

by Betty Chen, CSI, and Michael Chusid, RA, FCSI Photo © Julie Mohamad, OfficeWorks

A CLOSER HINGE, AN ADVANCED TYPE OF SPRING HINGE. INCORPORATES THE DOOR CONTROL MECHANISMS INTO THE BARREL OF **A HINGE.** INNOVATIVE ENGINEERING HAS MADE CLOSER HINGES MORE COMPACT AND FUNCTIONAL; THE NEW GENERATION OF PRODUCTS PROVIDES UNIQUE COMBINATIONS OF FEATURES AND BENEFITS TO ADDRESS DOOR CLOSING CHALLENGES THAT ARE NOT SATISFACTORILY MET BY OVERHEAD SURFACE-MOUNTED DOOR CLOSERS. IN ADDITION TO BEING USED ON DOORS WITH SPECIAL NEEDS, CLOSER HINGES ARE INCREASINGLY BEING EMPLOYED ON MANY TYPES OF ORDINARY DOORS DUE TO ECONOMIC, AESTHETIC, PRACTICAL, AND OTHER REASONS.

The high performance of contemporary closers can be appreciated by considering the limitations of primitive types incorporating a cord running from a door via a pulley to a counterweight mounted adjacent to the door frame. While this contraption is as dependable as gravity, its closing speed varies as the falling counterweight gains momentum. If, however, the door is released in a partially open position, the closing speed generated by the counterweight may be insufficient to cause the door to fully close. If the door is released while fully open, acceleration can cause the door to slam shut, producing objectionable noise and the potential for injury. It can be difficult to balance the force required to open the door with the force needed to close the door. Simple springs can also be used to close doors, yet have similar drawbacks, as can be attested by anyone who has heard a spring-loaded screen door slam shut.

Performance

To overcome these limitations, the springs in highperformance closer hinges are adjustable and regulated by various types of mechanical and hydraulic devices. As a result, some manufacturers of closer hinges exceed the Builders Hardware Manufacturers Association (BHMA) A156.17, *Self-closing Hinges* & *Pivots*, and are able to meet some or all of the following characteristics.

Accessibility

This is the de-facto criteria for accessible doors as stipulated in the *Americans with Disabilities Act* (ADA):¹

307.2 Protrusion Limits. Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finish floor or ground shall protrude 4 inches (100 mm) maximum horizontally into the circulation path.²

404.2.8.1 Door Closers and Gate Closers. Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of



The door on left uses three hinges, an overhead closer, and an overhead door stop. The door on the right uses just three closer hinges to reduce costs and installation time. The closer hinges have built-in door stops. Photos © Michael Chusid

12 degrees from the latch is 5 seconds minimum. 404.2.8.2 Spring Hinges. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum.

In addition to accessibility, limits on closing speed are a safety issue that can reduce door-related injuries.

Closer hinges were used on this exterior gate because they are semi-concealed to minimize visibility and exposure to weathering and abuse. Photos courtesy: Waterson Group





While hinges could have been installed in conventional template locations, the designer chose to use a pair of hinges near the top of the door and another pair at the bottom to more efficiently carry the rotational loads in the plane of the door.

404.2.9 Door and Gate Opening Force. Fire doors shall have a minimum opening force allowable by the appropriate administrative authority. The force for pushing or pulling open a door or gate other than fire doors shall be as follows: 1. Interior hinged doors and gates: 5 pounds (22.2 N) maximum.

While opening force for exterior doors is not specified in *ADA*, project specifications should require the minimum force practical.

Listed for fire-rated construction

To be used in an opening in a fire-resistance-rated wall or partition, closer hinges should be labeled by a recognized product certification service for use with fire-resistant doors. Up to three-hour ratings are available. Steel or stainless steel products are typically used for listed hardware.

Durability and strength

According to BHMA A156.17, Grade 1 closer hinges must pass rigorous testing for one million cycles of opening and closing on a door of a specified size and weight. They must also survive a static load test to ensure spring hinges have adequate strength to withstand anticipated loads.

Conditions of use

Closer hinges should be selected with regard for manufacturer's recommendations for maximum operating range (degree of opening) and ambient temperature. Closer hinges that install like full mortise butt hinges are less exposed to vandalism and abuse than surfacemounted types. Some products have built in hold-open capability and door stops, eliminating the cost and clutter of using separate hardware devices.

In other cases, a swing clear type of hinge, also known as an offset door hinge, can maximize the effective width of a door opening by swinging the door out of the path of travel and is useful for wheelchair-accessible doorways. Closer hinges are also convenient in pairs of communicating doors where space between the two doors is inadequate for surface-mounted closers. Weather-resistant products should be used in wet areas.



Each piece handled adds to the time and cost of door installation. Overhead closers require keeping track of and handling a multitude of small parts and fasteners, and holes for through-bolts and pilot holes may have to be drilled. In contrast, installing closer hinges requires only the same number of pieces as installing ordinary hinges. Images courtesy Waterson Group

Compatibility

Closer hinges conforming to BHMA A156.7, *Template Hinge Dimensions*, can be used interchangeably with ordinary door hinges. Using a familiar template simplifies door and frame preparation and allows closer hinges to be retrofit to existing doors.

Finishes and corrosion resistance

BHMA A156.18, *Materials and Finishes*, spells out tests for corrosion resistance and other factors affecting door finishes. It also has nomenclature for finishes and substrates. Stainless steel is recommended for exterior and harsh environments and heavy-duty doors; aluminum is also available for non-fire-rated and interior doors.

Acoustics

Closer hinges control closing speed to prevent the loud and startling noise of slamming doors. Noise control contributes to the comfort and well-being of building occupants.

Aesthetics

For many architectural doors, "form is the function," and hardware must enhance (or at least not detract from) the appearance of the doorway. Barrels of some closer hinges are only modestly larger than those of standard types and are so discrete they should be considered concealed closers.

WHY USE CLOSERS?

Here are some of the reasons for using door closers.

Hygiene

Hygiene has taken on new urgency as we learn to design and operate buildings that simplify and improve cleanliness. It is prudent to reduce the need to touch door and gate hardware surfaces that have the potential to transmit pathogens. About half of incidents requiring someone to touch a door are occasioned by closing the door. Using door closers as a hands-free way to shut doors is a strategy deserving increased consideration.

Means of egress

Doors in the path of egress that are normally required to be kept closed, such as those to a stair enclosure or horizontal exit, should be self-closing.*

Fire safety

An open doorway cannot protect against the spread of fire or smoke. Building codes require doors in fire-resistance-rated walls and partitions to use door hardware that is approved for the same. Fire-rated doors are required in many types of building occupancies, particularly in doorways leading to egress paths. They are also needed in occupied spaces and areas with combustible or hazardous contents, including between living areas and attached garages in residential buildings. Fire doors must be self-closing unless otherwise specified.** Doors in smoke partitions and smoke barriers must also be self-closing.***

Changes to building codes frequently are in response to disasters. A recent example was precipitated by a fatal fire in a Bronx (New York) apartment building. A fire in one unit quickly spread to the building's open stairwell because the door to the apartment of fire origin was left open; 12 people died and four more critically injured. In response, the New York City Building Code (NYCBC) has been amended to require, "All doors leading to interior stairways or corridors in R-1 and R-2 buildings must be self-closing." The new requirement to effect July 31, 2021 and applies retroactively to existing buildings.

Access control, security, and safety

Even if a doorway is monitored, it may be advisable to have closers on doors and gates to reduce unauthorized entrance and to improve safety and security. Common examples include entrances to swimming pool facilities to guard against accidental drowning of children, outdoor playgrounds, areas within nursing homes that must control the movement of patients, classrooms to delay intruders, and rooms with controlled or hazardous substances.****

Energy conservation and thermal comfort

Leaving a door open can result in the waste of conditioned air due to infiltration and exfiltration. This applies not only to exterior doors, but also interior doors separating rooms with different atmospheric conditions. Reducing energy loss helps meet sustainability objectives such as the Energy & Atmosphere requirements of the Leadership in Energy and Environmental Design (LEED) program.



This 3-m (10ft) tall door has been artfully concealed by matching the wood wall paneling.

Closer hinges were used to avoid the detrimental visual impact of an overhead closer.

Image courtesy Mood Box Design

Environmental controls

Closed doors can help protect against undesirable noise, odor, dust, insects and vermin, and other nuisances. Safeguarding against problems of these types can help meet goals for sustainability and occupant wellness. In other cases, environmental controls such as these may be required by health departments or other authorities having jurisdiction.

Convenience

Issues of hygiene aside, closing a door manually is inconvenient if hands are otherwise engaged in carrying packages, attending to children, operating a hand-held device, or whatnot. Closing can also be challenging to individuals with restricted use of their forelimbs. **CS**

- * Consult the National Fire Protection Association (NFPA)
- 101, Life Safety Code, §7.2.1.8.1.
- ** Referenced from NFPA 101, §8.3.3.3.5.
- *** Per NFPA 101, §8.4.3.5 and 8.5.4.4.

**** Consult the International Swimming Pool and Spa Code (ISPSC), §305. Some municipalities recommend spring hinges that do not provide a foothold that can be used by a child to climb over pool gates. Also, see ASTM F2049, Fences/Barriers for Public, Commercial, and Multi-Family Residential Use Outdoor Play Areas. Concerns about sheltering in place have drawn attention to a potential hazard of overhead closer devices. Some schools adopted the ad-hoc use of sleeves (sometimes made from segments of obsolete fire hose) to bind the parallel arms of overhead closers to resist opening. Numerous life-safety advocates have pointed out this violates building codes and could result in trapping occupants and preventing their escape if a fire occurred. NFPA 101, §14.2.2.2.4(6) and 15.2.2.2.4(6), prohibit modifying door closers. This warning has broader implications as, in other scenarios, miscreants can readily restrict the operation of overhead closers to trap victims or interfere with rescues.

Closer hinge should match standard Builder's Hardware Manufacturer Association (BHMA) template sizes and fastener spacing and be offered in popular hardware finishes. Adjustments are made at the top and bottom of the devices.



Comparing closer types

With many reasons to use a door closer (see "Why Use Closers," page 4) and an endless variety of building conditions, determining whether to use closer hinges or overhead closers requires professional judgment.

Doorway constraints

It is difficult to install an overhead closer if the top of a door is arched or constrained by a low ceiling or narrow door frame. Similar problems occur with gates and partial height doors where there is no place to anchor an overhead closer. If a doorway is in a corner, an adjacent wall, cabinets, or other surfaces abutting it may interfere with the arms of an overhead door.

Economics

As a general rule, the more parts to be installed, the greater the construction cost. One popular overhead

door model requires the installer to handle 47 separate components—many of which are small fasteners—that can be difficult to track in dimly lit construction sites. In comparison, installing closer hinges require no more parts than the ordinary butt hinges used with overhead closers. The number of installation steps goes up when one considers time for drilling holes to install overhead closers and the addition of separate hold-open and door stop devices.

Steel doors and frames require reinforcing to provide secure attachment of overhead closers. Reinforcing installed in the field further increases the number of parts to be handled and complicates inspection of work that will be concealed after installation. Reinforcement installed in the fabricator's shop requires coordination of shop drawings.³

Alterations

Adding overhead closers to doorways where they were not originally specified may require modifications to existing doors and frames. Closer hinges, on the other hand, can be installed by replacing the original hinges, one at a time, without having to do remedial work to existing doors and frames.

Visual

While overhead closers can be dressed up with handsome covers, they are still a visual intrusion. This may be of special concern with dramatic entrances, wood doors with matched veneers, the minimalist lines of glass doors, custom-designed doors, and when trying to preserve the appearance of doors with historic or period detailing.



ADDITIONAL INFORMATION



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Key Takeaways

Closer hinges combine the functions of door closers and hinges. Recent innovations have improved the performance of some types of closer hinges. They can be used where other types of door closers are impractical or would be visually or economically objectionable.

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Maintenance

The oil used in hydraulic closers can leak, staining clothing of people using the doorway and making floors extremely slick and dangerous. "More importantly," writes Matthew T. Orcutt, an authority on overhead closers, "when the oil drains from the [overhead door closer] cylinder, the closer's ability to control the door is lost. If total leakage were to occur, the door swings freely and could lead to injuries as well as costly damage to the door and frame."⁴

While the oil can also leak from a closer hinge that has hybrid mechanical and hydraulic action, the result should not be devastating. There is significantly less oil to leak and the spring in the door continues to provide basic door closing functions.

Another maintenance issue originates from protruding arms of overhead closers, which can be damaged by heavy use, abuse, or vandalism.

Overhead closers

Simply put, overhead closers offer many more options and a wider range of performance than is available from closer hinges. For example, some overhead closers can be adjusted to control back check, slowing the door before it opens fully. Others have a reservoir of force to boost latching speed to power through the final few degrees of closing a door. Others can be opened a full 180 degrees, an opening that may accelerate wear on some closer hinges.

Conclusion

BHMA points out door testing typically takes place under laboratory conditions. In actual use, results vary because of installation, maintenance, and environmental conditions. Actual closer performance is affected by fluctuating ambient conditions such as wind and pressure differentials.⁵

Closer hinges are frequently specified as a set where each of the closer hinges may have different attributes. It is best to consult with the closer hinge manufacturer or a hardware consultant familiar with the proposed product.

It would be a mistake to assume closer hinges will replace overhead closers in all locations. However, closer hinges have proven their utility for many entrance conditions, and may even prove to be the preferred solution for many ordinary doorways. **CS**





Closer hinges for doors eliminate the need for overhead closers that would interfere with the minimalist aesthetic of all-glass partitions.

Notes

¹ Excerpts from www.access-board.gov/ada. See, also, similar requirements in the *Architectural Barriers Act (ABA), Uniform Federal Accessibility Standards (UFAS)*, and ICC A117.1, *Accessible and Usable Buildings and Facilities*.

² One of the authors of this paper is approximately 1956 mm (6 ft 5 in.) tall and can attest to hazard of overhead closers protruding into doorways.

³ Section 5.2 of Steel Door Institute (SDI) A250.6, *Hardware Reinforcing on Standard Steel Doors and Frames. It* says, "Doors and frames shall be prepared by the installer in the field for surface applied hardware such as surface closers..."

⁴ Visit www.dhi.org/shared/forms/PDFforms/ Publications/DH_06/6_June06/Jun06_3_ SecureClsoer.pdf.

⁵ Consult the Builders Hardware Manufacturers Association (BHMA) A156.4, Door Controls – Closers.

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