Barrier Management

Fire Protective Rolling Steel Doors

David Dawdy | Director Fire Protection & Life Safety NPD
Fire Resistance and Fire Protection
Rolling Steel Fire Doors

• Fire resistance rating:
  • The period of time that the building element, or assembly of materials can prevent or retard the passage of excessive heat, hot gases or flames during a fire event while maintaining structural ability.
  • Measures temperature rise above ambient over time per ASTM E119

• Fire protection rating:
  • The period of time that an opening protective can maintain it’s ability to prevent the spread of a fire event through an opening
  • UL 10B is the test standard use to establish the rating of the assembly
  • Rolling steel doors are typically listed as fire protectives
A Word About ASTM E119

• Rolling fire doors *typically do not meet* the ASTM E119 standard
• Not designed to prevent conduction of heat
• 25% rule:
  • 707.6 Openings. Openings in a *fire barrier* shall be protected in accordance with Section 716.5 ....shall be limited to an aggregate width of 25 percent of the length of the wall....and any single opening shall not exceed 156 square feet.
  • One of five exceptions, including full sprinkling, is a listing for ASTM E119
Rolling Steel Fire Doors

- Structural separations for openings:
  - Fire barrier walls
  - Fire Partition walls
  - Fire Walls
  - Exterior Walls
  - Smoke barrier
Our job is always about Life Safety!
# of Reported Fires US 2018

- 223,000 structure fires (not including residential)
- 90 civilian deaths
- 1100 civilian injuries
- $4.6 billion in direct property damage

Above from: Fire Loss in the United States During 2018
Ben Evans, NFPA. Published October 2019
• NFPA 80

• Publishes the standards, best practices and guidelines created by the consensus standard development processes as approved by ANSI, (American National Standards Institute)
• Has no regulatory power nor enforcement ability
• Does not list, test, inspect or certify for compliance
• Does establish rules and establishes a consensus process to promote fairness
• Is the primary installation, maintenance and inspection document for rolling fire doors
The Purpose of a Rolling Fire Door is Well Defined

• Most important and primary purpose of a fire door is to protect lives. As far as NFPA is concerned, any other aspect is secondary.

• A rolling fire door must be maintained to be in a continuous and reliable state of readiness to secure a rated wall opening when activated for the purpose of protecting life and property from the spread of fire and smoke throughout, into or out of a building.

• To assure and maintain this state of readiness, fire doors must be inspected, drop tested and reset annually per NFPA 80, Section 5.

• All fire door types are considered “passive” fire protection, used to isolate fire events by completing compartmentation.
Labels and Agencies

- Listing Agencies
  - Underwriters Laboratories US, (UL)
  - Underwriters Laboratories Canada, (ULC)
  - Factory Mutual, (FM)
  - Warnock Hersey, (WH)
  - Intertek

- The label is evidence of testing to relevant standards and in-plant follow-up inspections
  - No label – no fire door – no argument
  - The label will show the manufacturer, listing agency and door rating. It must be permanently attached and clearly visible. It is irrefutable evidence of a listed product.
Types of Rolling Fire Doors

- Rolling steel doors are manufactured of steel or stainless steel only, and are available with a variety of finishes not only intended for fire protection but for enhanced life safety planning and aesthetic fit.
- Counter fire shutters are designed primarily for institutional environments where improved aesthetics and footprint help fit the surrounding environment.
- Side coiling fire doors typically traverse corridors and typically provide an approved means of egress.
Detection, Release and Notification

- Fusible Links
- Smoke / Heat Detectors
- Central Alarm Systems
- Local Fire Alarm Control Panels
- Release Devices
- Warning Modules
- Horns, Strobes, Annunciators
Detectors and Release Devices

• Failsafe Release Devices
  • Requires notification electrically: Smoke/Heat Detector or FACP
  • Perform their function when power fails – note battery backup condition: Eliminates “nuisance drops”
  • Highest degree of life safety performance and reliability

• Fusible Link
  • Both detector and release device
  • Useful when high levels of ambient contamination prevent the use of electrical detectors such as paint spray, high moisture environments, diesel exhaust etc.
  • Poorest of all means to activate a fire door
  • Lowest grade for life safety performance
Fire Alarm Control Panel (FACP)

- Monitors all electrical detection devices in a building or in a building zone
- Is programmed to receive input from a variety of electrical input signals
- Is programmed to activate appropriate fire protection systems and planned protocols
- May be a centralized building system or it may simply be the localized door system itself (integrated versus non-integrated)
Evolutionary Progress: Two Primary Fire Door Designs

- Traditional **Tension Release** Designs: Function in a *normally balanced condition* and, when activated, must release partial counterbalance tension to achieve an out-of-balance condition allowing the door to gravity self close.

- Modern Designs: Function in a *normally out-of-balance condition* all of the time, are gravity biased and eliminate tension release entirely.
An Out-of-Balance Condition
Fire Protection

• Active:
  • Sprinkler systems
  • Chemical suppressive systems

• Passive:
  • Compartmentation
    • The five walls of the IBC
    • Opening protectives
      • Dampers
      • Swing doors
      • Proscenium curtains
      • Coiling fire doors and shutters
Integrated Versus Non-Integrated Failsafe Systems

- *Integrated electrically activated* fire door systems are a component of the overall building fire protection system responding to electrical notification from the FACP
  - Are *always* notified by electrical means – *can smell smoke*
  - Are *always* fail-safe – activated from alarm or power loss
  - Central brain – the FACP – code requires 24 VAC battery backup

- *Non-integrated, electrically activated* fire door systems that are not wired to the FACP
  - Are actually stand–alone FACP
  - Are *always* notified by local electrical means – *smelling smoke is paramount!*
  - Are *always* fail-safe – activated from local alarm or power loss
  - Should always use battery backup to prevent nuisance drops
The Old Standard: Thermal Activation (165°F Fusible Links)

- **Thermal activation Pros:**
  - They are cheap, cheap, cheap...........cheap
  - Fire door will not nuisance drop during temporary power failure
  - May be the only option in areas of high space contamination

- **Thermal activation Cons:**
  - Fusible links can’t smell smoke – life safety and damage potential maximized
  - May not activate at planned temperature if painted or dirty
  - Can be difficult and expensive to route properly
  - Easily adds unplanned expense to periodic inspections
  - Response time to activate door is very slow
  - Has the potential to trap first responders
  - Will not activate if temp doesn’t reach 165°F, but smoke migration will occur regardless
  - *May never activate* in a “cold smoke” event
  - *The worst possible choice to activate a coiling fire protective that exists*
Not Fail-Safe

- Thermally activated release devices that activate a fire door to close when temperatures reach (per NFPA 80) 165° Fahrenheit:
  - Fusible links
  - McCabe Links

- Remember: NFPA 80: Failsafe means that the device will provide it’s intended function *upon loss of power*

- *Fusible link activation is not failsafe nor is it acceptable for smoke rated openings.....be alert when inspecting*
New Install and Retrofit Operators/ Integrated or Stand-Alone

- Failsafe Chain Hoist
- Failsafe Motor
- Failsafe Awning Crank
- Failsafe Tube
Smoke Migration

The Toxic Airborne Effluence of Combustion:
• Injures more people than fire - can be minimized
• Causes more deaths than fire - can be minimized
• Damages more property than fire - can be minimized
• Causes greater productivity loss – can be minimized
• Causes extended job loss – can be minimized
• Creates hazardous conditions for first responders – can be minimized

FCIA
Firestop Contractors International Association
One Recent Example: Smoke Kills!

- Russian Shopping Mall
  March 25, 2017
- Kemerovo, Siberia
- 64 lives claimed, 48 were children
- Most deaths attributed to toxic smoke inhalation
What is Driving Fire Door Evolution?

• The need for improved safety, reliability, install-ability
• Increasing life safety expectations
  • More stringent installation and testing standards (NFPA 80)
• Reducing liability profiles for both manufacturer and owner
• Disgruntled ownership experience – influences specifiers and designers
• High drop test failure rates of existing fire door installations
  • Up to 60% per historic industry statistics
• Code: Performance standards are changing – European standards
• Innovative retrofit solutions
  • Converting traditional fire door operation into safer, more reliable and compliant sensing and operational systems
Fail-Safe Operation

- NFPA 80 Definition of Fail-Safe: A device that will provide it’s intended function upon loss of power
- The Fire Alarm Control Panel is predicated upon fail-safe operation
- A fail-safe release device activates a fire door to close when electrically notified or when power fails
- However, when backup battery systems are employed, the device will delay release during a power failure until it receives a signal from a notification appliance or until batteries discharge
- Battery backup systems are smart business in fire protection, and recommended to prevent nuisance curtain drops from temporary power interruptions

Fail-safe Release Device
What Characterizes Today’s Modern Fire Door Designs?

- Greatly simplified systems with greater performance and high reliability
- Operation, release, governing, reset – all on one side within the operator
- Non-complex test and reset procedures
- **Greatly reduced** lifetime ownership costs
- Greater owner willingness to be compliant with test standards
- Higher incidence of owner inspection participation
- Lowered insurability risk profiles
- Greater ease of integration into the building fire protection system
Battery Backup

- Motor operators
  - Used to hold the door open and maintain alarm signal detection during a power interruption
    - May be integrated to the operator chassis
    - May be a separate component
- Chain hoist and crank operators
  - Used to hold the door open and maintain alarm signal detection during a power interruption
    - May be integrated to the chassis
    - May be a separate component
- Typically employed only to facilitate a door holding function, not to electrically operate the door during power failure
Testing and Resetting Fire Doors
Acceptance Testing and Periodic Testing
NFPA 80, 2019, 5.2 and 5.23

• Acceptance testing
  • NFPA 80 chapter 5
  • Required at the conclusion of installation
  • Identical requirements to annual drop testing
  • Shall include closing by all means of activation
  • Must be witnessed by an owners representative
  • Record must be maintained for life of assembly

• Periodic Testing (Annual Drop Testing)
  • NFPA 80 chapter 5
  • Adds an inspection component
  • Is the responsibility of building owner or property manager
  • Must be completed by a knowledgeable individual per NFPA 80 (This is changing to verbiage describing trained door systems technician 2021)
  • Shall include closing by all means of activation
  • Must be witnessed by an owners representative
  • Records must be maintained for three years

FM is unique as an insurer
Proper Heat Detector and Fusible Link Locations
NFPA 80 Section 4

Note: Measurements shown are to the closest edge of the detector.
There are three NFPA 80 mandated periodic drop test requirements:

1. Inspection
2. Operational
3. Drop test
Periodic Inspection Procedure

1. Evaluate and note items that are not as provided by the factory:
   - Labels that are not clearly visible and legible
   - Damage to guides, bottom bars, curtains, hoods that could impair proper operation
   - Painted cables, sash chains, fusible links, releases
   - Torch cut guides
   - Tears or punctures in curtain
   - Floor obstructions – curtain must be able to rest upon the floor with no more than a \( \frac{3}{4} \)” gap
   - Keep “As Tested” in mind at all times

2. Drop Test

3. Reset – twice
Records: NFPA 80, Section 5

• It is the owner’s responsibility to meet NFPA 80 standards and retain evidence of testing

• The inspection form should be filled out properly and a copy kept by the owner for inspection by the AHJ

• The AHJ needs not be present for drop testing, however, our industry recognizes that an owner’s representative should be present and sign as a witness to a successful inspection, operation and drop test

• Records of periodic testing should be retained a minimum of three years

• Paper or electronic media are acceptable forms of record keeping (video is an acceptable method)
A Non-Inspected Door Can and will:

- Close prematurely
- Not close at all
- Close part way and jamb
- Close with excessive force causing injury or death to those in the path
- Close with such exceptional momentum that curtain becomes detached from barrel
- Crush fire hoses cutting off water supply

Notable: The Charleston Sofa Super Store Fire of 2007
The Ownership Experience

- Owners and property managers have limited knowledge of annual responsibilities
- Construction/Remodel: Owners rely almost entirely upon designers and contractors for product information
- This has a few drawbacks:
  - Most GCs have limited knowledge of advanced fire protection systems
  - Effectively communicating any advantages to owner is difficult
  - Least expensive/minimum performance options typically bid
  - RFIs and change orders after the fact are not popular
- Lifetime cost and performance satisfaction to owner rarely communicated
  - System supports a thriving retrofit market to disgruntled property owners
- Owners have generally negative attitudes toward fire doors
Promoting New Ideas:
Boosting Fire Protection Performance
Smoke is simply a byproduct of combustion. Some types are more apparent, such as the ominous rich smoke of burning damp leaves, as compared to exhaust from a natural gas furnace. The process of combustion also produce gases and chemicals, which are hazardous or fatal to human beings. And, of course, smoke is fully capable of destroying furnishings, finishes, inventories and daily business operations.

Modern building respond to fire in two primary ways: active and passive fire protection. Actively fire sprinklers spray water to reduce or halt the growth of a fire thereby reducing the amount of heat produced, but smoke can still be generated. Passively, buildings rely upon fire barriers, or compartmentation, to isolate and restrict the migration of these elements.

Barrier walls often have large openings to which fire doors are employed to close by activation should a fire occur. But here's the rub: when fusible links are chosen to activate the door, voluminous amounts of toxic smoke and gas may escape before those links can reach the 165°F temperature necessary to melt them open and activate a door. And this is only under the broad assumption that everything is set and located properly.

Fusible links simply cannot respond to the initial stage of a fire event: smoke. To that point, the life-safety mission of this piece is to improve the way we activate our fire doors. The technology is well developed, affordable and readily integrated into fire protection planning.

It's all about life safety.

Fire protection planning tends to focus upon occupant safety because lives are far more precious than property.

November, 2019 edition of International Door & Operator, you will understand why I consider fusible link activation of fire doors to be a generally awful choice for activation, and also why I believe that skilled technicians are crucial to our success as fire protection practitioners. Smoke migration entraps and kills people by surprise, and a fire door that is improperly tested and reset is the fuel for catastrophe.

Fire protection planning focuses on a primary objective of evacuating building occupants quickly during a fire event. Code and standards communities concentrate on...
What’s new?
Alternate Methods: Fabric Fire Doors, New to the Scene

Pre burn UL Northbrook  3 hour mark at 1890 F  Post burn coil side
Atrium Protection, Alternate Methods
It’s always about Life Safety Questions?