

Lessons from a Smoky Fire Close to Home...

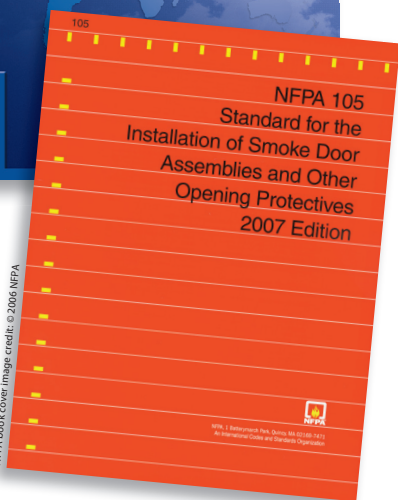
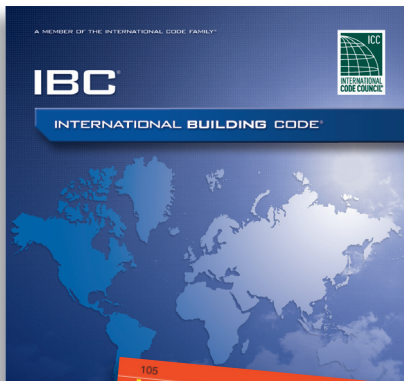
Smoke Protection in Codes, in Practice & in Action



SPECIALIZED SMOKE-CONTROL GASKETING SYSTEMS perform a vital role in minimizing the spread of smoke and toxic gases in building fires. Engineered to perform consistently in an installed environment, under all pressures and at all temperatures, these systems provide maximum protection for the safety and lives of occupants.

In the grim accounting of costs from fires in all types of structures, smoke inhalation is responsible for the vast majority of fatalities—around 80%. Recent developments in model building codes, along with industry guidelines and recommended practices, reflect that reality. The 2009 edition of the International Building Code (IBC) and the National Fire Protection Association’s NFPA 105-2007 Recommended Practice for the Installation of Smoke-Control Door Assemblies introduce new requirements for ensuring that fire door assemblies also provide effective smoke protection.

A four-alarm fire at Zero International in 2009 put Zero’s smoke gasketing to the test. While no lives were at risk in this case, the dramatic results demonstrate what happens when smoke gasketing is in place and works as intended. The case also offers practical pointers for door and hardware professionals who will be charged with helping building teams comply with new smoke control requirements.



BY JERRY HEID, AHC

Staff members at Zero International’s headquarters in Bronx, New York, snapped photos of the action when a dropped plasma cutter sparked a four-alarm fire in Zero’s unoccupied building across the street.

Photos Courtesy of Zero International

Sparking a Fire When There's "Nothing to Burn"...

Doorways at Zero are like a gallery of gasketing, each displaying a different configuration of perimeter and bottom door seals. For Zero's R&D team, every door is an opportunity to install, field test, observe and compare gasketing in action. And when Zero purchased a "spare" building across the street from its Bronx, New York, headquarters several years ago, along with its various "test tube" doorways eventually came an opportunity for a real-life field test of the highest order—a building fire.

The 3-story building, acquired to provide for future expansion, previously housed a woodworking shop and was vacant when the fire occurred. The original 90-minute fire-rated hollow metal doors were in place at emergency openings to both the main and secondary stairwells. Zero smoke gasketing installed at these openings featured neoprene bulbs with an extra lip for double-seal protection, which compensates for any gaps or door misalignment. The lower edges of all openings were fitted with automatic door bottoms utilizing lock-side magnets and a steel plate to amplify the action of integrated spring mechanisms for a controlled, uniform drop and seal.

At the time of the fire, work was underway to prepare the building for a major renovation.

Metal scaffolding was in place on the third floor allowing contractors to use hand tools to remove the last steel pipe, once used for pressurized air, from the ceiling. All other piping, wiring and plumbing had been completely removed to make way for installa-

tion of entirely new gas, electrical control and water systems.

A plasma cutter being used to cut the ceiling pipe fell, landed on the concrete floor and sparked. What should have been a non-event got more exciting when paint residues from a paint booth, long-since removed from that spot, flamed and started burning. Although the room was completely empty, wind drafting through plastic covering broken casement metal windows attracted the flame, igniting the plastic. Within minutes, the 10,000 sq ft space was filled with heavy, black impenetrable smoke.

Zero's staff witnessed the smoke billowing out from the windows—and the four-engine effort to extinguish the fire—from corporate offices across the street. And when Zero president Elias Wexler ventured into the building on first signs of trouble to check the whereabouts and welfare of the workers (who fortunately had already exited that floor), he saw nothing but swirling blackness on peering into the space to call for them. The stairwells, however, were completely clear. No smoke escaped into the stairwell through the smoke-gasketed fire doors.

The Gasketing Worked... and Needs to Work Every Time...

That's what matters most in the case of Zero's fire, of course. Most important to designers and their door and hardware professional advisors is to specify smoke gasketing that performs reliably and predictably under any and all installed conditions.

Effective smoke-control gasketing operates as a continuous system. All components must work together



While impenetrable, thick black smoke filled a 10,000 square foot space and billowed out broken windows, smoke gasketing on the fire doors completely blocked the spread of smoke into the stairwells.

to establish a solid, uninterrupted seal around the entire perimeter of the door. Designers need to be aware that it is far more difficult to achieve a solid seal consistently under working conditions than in the test lab. Practical considerations make mechanically attached gasketing the only solution that can be counted on to work efficiently in an operational door day-to-day, as well as in a smoke emergency. Issues to consider include:

- Gasketing material that is too thick can bind the opening and interfere with door operation. On the other hand, too-thin material will not make smooth contact with door edge surfaces.
- Gasketing needs to flex and yet remain intact as doors swell and compress along with changes in temperature and humidity.
- Permanent attachment is essential. Screw-attached systems eliminate the potential for abuse or even normal traffic to dislodge self-adhesive seals.
- Screw-attached systems provide greater flexibility during installation to compensate for inevitable variations in clearances around door perimeters.
- Additional features such as neoprene bulbs and extruded fingers will further enhance the overall seal.

- Adding a door bottom to the assembly ensures a tight, continuous seal especially for pressurized applications, such as stairwells.

Mechanically attached gasketing made with good-quality neoprene meets all of these challenges and assures long service life with appropriate maintenance. It is important to note that in a working building, under new code requirements, fire and smoke assemblies are now subject to annual fire inspections. Installed in Zero's unoccupied building, however, the smoke seals in the stairwell door assemblies had been in place for several years with no particular maintenance. Quality of design, construction and installation worked together to deliver perfect performance.

Code Changes Boosting Mandatory Smoke Control Measures...


As national standards and model building codes are now incorporating more explicit guidelines for smoke protection, door and hardware professionals need to educate themselves in order to assist designers in making best choices in smoke-control systems. While adoption of new requirements into local and regional building codes takes time, designers' fiduciary responsibility for life safety and security of their buildings' future occupants knows no time limits. Designers should begin incorporating new measures now.

IBC 2009 mandates that fire-rated doors also satisfy applicable smoke control standards. Section 715.4.3.1 of IBC 2009 states:

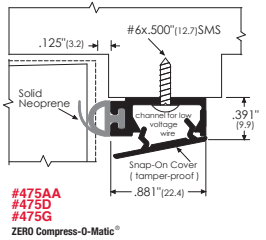
Smoke and draft control. Fire door assemblies shall also meet the requirements for a smoke and draft control door assembly tested in accordance with ULL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot (0.015424 m³/s—m²) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Lowers shall be prohibited. Installation of smoke doors shall be in accordance with NFPA 105.

The practical effect is that every fire door assembly will be required to carry an S smoke-and-draft control label, as well as a fire rating. That means smoke seals capable of blocking "cold smoke" generated by a non-adjacent fire must be in place for the assembly to be rated. And smoke gasketing incorporated into the assembly will also be assessed in annual inspections of the assembly.

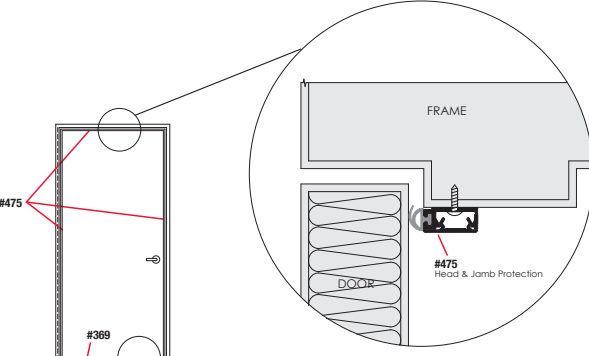
Application
Smoke-Control Gasketing System



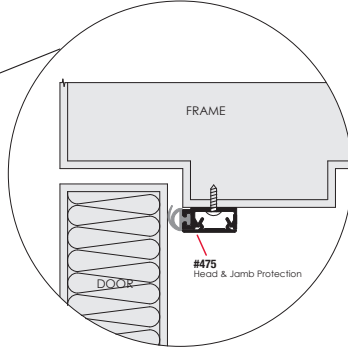
Note: A = Aluminum
 AA = Clear Anodized
 B = Bronze
 D = Dark Bronze Anodized
 G = Gold Anodized

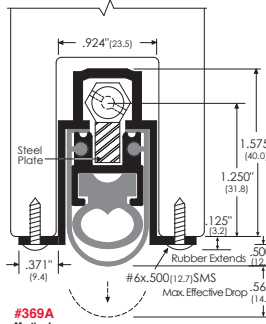


#475AA
#475SD
#475G
ZERO Compress-O-Matic®

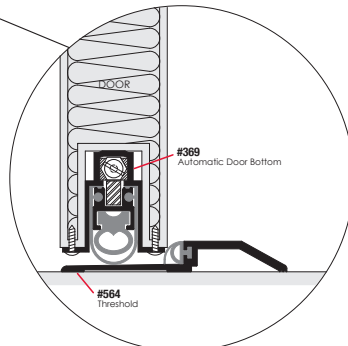


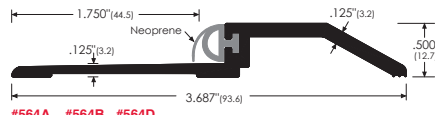
Elevation From Push Side of Door
(not to scale)





#369A
Mortised





#564A **#564B** **#564D**

This configuration of Zero International components illustrates the principles of an engineered smoke-control gasketing system. The mechanically adjusted system integrates advanced features to ensure a complete, uninterrupted seal in the working door. The combined efficiency of the double neoprene bulb in the door bottom and extruded neoprene lips in the threshold and perimeter seals also delivers a high level of sound control.

An additional requirement for those fire-and-smoke control assemblies comes out of a new provision of NFPA 105-2007 standards, which are incorporated into IBC 2009. Section 4.5.6.1 of NFPA 105-2007 states:

Smoke door assemblies installed where pressurization is provided to restrict smoke movement shall be required to have a bottom seal.

The prime example of where this applies is stairwell doors—like the fire and smoke control doors in the stairwells of Zero’s building. The type of automatic door bottom used there ensures the solid seal under all installed conditions that will be needed for required fire and smoke ratings under the new standard.

A Few Observations About Smoke and Sprinklered Fire Protection...


The use of sprinkler systems vs. compartmentalizing building interiors with fire-rated construction to contain the spread of fire and smoke has been hotly debated for years. DHI has taken the leading advocacy role on behalf of our industry. Following a generation of code trends favoring active (sprinklered) systems at the expense of passive systems for fire protection, the most recent reports from the organization show a shift toward restoring more balance in respecting the contributions of both forms of fire protection.

It is worth noting circumstances of Zero’s 2009 fire that speak to the vital need for passive smoke protection systems. The behavior of the fire and its heavy smoke by-product in the absence of any sprinkler system in our building can be directly compared with a fire

in a building with a non-operating sprinkler system. Whether by inadequate maintenance of sprinkler pipes and heads, water-supply disruptions from external sources, or human error, industry reports show the incidence of sprinkler failure to exceed ten percent.

The thick smoke in Zero’s building was generated by burning materials in the windows, outside the direct range of any sprinkler system that might have been in place. Comparisons can also be drawn here to shielded fires, which originate and build under desks or other barriers, and incubate and spread smoke prior to any fire suppression by sprinklers. In addition, the stairwell smoke control systems at Zero protected the spaces most vulnerable to the stack effect of smoke, wherein smoke ventilates to upper floor through stairwells and elevators. Documented fatalities from high-rise fires include scenarios where dozens of people on upper floors died from smoke inhalation resulting from a short-lived fire contained and extinguished on a lower floor.

In all of these circumstances, smoke-control gasketing, properly designed and installed, can and does save lives—with or without the benefit of fully functioning active fire protection systems.

And for specifiers and our industry consultants charged with optimizing life safety and security for occupants of the buildings they design, the challenge and the opportunity are the same—specify smoke-control systems that work and do the job they are intended to do. 

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