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Don't Forget About Overhead Doors

A Reference Guide for Safety Professionals

By Garth Thomas

Although overhead door systems are common, they are frequently overlooked as safety hazards, even in organizations with excellent safety programs. But this oversight can have catastrophic consequences, because commercial overhead doors are heavy, hang high in the air, are dynamic and often operate in building openings where there is pedestrian traffic.

Each year, there are far too many examples of struck-by and crushing incidents involving overhead doors that are avoidable with regular door maintenance/inspections and the inclusion of recommended safety entrapment devices (Evans, 2014; *The Province*, 2012; *Star Tribune*, 2012).

OSHA Compliance Requirements

Overhead door systems are subject to OSHA compliance standards, specifically Section 5(a)(1) of the OSH Act of 1970, the General Duty Clause, which has been used many times as the basis for overhead-door-related citations and penalties. State OSH plans may impose additional standards.

Federal OSHA Standards

Overhead door systems are not specifically referenced in the OSH Act of 1970 (Fairfax, 2002); however, they are subject to the General Duty Clause:

> Section 5. Duties
> (a) Each employer—
> (1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

Section 5(a)(1) has been used as the basis for overhead-door-related OSHA citations and penalties, and OSHA enforcement has cited improperly maintained and/or installed door systems as well as the absence of entrapment devices as causing unacceptable exposure to crushing or struck-by hazards. Following are several examples:

- "Overhead garage doors did not have a safety device edge, door stop sensors and proper signage" [OSHA(f)].
- "Two 14-ft wide overhead garage doors did not have a safety device edge or door stop sensors" [OSHA(d)].
- "Employer failed to ensure that the overhead door in Bay #3 was adequately constructed and adjusted to prevent it from coming off the track" [OSHA(a)].
- "Garage doors #1 and #2 did not have a safety device edge or door stop sensors" [OSHA(e)].

•OSHA abatement typically instructs to "hire a professional to install the safety devices and conduct periodic inspections" [OSHA(b)(c)].

State OSH Plans

State OSH plans must, by OSHA requirements, be at least as effective as federal standards, but having satisfied that requirement, they are free to be more specific about overhead door safety standards and practices. For example, Minnesota (Minnesota Department of Labor & Industry) provides more specific instructions on acceptable overhead door safety options.

How to Properly Include Overhead Doors in a Safety Program

To comply with OSHA regulations and minimize risk, a planned maintenance and compliance program should be implemented for overhead doors that meets the following standards. Inspection, maintenance and repair work is typically performed by a qualified overhead door service company.

Standard #1: Maintenance Practices & Intervals

All door systems should be installed, inspected and maintained in accordance with the manufacturer's specifications. This includes maintenance intervals, which can vary depending on daily cyclage and operating environment. If the manufacturer's specifications are not available, then the preventive maintenance program should adhere to established industry standards/best practices [e.g., Door & Access Systems Manufacturers Association].

Standard #2: Entrapment Devices

All motorized door systems should be equipped with entrapment devices to manufacturer's specifications, such as photo-eyes or sensing edges. If there are door systems equipped with older devices not current with newer, improved safety standards, modernizing should be considered where reasonably practicable, for example, upgrading to monitored entrapment devices.

Standard #3: Documentation & Reporting

Thorough, secure documentation should be maintained that details:

•maintenance and service work performed;

•problems or deficiences found, preferably documented with notes and photographs, corrective action recommended and corrective action taken;

•practices and standards used to inspect and maintain doors (e.g., manufacturer's operating/maintenance manuals or similar documentation).

Cost to Implement a Preventive Maintenance & Safety Compliance Program

Unless there are serious problems, properly maintaining door systems is not expensive and is certainly money well-spent. A thorough maintenance service takes a qualified door dealer about 45 (±15) minutes per door; this service typically should be performed once or twice per year. Depending on local rates, the cost for servicing most doors systems is between $50 and $100.

Beyond mitigating safety risk and meeting OSHA compliance requirements, properly maintaining door systems has the added benefit of being cost-effective in its own right. Most commercial doors are made with small, inexpensive components that wear, fatigue, and require checking and replacement during a door system's normal life cycle. While regular maintenance is not a guarantee against future problems, finding and fixing small problems, such as frayed cables or worn rollers, before they become big problems, such as a door that falls, usually results in significant cost savings.

Sectional Overhead Doors

How They Work

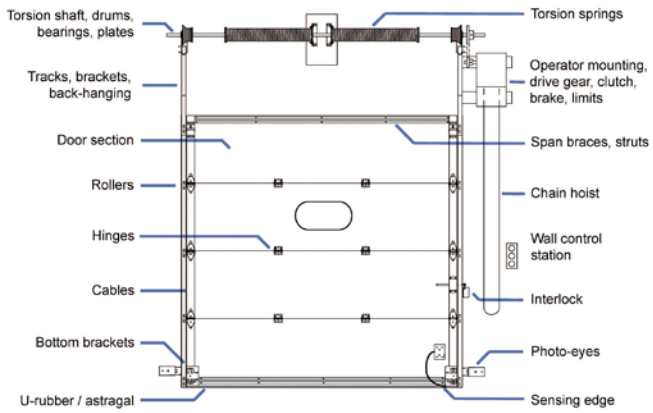
Sectional doors (Figure 1) are constructed of door sections, usually 24 in. high, which are stacked one on top of another and fastened together with hinges. The door articulates as it opens and closes, with its path guided by rollers that travel in steel tracks secured to the building.

Sectional doors utilize a simple counterbalance system in which the weight of the door is offset by the potential stored energy of a pre-wound torsion spring. The torsion spring helps rotate the torsion shaft and drums, which in turn spool the lifting cables (also attached to the door's bottom brackets) to lift the door. The torsion assembly and related components are under extreme tension.

What You Need to Know

1) Many door components, such as hinges, bearings, cables and rollers wear and fatigue with use, and require routine replacement. Left uncorrected, problems with

FIGURE 1
Sectional Door Components



smaller components can escalate into larger problems that affect the overall performance and safety of the door.

2) Sectional doors can become dangerous if the counterbalance system is compromised (e.g., lifting cables break, become unspooled from the drums, or detach from the bottom brackets). If this occurs when the door is in an open position, the door can be at risk of falling.

3) There are several accessories available for sectional doors to improve safety: safety bottom brackets, spring failure safety devices and cable tension springs.

Components

Bottom brackets anchor the lifting cables to the door. They are under significant tension from the counterweight forces of the torsion springs and it is important that they be securely fastened to the door.

Cables support the entire weight of the door and are under tension from the torsion springs. Undersized or frayed cables can break, leaving one or potentially both sides of the door unsupported. It is common for cables to need replacing several times over a door's life.

Rollers guide the door in the tracks. It is common for rollers to wear and need replacing. Failed rollers can potentially impede the free movement of the door and cause it to jam in its tracks.

Tracks, brackets, back-hanging position and support the door to the building structure. Ceiling support of the tracks, called back-hanging, is especially important as it supports the door in the fully open position.

Hinges connect the sections of the door and allow articulation. Poorly secured or aligned hinges can cause improper door movement and damage to sections or other parts of the door system.

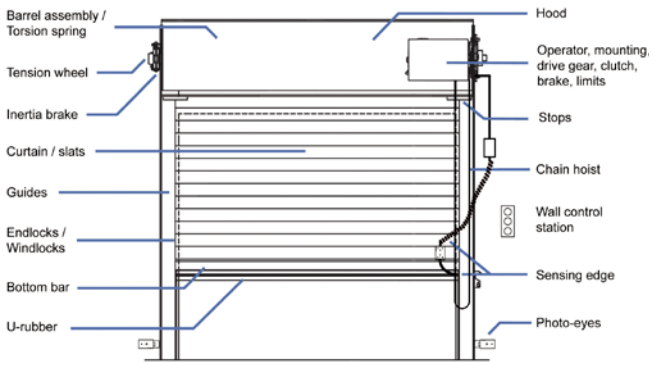
Span braces and struts attach across the width of the door to provide lateral stiffness. Without proper span brace support, a door can be vulnerable to bowing or high wind conditions, both of which can cause a door to dislodge from its tracks.

Torsion springs provide the counterbalance force to the weight of the door and possess a large amount of stored mechanical energy. Broken torsion springs cause abnormal loading on door and electric operator components. Most torsion springs are rated for 10,000 cycles-to-failure and will likely need to be replaced at least once during a door's life. It is generally not possible to determine how many cycles are left in a torsion spring by visual inspection.

Torsion shaft, drums and bearings are the mechanical and structural components of the torsion assembly. Potential problems include failed bearings, worn shafts, misalignments, loose couplers, improperly secured brackets and cracked drums.

Pusher springs, bumper springs and stops prevent the door from running off the end of the tracks. Pusher springs are installed to maintain cable tension on certain door configurations.

FIGURE 2
Rolling Steel Door Components



Interlocks should be installed on doors with locks and motorized operators to prevent the operator from attempting to open the door when it is locked.

Rolling Steel Service Doors

How They Work

Rolling steel doors are constructed of many individual steel slats, usually 2 to 3 in. high, which attach to each other and create a continuous vertical curtain. The curtain/slat assembly travels in channels in the door guides located on either side of the door and rolls up into the head assembly where it wraps around a barrel.

The weight of the curtain is counterbalanced by a torsion spring located inside the barrel. The balance of the door is adjusted using the tension wheel located at the end of the barrel assembly, which increases or decreases the tension on the spring.

Rolling steel service doors are often used in applications that require greater security, where insulation value is not critical or where there are space constraints.

What You Need to Know

1) Torsion springs are a critical component of the door and special care should be taken to ensure that they are tensioned properly and replaced before they fail. Most torsion springs are designed with a life span of 10,000 or 20,000 cycles, after which time they are prone to failure. Implementing a program of proactive spring replacement can reduce operational disruptions related to emergency spring failures.

2) Safety inertia brakes can prevent the door from suddenly falling in the event of a torsion spring failure.

Components

Barrel assembly/torsion springs provide the counterbalance force to the weight of the door, lessening the force needed to open and close the door. The torsion spring is located inside the barrel assembly, limiting access and making

visual inspections impractical. Torsion springs are typically rated 10,000 or 20,000 cycles-to-fail, making it important to track door usage to replace the spring before it fails.

A tension wheel is the component used to adjust the torsion springs balance. Adjusting the wheel will either increase or decrease tension on the doors torsion spring. The tension wheel is a direct connection to the torsion spring and possess a large amount of mechanical energy. If the tension wheel becomes loose or the mechanical connection to the spring is lost the operator will be subject to abnormal loading.

An inertia brake prevents the door from free-falling by stopping the door's movement if a maximum RPM threshold is reached. Some inertia brakes work by communicating with the operator and some physically lock the shaft in place. An inertia brake that physically stops the shaft can only be triggered so many times before needing replacement.

Endlocks/windlocks lock individual slats into the guides. Broken or loose endlocks can interfere with door movement by catching in the guides.

Stops physically prevent the door from running beyond the upper or lower limits. Stops are used along with limit switches to ensure that the door does not overrun the guides.

A hood protects the curtain as well as shields moving components of the door from the elements. A damaged hood can interfere with the curtain and potentially damage it.

Guides are the channels in which the curtain moves. It is important that the gap between guides is correct and the curtain is able to move freely. Obstructed movement due to damaged guides can exert an abnormal load on the operator.

Motorized Door Operators

How They Work

Because of their size and weight, many commercial overhead doors are equipped with motorized, electric operators. The most common type is a hoist (jackshaft) operator, which mounts near the torsion assembly and opens/closes the door by rotating the torsion shaft.

Operators can be controlled by various devices in various ways: push-button wall stations, remote control transmitters, timers, ground loops, etc. For convenience, many operators are programmed to close automatically (e.g., timers), semi-automatically (e.g., momentary pressure to close on a push-button station), or by radio controls (e.g., handheld remotes). Doors operating in these modes create entrapment risk and should equipped with entrapment devices that reverse the door's direction should it encounter an obstruction while it is closing.

Entrapment Devices

Photo-eyes emit a small light beam from a transmitter to a receiver across the width of the door opening at a height of 6 in. from the floor. If the light beam is interrupted when the door is closing, the operator reverses the door and holds it in a fully open position.

FIGURE 3
Photo-Eyes

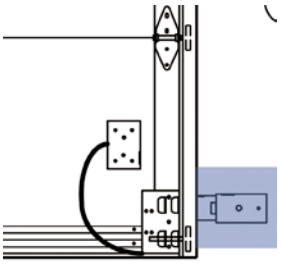


FIGURE 4
Sensing Edges

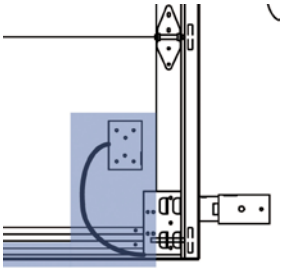


Photo-eyes can be monitored or non-monitored depending on their capabilities and the capabilities of the operator. Monitored means the proper functioning of photo-eyes is frequently checked by the operator's electronics and, should a problem be detected, the operator reverts to a safe mode restricting how the door can be closed. Non-monitored photo-eyes are not self-checking and therefore offer a reduced level of safety.

Sensing edges are positioned on the bottom, leading edge of the door and can detect physical contact with an object. If the sensing edge comes into contact with an object while the door is closing, a signal is sent to the operator to reverse the door to the fully open position.

Like photo-eyes, sensing edges can be monitored or non-monitored depending on their capabilities and those of the operator.

What You Need to Know

1) Entrapment devices are a critical safety component of motorized door systems. Their proper specification, installation and function are a core safety and compliance concern. Wherever reasonably practicable, doors should be equipped with monitored entrapment devices.

2) Modes of control affect entrapment device standards. The more hands-off the door's operation (e.g., automatic timer control), the higher the standard for entrapment devices.

3) All operator manufacturers call for (at a minimum) monthly checks of entrapment devices. These checks should be a routine part of a safety program.

What Now? Next Steps

Do not ignore door systems. Neglected doors simply become less reliable and potentially more hazardous over time. Take action by having a qualified door dealer perform an initial inspection and service to establish a baseline of door condition, performance and safety compliance. Then, take it from there.

Ensure that the dealer can perform and document maintenance work to meet the standards described

(i.e., maintenance practices and intervals; entrapment devices; documentation and reporting), as these are the standards that matter for safety compliance and door reliability. ■

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Garth Thomas is president of Safedoor Planned Maintenance Ltd. (www.safedoorpm.com), which provides planned maintenance and safety compliance software to the overhead door industry.

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Assistant Administrator
Carol A. Keyes, CSP
carkey@chess-safety.com

Content Coordinator
Kim Marie Lyons
klyons@amhealthandsafety.com

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chaguewood@asse.org

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