the top of the plate and the glass must be capped. Existing doors are not addressed by A117.1, which is typically used for new applications as referenced by *IBC*. Now the standards are consistent, and increased awareness and enforcement of this requirement seem likely.

Conclusion

With regard to these changes in the *Americans with Disabilities Act* standards, some accessibility requirements are not prescriptive and enforcement varies by jurisdiction. Therefore, it can be difficult to apply the standards, especially when conflicts exist. Additionally, some states have established their own accessibility standards. Following the most stringent requirements can help to avoid problems, and the local authority having jurisdiction (AHJ) can also provide assistance to determine what is required. **CS**

ADDITIONAL **INFORMATION**

Author

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Abstract

The 2010 *Americans with Disabilities Act (ADA) Standards for Accessible Design* has several requirements that continue to surprise architects and specifiers. This article examines changes to door hardware operable force, use of low-energy automatic operators, protrusions into egress, and the need for proper maneuvering clearance.

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C1030–Interior Doors

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Automatic operators
Bottom rails
Door hardware
Egress
Life safety


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Unlocking the Secrets of
Door Hardware

Part Two

Specifying Door Hardware

BY SCOTT J. TOBIAS, CSI, CDT, AHC

Specifying **Door Hardware**

Photo © BigStockPhoto/Kuzina

FAR TOO MANY DESIGN/CONSTRUCTION PROFESSIONALS FAIL TO PAY ENOUGH ATTENTION TO DOOR HARDWARE. IT DOES NOT MATTER HOW IT IS OPERATED, WHETHER A PUSH, PULL, KNOB ROTATION, OR DEPRESSION OF A PUSH BAR—IT IS TOO OFTEN GIVEN SHORT SHRIFT AS JUST A MEANS TO GET TO THE OTHER SIDE.

Virtually every building project will contain doors and hardware, starting with the entrance or possibly perimeter security. Despite the mundanity of these components, there are many considerations to specifying and using doors and door hardware such as life and fire safety, accessibility, security, and convenience of use—some of which can conflict and jeopardize lives. Fortunately, there is an industry standard to provide guidance to design and construction professionals.

The Door and Hardware Institute's (DHI's) *Sequence and Format for the Hardware Schedule* is specifically named for hardware schedules, but the same sequence and format is typically used for specifying door hardware sets in Division 08 architectural specification documents.[1] The specification documents are typically the responsibility of the architect, coordinated with a DHI-certified architectural hardware consultant (AHC), and used to estimate and understand what doors and hardware are required on a project.

When entering a building or space, the door hardware is often the first thing a person touches. This means it must be not only functional in terms of safety and security, but also aesthetically pleasing.
Photo © BigStockPhoto/aruba200

Once it is determined what is required, the entity furnishing the doors and hardware (*e.g.* a door and hardware distributor supplying through a general contractor) is responsible for the hardware schedule. This schedule is typically created from the specification and in conjunction with the drawings and is submitted back to the architect for approval prior to anything being ordered, furnished, or installed on the project.

The *DHI Sequence* is helpful with assisting anyone in the construction industry working with architectural door hardware. It brings a basic understanding of all the components and how they are applied to work with the total door opening. There are many products, functions, applications, and component combinations available to be specified, furnished, and installed. DHI's resource helps put order to the scheduling process to ensure all applications, codes, and components are reviewed for proper operation, compliance, and function.[2]

Categorizing the various types of door hardware

DHI divides door hardware into 10 sequenced sections in its standard.

1. Hanging devices

The first item addressed in the sequence is the hanging device. Although not typically a highlight of the door opening, the hanging device is one of the most important components. Supporting the entire weight of the door from the top, bottom, side, or a combination thereof, they are relied on for precise and consistent pivot-point swing or slide—hanging devices are probably the most actively used door opening components.

Depending on the type of door, function, and application, it can be hung onto a frame (of a door or an opening) or directly on a wall. A swinging door can be hung on hinges, continuous hinges, pivots, or floor closers, while a sliding door can be hung on tracks and hangers suspended from the top, underneath the head of a framed opening, on the face of the wall, or supported by the floor from underneath the door.

The most efficient and effective way to hang a door would be any means supported by the floor, rather than the frame or wall. In the latter cases, the door pulls away from the frame or wall, causing tension, whereas a door supported by the floor is resting on top and has no tension at all. Although a swinging door is the most common type, sliding door options and use have increased over recent years for their function, space-saving ability, and aesthetics.

2. Securing devices

Now that the door is hanging, the next part of the sequence is to secure it with devices such as bolts, bored or mortise locksets, fire-exit hardware, or deadlocks. When specifying or scheduling a pair of doors, the inactive leaf is always secured first—otherwise, the active leaf has nothing to secure itself into, leaving both vulnerable. In other words, the inactive leaf must act as the fixed material that the frame or wall would be for a single door opening.

Once the inactive leaf of a pair has been secured (or, only a single door opening is being specified), the proper securing device is then specified. There are many factors, options, and preferences to take into account when securing the opening, including function, building codes, life safety and fire codes, design, and personal preference. Sustainability can also be a factor when choosing the materials used to manufacture a product. When the life cycle is twice as long as another product of the same function, not only are healthier materials used, but they are also replaced less often, reducing labor and material needs, along with products being sent to the landfill.

When specifying any type of electrified hardware, operations descriptions (also known as operations narratives) should always be used. These are short paragraphs describing the operation of every part of the opening from either side, so the designer, installer, and user can all have the same understanding of what is supposed to happen at the opening at any given time.

It is very important to have the owner or user's input when specifying door hardware for proper functionality of use. When one decides how someone else will use a room or a door, it might not be exactly what that person has in mind. By coordinating the original specification with all parties involved (including the user, security consultant, installer, contractor, architect, distributor, and any other party affected), the results can be less mistakes and misunderstandings.

Elevation and point-to-point diagrams should also be required as part of the submittal process. Elevations provide an overview of what the opening looks like with all the components of the system connected. The point-to-point shows the system connections as well, but is geared more toward the actual wiring, including the colors and connections of each. A logic diagram might be used by the person who designed the system in order to lay out the system flow and process.

3. Operating trim
Once the door has been hung and secured, the third part of the sequence is to specify operating trim. Whether or not there is a locking device (*e.g.* mortise lockset or panic hardware), one must specify or schedule a door pull, push plate, or a push-pull bar. There are many different manufacturers and variations of operating trim to ensure something for all aesthetic tastes. Further, some manufacturers have the ability to fabricate custom design or patterns into existing operating trim.

4. Accessories for pairs of doors only
When working with a pair of doors, the next step in the sequence is to include the related accessories, including coordinators and carry bars. These devices help coordinate the closing and opening of certain pair of door applications.

Delayed egress fire exit hardware delays the release of the latch from the egress side with the intent to allow time for a responder, while not keeping the person in danger for longer than necessary.
Photos courtesy Scott Tobias

5. Closing and control devices
Closing and controlling a door is important for many reasons, including the protection of lives and materials, traffic control, security, and energy efficiency. Closing devices, also known as door closers, can be manufactured for different types of applications depending on the function, aesthetic, and frequency of use of the opening.

Surface-mounted, concealed overhead in the door or frame, and concealed in the floor are available for different applications with various options for each. A control device, also known as a door stop, can also be manufactured as different types (*e.g.* floor, wall, and overhead) in order to protect the door, frame, hardware, and the surrounding conditions. Sometimes, a closing device is erroneously used as a controlling device to stop the door from going past a certain point in the open position, which is not its intended application. (In all cases, a door stop of some sort, as described earlier in this article, should be used.) By misusing the closing device, the life of the opening will certainly be shortened, having to maintain and adjust the door, frame, and hardware time and again.

6. Protective plates and trim
Next in the sequence are protective plates, which defend the door as a layer installed on the surface of the door. Some doors can be very expensive to replace, so rather than damaging, dinging, denting, scratching, or ruining their surfaces, the plate can take the abuse. A protection plate is also typically less expensive to replace than an entire door.

7. Stops and holders
If floor or door closers with overhead stops are not applied, the next step in the sequence involves stops and holders. Plates and trim are not enough—the surrounding conditions must also be taken into account. The door and frame can be protected with floor or wall stops, floor or wall holders, and electromagnetic door holders.

8. Accessories
The next item in the sequence comprises accessories that include astragals, thresholds, weatherstripping, and gasketing. These hardware types are employed to seal the clearances around the perimeter of an opening. This can help with many issues, including:

- keeping sound, light, and smoke either in or out;
- maintaining energy efficiency; and
- helping contain indoor conditions inside the structure and the exterior conditions outside.

Although most weatherstripping and gaskets are surface-mounted or recessed installed, some manufacturers offer their door frames with gaskets already installed in kerfs where the rabbet meets the stop of the frame.

Flush pulls are an option for doors that do not require a locking or latching device—a publicly accessible closet might be an ideal application. Other reasons to choose pulls over locks or latches could be for the design intent or cost.

9. Miscellaneous items
From bumper guards, card holders, and coat hooks to signs, silencers, and viewers, this is the part of the sequence that miscellaneous items are listed.

10. Miscellaneous items
Yes, there are two categories for miscellaneous items. To this author, the main difference between the two seems to be the previous category contains hardware applied to the door (*e.g.* hooks and viewers), while this one contains items not installed directly on the door, such as computers, wiring diagrams, key switches, software, and wire.

Six important things to remember

With many other aspects of door hardware with which a specifier should be concerned, this article now explores six pertinent items that can help limit the amount of door hardware punch list items on a project.

1. Most door hardware components have to meet various codes and standards for minimum functionality and durability, depending on the device type.
Door hardware is affected by many building, fire, safety, accessibility, and other standards and codes. Some local jurisdictions have specific codes and standards for their own use.

2. ANSI and BHMA's standard refers to three finish designation systems.
In the co-published ANSI/BHMA A156.18, *American National Standard for Metals and Finishes*, the American National Standards Institute and Builders Hardware Manufacturers Association refer to a trio of finish designation systems:

- National Bureau of Standards of the U.S. Department of Commerce;
- Canadian Builders Hardware Manufacturers Inc.; and
- BHMA.

The BHMA finish designations provide more information in their number by stating not only the item's finish, but also its base metal. This is important when specifying fire-rated openings, as an example, to ensure there is a steel-based metal as required by National Fire Protection Association (NFPA) 80, *Fire Doors and Other Opening Protectives.* Otherwise, any other base metal, such as brass or bronze, would melt long before the time required by code, leaving the door vulnerable to fire hazard.

For instance, US26D is the U.S. designation for 'satin chromium plated,' while 626 is the BHMA designation for 'satin chromium plated on brass or bronze base metal,' and 652 is 'satin chromium plated on steel base metal.' This is important when specifying, ordering, and installing hinges on fire-rated doors, as they require steel-based hinges per NFPA 80.

3. Most hardware devices are tested to meet multiple minimum criteria, and depending on the levels met, grades are applied.
Grade 1 is the best-performing device passing the highest minimum standards, Grade 2 would be the next, and Grade 3 would be the lesser quality of the three. Procedures include cycle testing, which is the performance of how many times a device can be 'used.' For example, one cycle of a test would include such a lever handle of a lockset being rotated to retract and extend a latchbolt. Another example would be a door closer cycle—each time the door closer opens and closes would be one cycle.

Other examples include:

- impact testing where the devices are struck;
- weather or salt tests where the devices are exposed to outdoor weather to see how long they will last; and
- finish tests to see how long the architectural finish on the device will resist wear and the test of time.

4. Although many door hardware devices are not 'handed,' there are many devices that are.
'Handing' a device is determined by which way a door swings. A door hanging on the left and pushing away from the user is a left-hand door and a door hanging on the right and pushing away is a right-hand door.

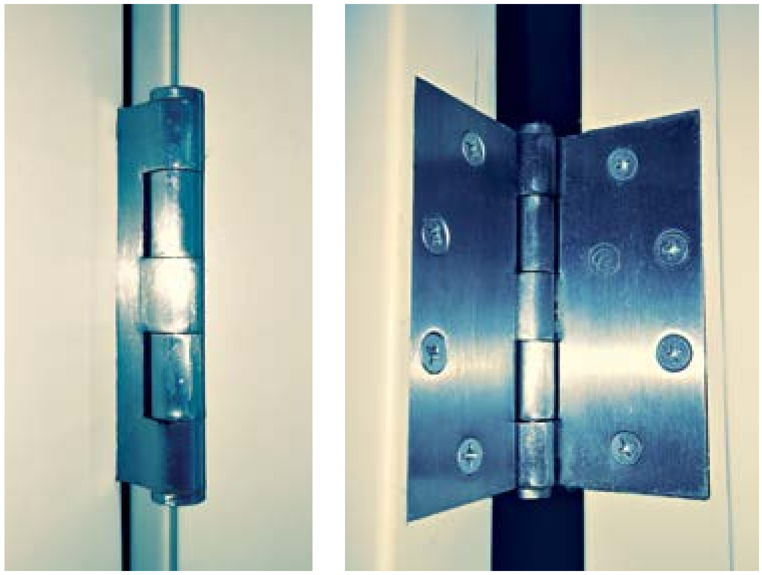
Reverse-handed doors are the opposite, as their name suggests. In other words, when a door is hanging on the left and pulls towards you, it is a left-hand reverse, and a door hanging on the right and pulling toward you is a right-hand reverse door.

5. Hardware schedules, also known as submittals, are typically created from architectural project specifications and drawings, which are created by an architect, typically coordinated with a DHI-certified AHC. Hardware schedules are created from the specifications typically by a door and hardware distributor employee. The schedule is typically submitted to the project general contractor or construction manager, who typically submits it to the project architect for approval prior to ordering and delivering to the jobsite.

While a vertical schedule is typically specified and preferred by an architect, this standard describes both horizontal and vertical formats. Project specifications typically specify that hardware schedules are required to be created by an AHC.

6. If product substitutions requests are allowed from what was originally specified, the request process is typically specified in Division 01 of the Project Manual, otherwise known as the specifications. The substitution request requirements are typically asking for product data and proof the requested substitution will meet the same grade, function, application, aesthetic, and quality of the originally specified product. It is recommended all substitution requests be submitted within the procedures as outlined in Division 01, Section 01 25 13 Product Substitution, and on CSI Substitution Request Forms.

One should be cautious of what is considered an 'equal,' as standards refer to the minimum standard, but there are some manufacturers, products, and solutions that go above and beyond these minimums. It is recommended substitution requests and approvals not be taken lightly as sometimes the substitution is proposed or taking place to strictly save money or to become more competitive on a bid to win the project contract to supply the door hardware without considering the item's quality or durability. Typically, with door hardware, you get what you pay for. This means if you are saving money on an item, it is likely it is not of the same standards and quality as the originally specified device.



A five-knuckle non-bearing hinge is one of the most commonly used hanging devices, along with the bearing five-knuckle hinge. Non-bearing hinges allow the knuckles to rub together, causing wear of the metal over time, while bearing hinges allow for a smoother operation and less friction.

A kickplate, also known as a protection plate depending on its height and application, is used to protect the face of the door in high use and abuse areas. This way, the face of the plate withstands the damage or elements, and can be replaced at a lesser cost than the replacing the door. Although available in most finishes, stainless steel is the most common.

Conclusion

Following the *DHI Sequence* can help ensure all components of an opening have been addressed and no items were missed. By going through each step in sequence, it is easier to focus on what is required—the opening comes together like a puzzle. It is also very important and necessary to coordinate with other relevant specification sections, such as hollow metal or wood doors. By cross-referencing sections, one can see where one product can affect another, such as with

A floor-mounted magnetic holder can be used to hold the door in the open position. This application would typically be tied into a fire alarm system—when the alarm goes off, power is cut off, and the door closes and latches as required by code or preference. These devices are also available mounted at the head of the door if the application and surrounding conditions allow.

coordinating door and frame preparations for hardware or the coordination of who furnishes materials such as a power supply. These are both typical items that can be assumed by others, and can be missed or left out of a bid, submittal, or, worse, installation when the building is ready to open.

With all the items to take into consideration, one can see why a door opening is not something to just walk through. Among other things, with the proper components or assemblies, applications, functionality, code and standard compliance, and installation, lives

The manual flush bolt is typically specified, furnished, and installed in pairs—one at the top edge of the inactive door, and one at the bottom. Manual flush bolts cannot be used on fire rated doors as they require manual operation to secure the door leaf in place, while the codes require automatic latching at the time of a fire. In this case, automatic flush-bolts are an option.

can be saved and things will operate the way they are intended for the user without the massive punch list issues for which door hardware can be known. **CS**

Notes

[1] With roots dating back to 1934, DHI is a paid annual membership-based association formed from two other industry groups—National Builder's Hardware Association (NBHA) and American Society of Architectural Hardware Consultants (ASAHC). As the industry resource for door opening standards, all industry professionals including contractors, manufacturers, distributors, sales representatives, building officials, facility managers, architects, and others turn to DHI for education and certification.

[2] This article has been excerpted and adapted from the author's book, *Illustrated Guide to Door Hardware: Design, Specification, Selection* (Hoboken: John Wiley & Sons Inc., 2015). Used with permission.

ADDITIONAL **INFORMATION**

Author

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Abstract

Found in virtually every building, door hardware often gets short shrift when it comes to attention to detail—this despite it is usually the first thing a building owner will touch. This article takes a look at the Door & Hardware Institute's (DHI's) *Sequence and Format of the Hardware Schedule*, which is the industry standard for specifying hardware sets in specifications, and detailing submittals for approval.

MasterFormat No.

08 06 71–Door Hardware Schedule
08 71 00–Door Hardware

UniFormat No.

B2050–Exterior Doors and Grilles
C1030–Interior Doors

Key Words

Division 08
DHI Sequence
Door hardware


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The EKU Porta 100 G embodies all the superior qualities of the EKU Porta product group and utilizes a simple yet reliable glass clamp to secure the door with friction alone. The combination track can be wall or ceiling mounted and designer fascia panels made of aluminum or wood can be easily clipped into position. The EKU soft closing mechanism can be added at the time of installation to leave a lasting impression of quality and sophistication.
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Unlocking the Secrets of Door Hardware

Part Three

The Standard for Hardware Performance

BY MICHAEL TIERNEY

The Standard for **Hardware Performance**

How specifiers can use BHMA standards to ensure safety and access

All photos courtesy BHMA

SCHOOLS, HOSPITALS, AND GOVERNMENT BUILDINGS SHARE ESSENTIAL CHARACTERISTICS; THEY HOUSE SENSITIVE INFORMATION, ARE DESIGNED TO BE USED FOR LONG PERIODS, AND HAVE PUBLIC RESPONSIBILITIES. SPECIFIERS AND BUILDING MANAGERS MUST ENSURE SAFETY AND SECURITY NEEDS ARE MET BY SELECTING THE APPROPRIATE DOOR HARDWARE.

The suite of Builders Hardware Manufacturers Association (BHMA) standards is a tool for architects, designers, specifiers, and engineers working on non-residential, public projects to help ensure buildings are accessed and used as intended.

The industry group is composed of U.S. manufacturers in categories such as:

- cabinet hardware and hinges;
- sliding and folding doors; and
- power doors and components.

BHMA is the only U.S. organization creating standards for builders hardware through the American National Standards Institute (ANSI). ANSI/BHMA standards are written criteria defining appropriate operation, test values, and safety criteria for builders hardware products. In addition to ensuring hardware quality and performance through its development of standards, BHMA sponsors third-party certification of hardware products.

The standards certify essential products for daily use, including locks, hinges, exit devices, and gaskets.

What are BHMA standards used for?

As quasi-public buildings, hospitals, schools, and government facilities must balance safety and security with openness and use. BHMA standards provide specific information on the way materials are tested for certification. What is relevant in the lab should prove relevant to real-world use.

All BHMA standards have certain elements in common including:

- designated criteria of performance for the product;
- product performance levels;
- expectations for use of products; and
- tests the product has passed.

The most important features are evaluated in terms of security, durability, strength, finish, and operation. The results garnered from tests allow specifiers to answer the questions of "how does it work?" or "how do I want it to work?"

The three steps of the certification process are:

- independent testing;
- statement of compliance; and
- third-party follow-up testing and auditing.

When a product has been certified and tested under these standards, it will then be listed in BHMA's *Certified Products Directory*, along with applicable model and type numbers.

Most of these standards provide a numbering system that uniformly applies to all tested builders hardware. Therefore, specifiers acquainted with the standards can look at a hinge standard, see the specific numbers assigned to it, and know what level of performance it is expected to achieve. This gives a common language to the industry and, depending on the standard, can include a lot of information.

How to read a BHMA Certification

Using the example of a hinge specification, type numbers will read as:

A2412

Where:
A–Section A;
2–Material (Wrought Brass or Bronze);
4–Type (Half Surface Hinge);
1–Description (Anti-friction Bearing); and
2–Performance Grade (Grade 2).

After consulting the BHMA certification number of a project, a specifier or engineer can determine whether the product performs the required task.

Grades are determined by tests designed to measure a product's performance capabilities. They assist the specifier in determining which product is most appropriate for a project. Performance assurance is especially important for products that have an impact on life safety and security. For those less familiar with builders hardware, definitions for the products and technical jargon are included throughout the standards. (See "Builders Hardware Terms.")

After the specification process, these standards can also be applied to help facility mangers determine if a product is operating correctly, and to ensure it was installed and made for the right purposes. For example, when an exit device is pushed, it should not require more than 67 N (15 lb) of force, as stated in the standards. Also, many of the standards for builders hardware come with illustrations for better specification.

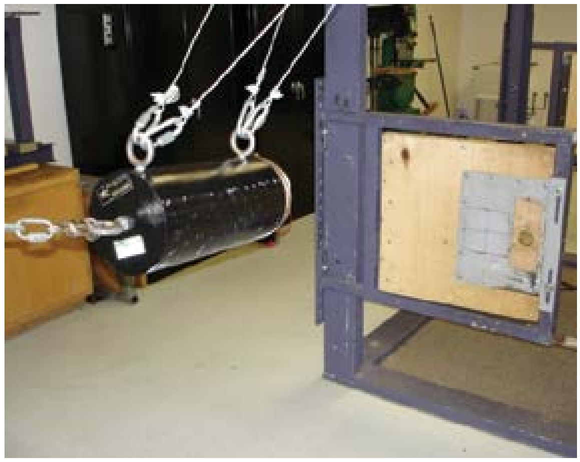
As mentioned, builders hardware impacts life safety and security, and it is therefore one of the few categories of functional hardware that is specified. These components are subject to repeated use and wear, yet must withstand constant operation. The standards are not designated for use by facility type, but some facilities tend to rely on certain standards.

Hospitals

Hospitals have a large number of practical and operational matters to take into consideration during design planning. They must be functional for staff and personnel, while also providing easy access for patients with limited mobility. By limiting the amount of touch surfaces, which can pass germs in highly trafficked areas, the potential for spreading infection is minimized. Also, as a highly populated building, a hospital must meet safety and fire requirements when it comes to builders hardware.

Low-power-operated doors are fairly common throughout many hospitals. BHMA 156.19, *Power-assist and Low-energy Power-operated Doors*, deals with assemblies that allow patients to easily navigate and access the hospital. They also have the added benefit of making it unnecessary to touch a handle. Placing sensors in front of doors that open when someone walks in front of them helps reduce potential for the spread of germs and infections through touching a handle or button.

Builders Hardware Manufacturers Association (BHMA) product certification signifies a product meets the American National Standards Institute (ANSI) and BHMA standards.



The main third-party testing facilities include Underwriters Laboratories (UL), Architectural Testing Inc. (ATI), and Intertek Testing Services.

Push/pull passage locks offer a similar benefit. They are often specified for patient rooms to provide privacy, but they can be opened without a lever so nurses or other staff members can exit or enter the room with their hands full.

Hospitals also commonly rely on BHMA 156.24, *Delayed Egress Locks*. For a patient suffering from dementia and requiring a certain level of security in a hospital, wandering can be prevented by using the features of a delayed egress lock. However, the hospital must balance egress during an emergency situation with the security needed to keep patients safe. A delayed egress lock does this by activating an alarm to notify personnel the door is being used, but will open within 10 seconds to allow for exiting during an emergency. Specifiers must be acutely aware of situations like this in a hospital, and the BHMA standards are essential to properly executing this process.

Hospitals often use National Fire Protection Association (NFPA) 101, *Life Safety Code*, which includes references to the BHMA standards, including those for exit devices and low-power-operated doors.

BUILDERS HARDWARE TERMS

Builders hardware—sometimes referred to as architectural hardware, building hardware, or finish hardware—consists of products mounted onto the moving parts of buildings (*i.e.* doors, windows, or drawers) in order to move, fasten, or protect them. Examples of builders hardware include:

- locks;
- latches;
- cabinet hardware;
- hinges;
- door hardware;
- door closers;
- exit devices;
- power doors;
- sliding doors; and
- folding doors.

Mortise lock

This type of lock fits a rectangular cavity in the edge of a door. A round hole in the face of the door receives a spindle to which knobs or levers are attached. If key-operated, a second round hole above the first receives the cylinder(s) and thumbturn.

Auxiliary lock

An auxiliary lock has a latch-bolt or dead-bolt operated by a key, thumbturn, or both. This lock is often used in addition to another lock, which may or may not be key-operated, but which has a latch bolt operated by knobs or levers.

Cylinder

The cylindrical sub-assembly of a lock containing a cylinder plug with keyway and a cylinder body with tumbler mechanisms.

Automatic closing

A code term involving the permitted practice of holding a fire door in the 'open' position providing the door closes upon detection. Generally, the detection must be from the presence of visible or invisible particles of combustion.

Exit device

An exit device is also called panic device, panic hardware, panic bolt, and crash bar. It is a type of lock having an inside release bar. When depressed, the release bar (*i.e.* crossbar or push pad) retracts the latch bolt, permitting the door to be opened. **CS**

The ANSI/BHMA standards ensure high-quality, safe products meet the market.

Schools

Schools face a particular set of challenges in their design and operation, but they are not necessarily much different than those posed by other buildings being discussed.

Similar to other public buildings, schools must meet requirements for assembly areas. Exit devices, also known as 'panic devices,' are common. Mostly used in auditoriums and gymnasiums, they are required for educational occupancies that can be highly crowded and difficult to escape. The devices employ a release bar across the door that, when pushed, releases the latch bolt and allows the door to easily open.

Many schools employ door closers, especially as they are required on fire doors. For example, a door in a location designated to help stop a fire from spreading (*e.g.* fire partition, fire barrier, or fire wall) needs a closer to ensure it is completely closed. The testing for Grade 1 door closers endure two million cycles, to make certain the best products do not fail when they are needed. The full array of requirements for their performance is described in ANSI/BHMA A156.3, *Exit Devices*.

BHMA standards for schools also include ANSI/BHMA A156.2, *Bored and Preassembled Locks and Latches*, and ANSI/BHMA A156.13, *Mortise Locks and Latches, Series 1000*. These bored and mortise locks provide a special classroom function; they enable a door to be secured from the outside solely with a key—this way a teacher cannot be locked out of the room.

For schools, nothing less than Grade 1 products generally suffices, meaning products tested and certified perform at the highest level under the toughest conditions. All builders hardware in schools need exceptional durability and strength for the long-term wear and tear that will be put on the products. Tests such as the vertical load test are not much different than the stresses these products actually face once in use.

Government buildings

Government projects can include any number of facilities such as local police stations, town halls, and municipal buildings. A key focus on these buildings is security, both of sensitive materials and personnel. Top-grade builders hardware—such as locks that are certified by BHMA—are essential to ensuring top-level security.

BHMA A156.30, *High-security Cylinders*, is commonly used for government buildings with features over and above typical cylinders. Products under this standard must pass three categories of tests: key control, destructive, and surreptitious.

Key control means limiting accessibility to key blanks, such as creating no markings on the keys or leaving trails of the bittings (the geometry of a key) or serial numbers; it also applies to electronic locks that control the audit trail and time-zoning. For destructive tests, the locks undergo drilling and impact evaluations over and above the normal amount. Surreptitious tests seek to ensure a lock provides safety against picking. They ensure high levels of resistance to picking and bumping, which are common lock-breaking techniques.

BHMA-compliant hinges have anti-friction bearings so they hold up for long-lasting use. For higher security use, hinges with non-removable pins that perform at Grade 1 level are tested to withstand 2.5 million cycles.

In addition to high-security cylinder locks, all the lock and exit device standards have security concerns designed into them. Latching products have security operating hardware standards as well.

While government buildings are rightly focused on security, they also have access needs, to ensure smooth functioning in places often visited by the public. Power-operated doors produced to ANSI/BHMA A156.10, *Power-operated Pedestrian Doors*, and ANSI/BHMA A156.19, provide access by automatically opening. In some doorways, levers have replaced knobs.

Government buildings must often follow International Code Council (ICC) A117.1, *Accessible and Usable Buildings and Facilities*, for accessible routes. The operable part of a door in this case must be functional with one hand, and should not require tight grabbing or twisting of the wrist. Buildings following this code need to consult BHMA standards for lever locks, exit devices, or power-operated doors to ensure compliance.

Certified products

BHMA primarily concerns itself with safety and performance, but builders hardware is also expected to be functional and attractive. It is imperative to ensure the finish holds up on any visible components, and are subjected to constant wear and tear.

BHMA ensures this under A156.18, *Materials and Finishes*. Products with certifications for finishes undergo testing—such as salt spray, ultraviolet (UV), hardness, humidity, and solvent resistance—to ensure a product will not scratch, corrode, or discolor. A product frequently touched generally has higher requirements than a product not in constant contact with users, such as a door closer.

A BHMA-certified product can be distinguished from other products by the "BHMA Certified" logo on the product or its packaging. A list of certified products can be found in the BHMA *Certified Product Directory*.[1]

Conclusion

Designing a building or facility for both ease of access and security is a complex task. It can often come down to the details of whether or not a plan is successful. Relying on the BHMA standards allows specifiers and architects to ensure the builders hardware they use will help them bring plans to life. **CS**

Notes

[1] The complete directory can be viewed online at www.buildershardware.com/cpd_entry.html.

When tested for compliance with ANSI/BHMA standards, products undergo repetitive tests to ensure the product holds up under repeated use.

ADDITIONAL **INFORMATION**

Author

Michael Tierney has been the standards coordinator for the Kellen Company since 1999. He coordinates the development and revision of 35 Builders Hardware Manufacturers Association (BHMA) performance standards covering a broad range of products form gaskets to hinges to power operated doors. Tierney is a principal member on technical committees for the National Fire Protection Association (NFPA), the International Code Council's (ICC's) A117 Committee for Accessible Buildings, ASTM, and American National Standards Institute (ANSI). He can be contact via e-mail at mtierney@kellencompany.com.

Abstract

Certain facilities such as hospitals, schools, and government buildings would all benefit from making full use of Builders Hardware Manufacturers Association (BHMA) standards for builders hardware and BHMA-certified materials. Hospitals, schools, and government buildings all contain sensitive information, will be occupied for a long period, and have certain public responsibilities. By relying on the BHMA standards, managers of these kinds of facilities can ensure they are prioritizing safety and security in areas of their buildings where that is the priority, or open and long lasting use where that is the priority. This article will explain how to make full use of the BHMA standards for the needs of these facilities.

MasterFormat No.

08 06 71–Door Hardware Schedule

08 11 00–Metal Doors and Frames

08 34 53–Security Doors and Frames

UniFormat No.

B2050.90–Exterior Door Supplementary Components

Key Words

Division 08

American National Standards Institute

Builders Hardware Manufacturers Association

Builders hardware

High-security locks

Unlocking the Secrets of Door Hardware

Part Four

Layering Security Controls for Healthcare Projects

BY MARILYN A. COLLINS, EDAC

Layering Security Controls for Healthcare Projects

Photo © Bigstock.com

IT IS NOT DIFFICULT TO IMAGINE THE NEED FOR SECURITY IN HEALTHCARE ENVIRONMENTS. WHERE ARE THE EYES AND EARS ENSURING THE SAFETY OF A NEWBORN TRANSPORTED FROM LABOR AND DELIVERY? CAN FAMILY MEMBERS VISITING A SICK RELATIVE BE CONFIDENT THEIR VALUABLES ARE SAFE AT BEDSIDE IF THEY LEAVE TO GRAB A SNACK? WHAT SECURITY PRECAUTIONS ARE TAKEN WHEN A REAR EXTERIOR DOOR TO THE HOSPITAL IS PROPPED OPEN SO STAFF CAN TAKE A BREAK?

Of course, there are numerous other considerations. For example, an employee might notice certain supplies diminishing on a regular basis—how does the hospital protect clinical, professional, administrative, and environmental staff from suspicion of diverting equipment or even medication? When there is an influx of visitors during the shift change on the behavioral health unit, and an anticipated increase in patients through the Emergency Department due to a rapidly spreading virus, what are the visitor tracking and patient protection procedures to ensure safety for everyone—even in the case of

> The security department is the heartbeat of the hospital with regard to protecting the systems providing for the facility.

a possible epidemic or weather-related crisis? There is also the matter of satellite functions and procedures performed by a hospital system at remote ambulatory care facilities and medical office buildings tied to the main building via an access control system.

Consideration of these and many more facets of hospital life provoke a host of thoughts about security, convenience, and safety (for patients, visitors, and staff alike), along with energy efficiency and resilience in the face of disasters. These are weighty topics requiring input from virtually every department in the hospital. Together, they form the 'Environment of Care' (EOC).

The EOC comprises three basic elements: building and space, equipment, and people. The first step in planning for this complex environment is to identify the stakeholders and decision-makers invested in the outcomes—whether related to compliance, the delivery of care, or the successful protection of people and assets.

While design/construction professionals are obviously not part of all the related choices and factors in a healthcare project's creation and operations, their decisions and collaboration with the building owners can have important impacts.

Understanding stakeholders in the healthcare environment

Major departments in the hospital are now collectively involved in decisions affecting patient safety, Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores,[1] building design, access control, and employee training. No longer are decisions made in the vacuum of one's own department or even within the confines of a single hospital.

Consolidation and acquisition in healthcare, as well as the requirements for reimbursement from the Centers for Medicare and Medicaid (CMS) have changed the game. Healthcare administrators, operations personnel, and virtually every department have recognized decisions made in one area of the hospital system may affect every other one. This domino effect can affect a hospital's reputation.

For instance, if a hospital selects a unique or proprietary access control system, and then is acquired by a parent healthcare system, the parent may be constrained in its ability to cascade an efficient open architecture solutions across the entire healthcare system. Myriad results may include having to carry several 'badges' or credentials, increasing the complexity in accessing the hospitals in the system.

Every hospital wants its reputation to get the highest marks for welcoming families, caring for patients, retaining staff, and securing supplies, medical equipment, and controlled substances. As hospitals adjust to the various changes that are associated with the *Affordable Care Act* and cope with other changes in the delivery of care, consensus building and collaboration become the basis for making decisions.

The security department is the heartbeat of the hospital with regard to protecting the systems providing for the facility. However, the built environment itself is a critical element in both security and in healthcare delivery—design/construction professionals can also have a major role, both directly and indirectly.

Additionally, there is often a 'compliance department' spanning the many agencies, ensuring compliance with life safety regulations such as National Fire Protection Agency (NFPA) and other authorities having jurisdiction (AHJs). Other critical guidelines and compliance elements include the *Americans with Disabilities Act* (*ADA*), *Health Insurance Portability and Accountability Act* (*HIPAA*), and Facility Guidelines Institute (FGI).

The U.S. federal government supports the delivery of healthcare for a large percentage of the population through Medicare and Medicaid. CMS authorizes reimbursement for medical services provided to qualified recipients. The administration of such reimbursements includes a process 'deeming' each hospital worthy of the payment according to certain standards, which are surveyed or monitored by organizations such as Press Ganey, the Joint Commission, Healthcare Facilities Accreditation Program (HFAP), and DNV (*i.e.* National Integrated Accreditation for Healthcare Organizations [NIAHO]). Since a large percentage of hospital revenue comes from CMS, compliance with these 'deeming' bodies is a high priority.

Multidisciplinary committee decision-making, involving representatives from the above departments, regarding 'layering' security is the new normal in healthcare. Such decisions are put through a five-lens filter measuring the impact on patients, families, staff, physicians, and cost. The Joint Commission requires all hospitals they survey to develop and implement a performance improvement framework for their processes affecting the safety of patients and everyone else entering the hospital, the security of everyone having access to the hospital, including fire safety and emergency operations.

Each hospital should perform an annual risk assessment to point out the need for a security plan for the entire hospital facility or system. This security plan is a major factor in compliance, as well as improving the 'patient experience.'

Online access control—either hardwired or wireless—provides centralized control over facility doorways.

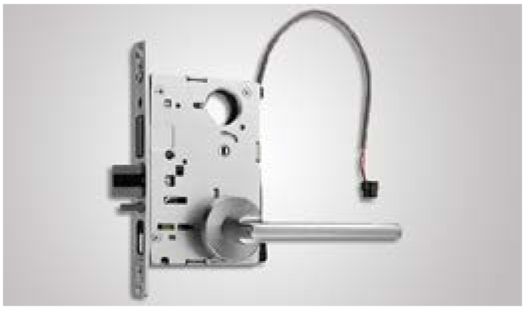
Images courtesy Assa Abloy Door Security Solutions

Layering security

All this information forms the basis of the 'who/what/when/where' of a security system, which is an exercise in layering security vertically and scaling that security plan horizontally. Once the stakeholders and decision-makers have been identified, the hospital can creatively scale security solutions to match the risk associated with each opening. This allows the hospital to maximize the security plan while staying within a budget. High-security areas may require more sophisticated online solutions, while lower-risk ones could need simpler, offline products. The hospital has far more flexibility in designing a security system in this manner.

The typical steps for security system design are:

1. Define users (*e.g.* clinical staff, general public/visitors, patients, those with disabilities, other populations within the hospital).
2. Identify estimated budget.
3. Determine the specific areas of greatest concern (*e.g.* nursery, intensive care units [ICUs], medication stations, pharmacy, supply cabinets, exterior visitor entrances, employee entrances, linen storage, nurse servers, patient rooms, staff lockers, and stairwells).
4. Assign the frequency of use (*e.g.* high-traffic or low-use areas).
5. Document locations in the building subject to fire/egress codes such as NFPA 101, *Life Safety Code*, and NFPA 99, *Healthcare Facilities Code*, or the *International Building Code* (*IBC*). In many instances, the hospital has employed PIN-based devices that do not offer an audit trail or specific, individual accountability. Simply providing one code per unit or department for a push-button lock does not identify individuals who may have access to medicines or supplies. In some cases, the 'confidential' codes to access these doors are written either on the doorframe or on a sticky note nearby. Such locations would be suitable for re-evaluation.
6. Assign a level of security (*e.g.* general access, high security, lockdown areas).



Most healthcare facilities have sustainability goals. Modern electronic door locks, which can be 99 percent more energy-efficient than previous-generation locks, help meet sustainability targets.

Every door opening, including pharmaceutical storage cabinets, can benefit from online access control to ensure safety and security.

7. Add sustainability requirements such as energy efficiency and/or Leadership in Energy and Environmental Design (LEED) goals. Doors contribute to significant energy loss from the building envelope. Furthermore, many of these facilities now require environmental product declarations (EPDs) and/or health product declarations (HPDs).
8. Build in infection control by specifying antimicrobial coatings.

Reviewing the door hardware and security device options

Once the committee has identified and agreed on these factors, selection of devices (and the platforms they require) can begin. Frequently, security consultants, door and hardware manufacturers' representatives, and end-user specialists provide valuable details for product selection. This may include performance specification, integration to third-party access control systems, or maintenance plans.

Online access control

Until recently, the only option for online access control was to hardwire every opening. This technique can be desirable (and even necessary) where immediate lockdown or egress might be required—for example, in the case of stairwells. However, the expense of hardwiring, particularly in the case of a retrofit application, can be cost-prohibitive. Adding in the expense of qualified, licensed electricians and other professionals can raise the actual installed costs much higher than expected. There are other ways to accomplish online access control employing two similar platforms as discussed in the following sections.

Wi-Fi

Most hospitals are equipped with a Wi-Fi network that can be employed as the platform for access control. The main advantage of using Wi-Fi is it is an ideal solution for non-critical openings that still require monitoring, audit trail, and secured access. Wireless devices provide a secure encryption for access codes and, in many cases, can use the existing badge or credential currently employed by the hospital.

Another advantage of a Wi-Fi device is access decisions are authorized 'locally,' meaning the locking device does not have to 'check in' with the access control panel. Additionally, a record of transactions is maintained in the device at the door.

Wireless

Typically, a wireless device requires a hub or interface that is actually hard-wired back to an access control panel. One advantage with the wireless devices is the card reader (or integrated reader/lock) can be applied directly to the door, making for an aesthetic and cost-effective application. Further, these devices are often ideal for otherwise-difficult applications, such as historical buildings, stone assemblies, or extra thick walls. Since the hub or interface is above the ceiling, the installation of the device on the door is faster and causes far less disruption for the hospital. Additionally, the programming of wireless devices is typically done right at the access control system and access can be provided to anyone at the time of on-boarding.

Power-Over-Ethernet (PoE)

This platform uses the network power provided by the Cat 5 or Cat 6 cable installed throughout the hospital. The main advantage of PoE is the significantly reduced energy cost. Devices on PoE act just like hard-wired devices and provide immediate tracking on the access control system.

Balancing security and design, today's healthcare facilities place greater attention on their aesthetics, including the design of doors and hardware.

Offline devices
Some non-critical areas of the hospital are not necessarily the object of inventory shrink or losses due to 'diverting' of supplies. This may include soiled linen rooms or even staff restrooms. Such areas can be secured with PIN-pad-only devices that do not provide audit trail or monitoring.

Electronic cylinders
Often referred to as 'portable security,' some electronic cylinders can replace existing mortise cylinders and provide simple access control. These devices use a battery-powered key to program the cylinder locally or it can be web-based. Another advantage is electronic cylinders are available in a number of form factors that allow application to remote or fenced areas of the hospital campus, such as large equipment storage where padlocks might be used. Other areas might include a cash office or the cabinets on trucks or other areas. This type of platform is particularly effective where there are fewer than 50 users.

The objective of this exercise is to 'scale' the security solution to fit the unique needs of the hospital or system. Most of the platform solutions can be cascaded across an entire healthcare system—even one with locations in different states.

Facility operations

Other aspects of facility operations can also be addressed simultaneously with security.

Aesthetics
As part of the drive to improve patient outcomes, many healthcare facilities feature pleasing designs that create a relaxing atmosphere. Decorative doors and hardware deliver security without sacrificing design.

Resiliency
Geography determines whether or not specialized door openings are needed to protect against hurricanes or tornados. Door opening assemblies tested to withstand destructive storms will help a healthcare organization continue normal operations once the danger has passed.

Sustainability
Hardwired locks that draw low power consumption and insulated doorways that block heat transfer and air leakage improve the energy efficiency of a facility and help meet sustainability goals. Any transparency statements tied to these products will verify their contents and ensure they are free of harmful chemicals.

> Each hospital should perform an annual risk assessment to point out the need for a security plan for the entire hospital facility or system. This security plan is a major factor in compliance, as well as improving the 'patient experience.'

Sound attenuation

Peace and quiet are hallmarks of a restorative environment. Having Sound Transmission Class (STC)-rated doorways on patient rooms blocks out the noises accompanying the hustle and bustle of a hospital hallway.

Loss prevention

Pharmaceutical distribution, storage cabinets, employee lockers, and server cabinets containing sensitive data are prone to theft. These small 'doorways,' typically on cabinets, can be protected with a new generation of cabinet locks that connect wirelessly with the building security control system. The locks communicate with a nearby hub that relays signals back and forth with the central system. Therefore, these often-overlooked doorways, even when found on a portable cart, are now incorporated as another layer of security that can be monitored and tracked.

Conclusion

With the wide range of locking technologies now available, it is easier than ever to tailor the access control capabilities of each opening to match its exact security needs. Hospitals can implement varying degrees of access control at each opening whether it is a loading dock on the building perimeter or a cabinet door in a patient room and everything in between. The locking technologies employed at each opening mesh together and operate seamlessly with the building control system to create a fully secure facility.

Successfully layering security in this manner requires input from all stake-holders to identify risks, applicable codes, and regulations that need to be met, alongside sustainability goals, aesthetic preferences, and budgetary concerns. When the needs of each stakeholder are mapped out vertically, security solutions can then be layered horizontally to achieve the desired goals and deliver the best possible outcome. **CS**

Notes

[1] For more info, visit www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-instruments/HospitalQualityInits/HospitalHCAHPS.html.

ADDITIONAL **INFORMATION**

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Abstract

The wide variety of facets of hospital life provoke a host of thoughts about security, convenience, patient/visitor/staff safety, energy efficiency, and even resilience in the face of disasters. These are weighty topics that require input from virtually every department in the hospital because they form the Environment of Care (EOC), which comprises three basic elements: building and space, equipment, and people. But where do doors, hardware, and access control fit into the bigger picture?

MasterFormat

08 74 00–Access Control Hardware
28 13 00–Access Control

UniFormat

B2050–Exterior Doors and Grilles
C1030–Interior Doors
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Unlocking the Secrets of Door Hardware

Part Five

Antimicrobial Copper and Healthcare Projects

BY ADAM ESTELLE

Antimicrobial Copper and Healthcare Projects

One of the oldest metals fights against the newest superbugs

All photos courtesy Copper Development Association

EVEN IN THE MOST PROACTIVE HOSPITALS, ACTIONS SUCH AS OPENING DOORS, FLUSHING TOILETS, AND TURNING ON FAUCETS CAN EXPOSE PATIENTS, HEALTHCARE WORKERS, AND VISITORS TO ANTIBIOTIC-RESISTANT SUPERBUGS INCLUDING METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) AND VANCOMYCIN-RESISTANT ENTEROCOCCUS FAECALIS (VRE), WHICH CAN SURVIVE ON TRADITIONAL SURFACE MATERIALS LIKE STAINLESS STEEL AND PLASTIC FOR DAYS OR EVEN MONTHS.

Through installing hardware and components made of antimicrobial copper, hospitals across the country are supplementing their infection control programs. This material continuously kills more than 99.9 percent of bacteria transferred by touch within two hours between regular cleanings, even after repeated contaminations. Grinnell Regional Medical Center—an Iowa healthcare facility consisting of 49 beds and serving 40,000 residents—is one of those early adopters of antimicrobial copper to further protect its patients, staff, and visitors alike from harmful bacteria.[1]

In a perfect world, healthcare providers would wash or sanitize their hands before and after each patient contact, but many studies have found staff adhere to national guidelines for hand hygiene less than 50 percent of the time. While antimicrobial copper products are a supplement to, and not a substitute for, standard infection control practices like washing hands and disinfecting surfaces, the advantage of copper is it is always working. Its effectiveness is not dependent on behavioral compliance of hospital personnel beyond routine cleaning and disinfection of the copper surfaces.

Hospital installations

In most cases, copper components can easily be installed or retrofitted in a matter of minutes—sometimes, all it takes is a screwdriver. Freestanding medical equipment and instruments made of copper

Maintenance crewmembers wipe down a copper IV pole and an over-bed tray table made of copper.

require even less work. With more than 500 copper alloys registered by the U.S. Environmental Protection Agency (EPA) and more than two dozen U.S. manufacturers offering products, options are available to satisfy diverse needs and to facilitate sustainable design from the hospital intensive care unit (ICU) to visitor waiting rooms. Copper can be used for everything from door handles, stair handrails, grab bars, sinks, faucet levers, carts, and other healthcare equipment. These durable and long-lasting products can exhibit warm tones of brushed nickel, colder gray of stainless steel, deep yellows of brass and bronze, or traditional red of copper.

Pullman Regional Hospital, a Level IV trauma center in Washington, has also installed copper components throughout its facility. The hospital has copper faucet levers on 40 sinks in the public restrooms and hallway basins, more than 400 cabinet pulls, handles for IV poles used in its in obstetrics facility, ICU, and medical surgery unit, and accessibility buttons for double-doors throughout its 8825-m^2 (95,000-sf) facility. Eventually, the administration would like to add countertops, chair armrests, bed rails, and bed handles made of copper.

Copper hardware, fixtures, and components can be cared for and maintained in likely the same way as the components currently found in hospitals. Routine cleaning to remove dirt and grime is still necessary, but this is essentially the only thing required for the surfaces to kill bacteria continuously.

Normal wear, and even the natural oxidation of some copper alloys, do not impair the material's efficacy. It remains effective even after repeated wet and dry abrasion and re-contamination. The antimicrobial property of copper-based alloys like brass and bronze is inherent to the metals and will last the entire lifespan of the product.

Parkview Hospital Randallia in Fort Wayne, Indiana, is currently planning to install doorplates and handles, cabinet handles, and other frequently touched surfaces made of copper. The hospital will install the copper components strategically within specific areas of the hospital like the ICU. Retrofitting a hospital with antimicrobial copper is a one-time investment that has long-term benefits far outweighing the upfront costs.

At Grinnell, antimicrobial copper hardware and components have been installed throughout the facility, including patient rooms and bathrooms. In addition to grab bars, light switches, door handles, faucet levers, and toilet flushes made of copper, the hospital has purchased over-bed trays and IV poles made from these bacteria-killing metals.

Hospital-acquired infections (HAIs) contribute to significant loss of life and increased treatment costs. When patients develop an HAI, their length of stay is estimated to increase by about 19 days, adding up to $45 billion in healthcare costs.

"It is a very serious problem," said Ed Harrich, director of surgical services for Pullman Regional Hospital. "I think every hospital across the nation is doing everything they can to try to deal with it the best that they can. But there's bioburden on

A copper lightswitch is installed in a patient bathroom at Grinnell Regional Medical Center in Iowa.

everything and people aren't good at handwashing and there's cross-contamination everywhere you go."

Hospitals are not the only buildings where there is antimicrobial copper to be found. Transportation hubs, restaurants, athletic training facilities, and healthcare centers have begun to recognize this metal's benefits. In 2012, the Ronald McDonald House (RMH) in Charleston, South Carolina became the first nonprofit temporary residence facility in the country to undergo a copper retrofit.

Throughout the facility, wood, plastic, and steel touch surfaces were replaced with antimicrobial copper to further protect guests with compromised immune systems from harmful bacteria. Antimicrobial copper was used for the RMH facility's stair railings, sinks, faucets, tables, locksets, cabinet pulls, and chair arms—virtually all high-traffic areas in the building.

Additional advantages of copper touch surfaces

There is no need for any aftermarket coating, special cleaning protocol, or treatment for copper alloys. For copper to remain effective, it should be left bare and cleaned regularly, just like any other traditional touch surface material. As some uncoated copper alloy surfaces naturally age, they may change color slightly due to natural oxidation, which does not impair the antimicrobial efficacy of the surface. The change in appearance depends on the alloy composition, and tarnish-resistant alloys are also available. Additionally, each alloy ages differently depending on the application, giving architects, designers, and specifiers a wide range of choices.

This antimicrobial effect does not diminish over time. Regardless of how many people touch the side rails on a hospital bed or push on the exit plate of a door over the years, copper exhibits the same antimicrobial properties from installation, as long as it is cleaned regularly to remove dirt and grime. Considering copper's exceptionally long service life, an application should last, once installed, as long as the structure it is housed in—taking into account normal wear and tear. This metal and its alloys are made mostly from recycled material and, at the end of service life, are also 100 percent recyclable.

Copper and copper alloys can be easily fabricated into a wide variety of shapes and forms, from large wall sections to small cellphone covers, making it beneficial for many different applications.

The science

People have been aware of the inherent antimicrobial properties of copper since the dawn of civilization.

A nurse cleans a copper sink in a patient room. Copper fixtures were installed as a way to reduce hospital-acquired infections (HAIs).

Door handles have been retrofitted with copper hardware.

The ancient Egyptians, Greeks, Romans, and Aztecs used copper compounds to treat diseases, burns, sore throats, and skin rashes, as well as for good hygiene. During the 19th century, scientists discovered the existence of microbes and the role these tiny organisms had in causing infections and diseases.

More recently, copper alloys were registered by EPA in 2008 after rigorous laboratory testing. It is the first solid antimicrobial touch surface material to receive a public health registration. In the United States, this registration permits products manufactured from uncoated copper-based metals with at least 60 percent copper content to be advertised with antimicrobial claims against six disease-causing bacteria:

- E. coli 0157:H7;
- Pseudomonas aeruginosa;
- Staphylococcus aureus;
- Enterobacter aerogenes;
- VRE; and
- MRSA.

The mechanisms by which solid copper damages and destroys bacteria are still being studied, but sufficient work has been done to confirm the broad spectrum efficacy of the metal and its alloys. By interacting with the cell structure, copper initiates a series of cascading events, including rapidly interrupting normal functions and compromising cell membrane integrity. This allows copper ions to enter the microbe structure and totally overwhelm the metabolism. The final stage is the breaking down of genomic material.

Thankfully, there is little danger of running out of copper. Worldwide resources of this important and valuable metal are estimated at more than 3.6 trillion kg (8.1 trillion lb) of which only about

490 billion kg (1.1 trillion lb) have been mined throughout history. Copper's ability to be repeatedly recycled, without any loss in performance, is an important sustainable benefit.

Conclusion

The direct cost of treating a single hospital-acquired infection (HAI) is approximately $43,000, and this does not take into account the patient's pain and suffering. In comparison, the incremental cost to outfit a patient room with copper products is typically less than $5000 based on current estimates from EPA-registered product suppliers. A typical suite of products includes door and cabinet hardware, light switch plates, outlet covers, IV pole, patient tray table, sink, faucet levers, flush lever, grab bars, and soap dispenser touch points. This represents an attractive value proposition, particularly when considering the useful life of antimicrobial copper products.

Now armed with scientific proof, hospitals can take steps to supplement their infection control practices with antimicrobial copper. Whether for a new medical facility going up or an existing hospital wing receiving an upgrade, copper can be incorporated into the building design or retrofitted to meet changing needs and scope. By installing these hardware, fixtures, and components throughout their facility, healthcare providers are helping prevent the spread of potentially harmful bacteria.[2] **CS**

The toilet flushes inside the patient rooms at Grinnell Regional Medical Center are made with copper.

Notes

[1] See the EPA public health registration for copper alloys at www.antimicrobialcopper.org/us/epa-registration.

[2] To help educate hospital executives and their staff on the benefits and ease of installing copper components, the Copper Development Association (CDA) recently launched two videos: "Installing Antimicrobial Copper Components and Cleaning" and "Maintaining Antimicrobial Copper Surfaces." For more information, visit www.antimicrobialcopper.com/us.

ADDITIONAL **INFORMATION**

Author

Adam Estelle is a manager for the Copper Development Association's (CDA's) Antimicrobial Copper Program and Rod and Bar Council. He joined the CDA in 2008 as a project engineer to help develop a new market for copper alloys based on their inherent antimicrobial properties. Estelle has helped many material suppliers, manufacturers, and healthcare professionals overcome technical, promotional, and regulatory obstacles associated with the antimicrobial copper market, while co-authoring several papers on the public health benefits of copper alloys. Estelle is also the recipient of an award of appreciation from ASTM for his contribution to their work with copper products. He can be reached at adam.estelle@copperalliance.us.

Abstract

Copper components are increasingly being installed in healthcare facilities because they have been shown to kill bacteria and reduce hospital-acquired infections (HAIs). This article looks at a few projects, including two hospitals in Washington and Iowa, that have installed this 'new' technology in the form of cabinet hardware, accessibility buttons, faucet levers, and even medical equipment to further protect patients, staff, and visitors while easing maintenance.

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