

# Integrating Life Safety and Security Systems

## Designing Effective Stairwell Re-Entry Systems in High-Rise Buildings

By Jon Evenson

**D**ue to recent fire events, building owners and property managers across the country are re-examining the life safety and security systems installed in their high-rise buildings. Major cities as well are starting to focus on the need to ensure occupant safety and security during life-threatening emergencies. The City of Chicago has taken center stage in this area in response to high-rise fire emergency tragedies at the Cook County Building and 135 South LaSalle in downtown Chicago.

In the Cook County Building fire, several people lost their lives when locked stairwells stopped them from escaping the building. The City of Chicago took immediate action to develop and pass an ordinance requiring building owners to ensure that all stairwells are unlocked to allow floor re-entry during emergency situations. Without the ordinance, high-rise building ownership would not typically budget money to install stairwell re-entry systems that immediately unlock stairwell doors upon activation of the fire alarm panel.

Stairwell re-entry systems can be expensive to install and may require complete modification of stairwell doors as well as modifications to the building fire

alarm panel. Owners now must balance the need and desire for secure individual floors with the need to ensure the safety of all occupants during emergency situations. Though the new Chicago ordinance requires specific actions to be taken by ownership, it provides owners with options to lessen the overall expenses to both the building occupants and the ownership.

## **Ordinance and Regulatory Mandates**

Chicago approved Municipal Code Chapter 13-196-084 in December 2003, which requires ownership to take specific actions to ensure stairwell re-entry. Chapter 13-196-084 provides the following re-entry options to building owners:

**Option 1.** The stairwell enclosure doors shall not be locked from the stairwell side at any time, in order to provide re-entry from the stair enclosure to the interior of the building; or

**Option 2.** The stairwell enclosure doors shall be equipped with a fail-safe electronic lock release system that is activated both manually, by a single switch accessible to building management and firefighting personnel, and automatically, either by approved smoke detectors or sprinkler water flow devices, connected to an annunciator panel. If this option is selected, a telephone or other two-way communications system connected to an approved station shall be provided at not less than every fifth floor in each stairwell.

The National Fire Protection Association has also developed specific requirements related to stairwell re-entry. The following requirements are from NFPA 101 Section 5-2:

**5-2.1.5.2.** Every stair enclosure door shall allow re-entry from the stair enclosure to the interior of the building, or an automatic release shall be provided to unlock all stair enclosure doors to allow re-entry. Such automatic release shall be actuated with the initiation of the building fire alarm system.

**5-2.1.5.3.** A latch or other fastening device on a door shall be provided with a lever, knob, handle, panic bar, or other simple type of releasing device having an obvious method of operation under all lighting conditions. The releasing mechanism for any latch shall be located not more than 48 inches

above the finished floor. Doors shall be open-able with no more than one releasing operation.

In each of these examples, ownership is provided with specific instructions for compliance. Owners in Chicago have two compliance options: (1) keep the doors unlocked at all times or (2) design an electrified lock release system that is directly connected to the building fire alarm panel and unlocked when the fire alarm panel is activated. Both options are available to owners, but the determining factor is the level of security required at the building.

Most building owners concerned with security should opt for designing a stairwell re-entry system. Although this option is more expensive, it will provide their occupants with a more secure environment while helping ensure their safety during emergency situations.

### Elements of the Stairwell Re-Entry System

Owners of high rises with either no security in their stairwells or locked stairwell doors should look for assistance from professional engineering firms to design a stairwell re-entry system that ensures stairwells will fully comply with the current local and national building codes. Professional engineering consulting firms with expertise in life safety and security can help building owners correctly identify the existing stairwell deficiencies and design a

compliant system.

Prior to starting the design of the stairwell re-entry system, building owners should review the following basic elements that will factor into the design.

**Building Fire Alarm Panel.** What type of fire alarm is currently installed at the building? Regulations require that fire alarm systems be installed in all new high-rise construction or at the time of building retrofit. Addressable fire alarm systems allow the local fire department to determine where the fire alarm condition is occurring, and they also provide the capability to alert the affected occupants. The type of fire alarm system installed inside a building is a critical factor in determining how stairwells will unlock in a fire emergency.

**Building Security Philosophy.** What level of security is required for the occupants of the buildings? In high-rise financial buildings, the occupants may require the stairwells to be secured at all times, while residential building occupants may prefer to have the stairwells and floors accessible to allow for interflow between floors.

**Stairwell Door Hardware.** What kind of door hardware is presently on the stairwell doors? It is required that stairwell doors have latching hardware to ensure that in the event of an emergency the loss of power will not create a breach of the fire barrier and smoke control, rendering the exit stairwell unsafe.

**Stairwell Door Construction.** Do the exit stairwell doors and door frames

## Snapshots

**The IntelliKnight 5700 Fire Control Communicator** from Silent Knight, part of Honeywell's Fire Systems Group, provides digital fire reporting over ordinary telephone lines. The 5700 supports up to 50 addressable devices. It also uses a distributed power scheme to simplify installation and reduce wiring requirements.

The drift compensation feature of the 5700 helps reduce false alarms and pinpoint maintenance problems. If a fault condition is detected at any of the 50 addressable points, the system will display the problem sensor and generate a trouble report that is sent



to the central station. In addition, the system conducts an automatic test every 24 hours that is sent to the central station. The 5700 reports in both the SIA and Contact ID formats.

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meet the code requirements for fire ratings? Fire-rated doors may or may not be currently installed on stairwells to create a fire barrier between the stairwell and the adjacent floor. As part of the stairwell re-entry system, owners should review the door construction and replace existing non-compliant doors with doors that meet the requirements outlined in the local building codes. Without proper fire-rated doors, the exit stairwells may not provide a safe route of egress during a fire emergency.

## Stairwell Re-Entry Solutions

Owners of high-rise buildings have three options when retrofitting or designing a stairwell re-entry system. Each option has pros and cons, but each provides the essential elements of stairwell re-entry upon alarm.

**Free Egress.** The simplest means to ensure stairwell re-entry during an emergency situation is to keep the stairwell doors unlocked, but latched at all times. **Pros:** This solution provides the ownership with the quickest and easiest method to ensure occupant safety during emergencies. This solution also is most cost-effective method to provide stairwell re-entry. **Cons:** This option does not provide any level of security to the building occupants on a daily basis. Not securing the stairwells allows any person that enters the building to access the stairwells on any floor.

**Electrified Locksets.** In this option, the stairwell is kept in a closed, latched and secured condition at all times. The occupied side of the door is unlocked to allow free egress from the floor into the stairwell. The stairwell-side door hardware is kept locked to prevent entry onto the floor. Upon activation of the building fire alarm panel, power is interrupted to the door power supply and the stairwell-side door hardware is released to allow entry from the stairwell onto the floor. **Pros:** This design involves equipment that can be purchased from numerous vendors throughout the United States. It is a suitable method for new-construction buildings or situations where the entire door needs to be replaced. Card reader technology can be easily added to require authorized access from the stairwell onto the floor. **Cons:** This option requires extensive door modifications to run wiring from the external power supply to the door handle.

**High Tower-Type Locksets.** High tower-type locksets were developed and patented by Security Door Controls and have minimized the need for door modifications by providing power to the stairwell-side door frame instead of the door hardware. The occupied side of the door is unlocked to allow free egress from the floor into the stairwell. The stairwell-side door hardware is kept locked to prevent entry onto the floor. Upon activation of the building fire alarm panel, power is interrupted to the door power supply and the high tower-type electric strike is released to allow entry from the stairwell onto the floor while keeping the door latched. **Pros:** This approved design offsets the problem of using electric strikes, which are designed to release upon alarm, thus creating a breach of the fire barrier and smoke control. While providing controlled access and remote control capability, the door stays latched even when unlocked, maintaining

fire door integrity. The high tower-type lockset consists of a mechanical door lock controlled by an electric actuator designed into the door frame. This actuator is powered by an external power supply connected to the fire alarm panel. Wiring runs inside the door frame instead of running from the power supply, through the door and to the door lock hardware. This method reduces the associated expenses related to electrified hinges, door modification and wiring. **Cons:** This design requires that existing locksets be sent back to manufacturers for minor modifications and retrofitting.

### Steps of System Installation

During an alarm condition, the door must go from being fail secure to fail safe, instantly. Following the installation guidelines below will ensure it does just that.

**Door Hardware Installation or Retrofit.** To ensure the stairwell re-entry system activates appropriately during a life safety emergency, the owners should inspect the current stairwell doors and determine if modifications to the door hardware are needed.

#### Supply Power Sources to Each Stairwell Door.

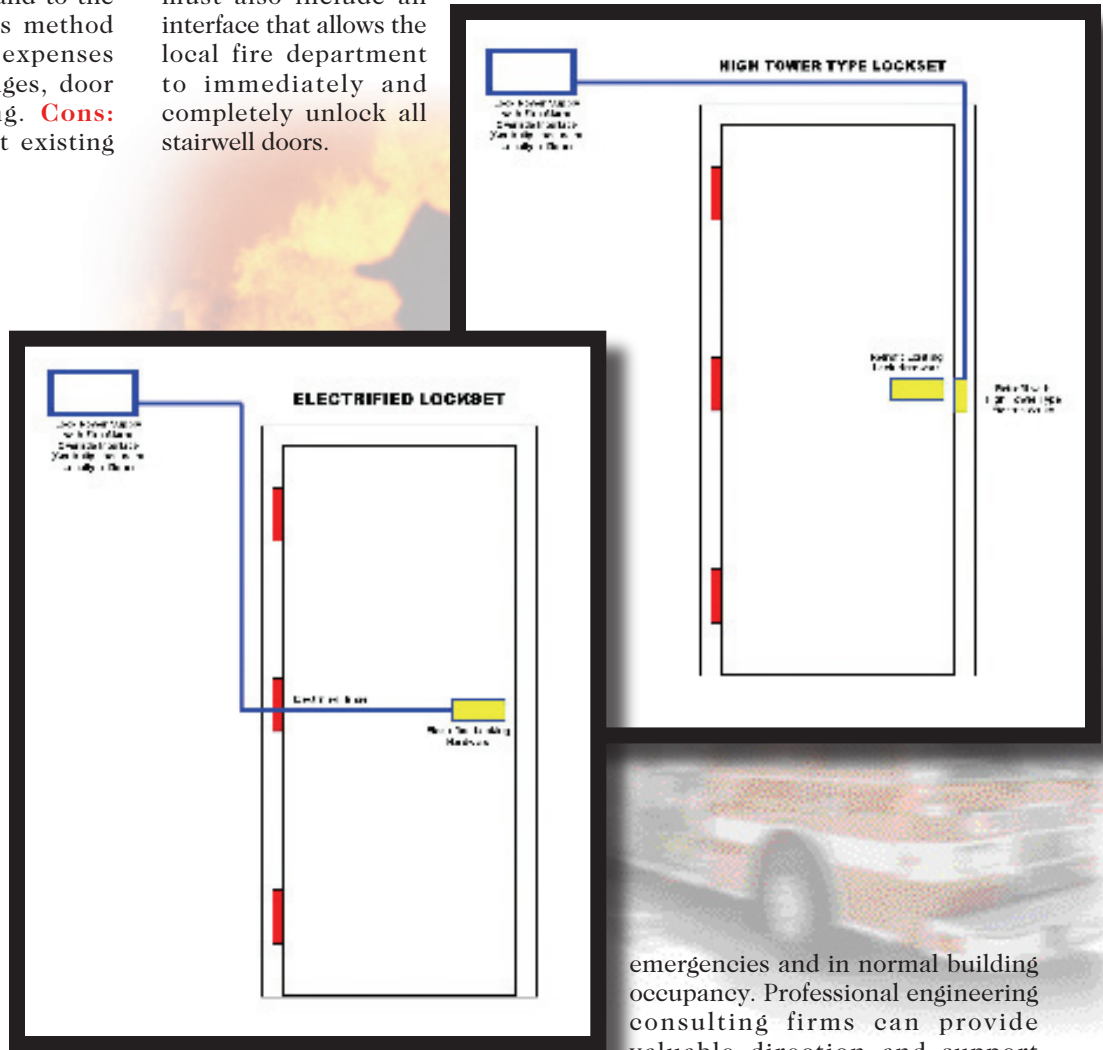
For a stairwell re-entry system to work properly, each stairwell door must be provided a power source that is connected to the fire alarm system. In most cases, engineers will design these power sources so they are connected to a main power panel at the lowest level of the stairwell. This main power panel is then connected through a dry contact relay to the fire alarm system. Upon activation of an alarm, the fire alarm system cuts power to the dry contact relay and the stairwell doors connected will lose power and unlock.

**Provide a Fire Alarm Interface.** A reputable fire alarm contractor

should be brought into the design process to ensure the fire alarm interface and programming is done correctly. The dry contact relay must be programmed correctly to ensure that in the event of an alarm, power to the contact is interrupted, thus unlocking the stairwell doors. The interface to the fire alarm system must also include an interface that allows the local fire department to immediately and completely unlock all stairwell doors.

system to ensure the interface allows the local fire department to unlock all stairwell doors.

Stairwell re-entry systems can save lives. Scenarios in which the stairwells are either always locked or always open can create unsafe conditions both during life safety



**Provide Door Signage on Stairwell Doors.** Upon installation of the new or modified stairwell locking hardware, each stairwell door should be provided with appropriate signage that alerts an individual of what floor they are on and where the next egress point is located.

**Conduct a Test of the Stairwell Re-Entry System.** The final installed system should be tested to ensure that when activated, all stairwell doors unlock properly and immediately. A test should also be conducted on the

emergencies and in normal building occupancy. Professional engineering consulting firms can provide valuable direction and support when designing a stairwell re-entry system. Building owners should take a pro-active approach to ensure the safety and security of all occupants that reside or work inside their buildings. **ST&D**

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