THE MAGAZINE OF EFFECTIVE COMPARTMENTATION

Life Safety DIGEST

FALL 2017

Some ABCs of Smoke Control

What Architects Can Learn From Firefighters

One-Size-Fits-All Engineering Judgments Don't Work

From Devastation Comes Inspiration

Maintenance and Management

Life Safety Digest | 4415 W. Harrison St., #540 | Hillside, IL 60162

WRITTEN BY **ANGELA M. OGINO**

ONE-SIZE-FITS-ALL ENGINEERING JUDGMENTS DON'T WORK

THE SIX DESIGN CRITERIA OF PERIMETER FIRE BARRIER SYSTEMS

Thermafiber, Inc., a pioneer of the perimeter fire barrier system, has been testing exterior curtain wall conditions for over 45 years. Through this extensive testing, we have developed in-depth knowledge around the critical design components that are required in successfully containing fire at this complex area. The area is where a fire-resistance-rated horizontal floor assembly is separated from a non-rated wall structure.

Contrary to common perception, simply stuffing and spraying (installation of safing insulation with a smoke sealant applied) into the void between the floor and exterior wall, doesn't necessarily yield an effective fire and smoke barrier in curtain wall conditions. Therefore, the idea that the protection is based on the "performance of the joint system" doesn't mean that flame and hot gasses will be stopped at the interior joint, as is required by the code.

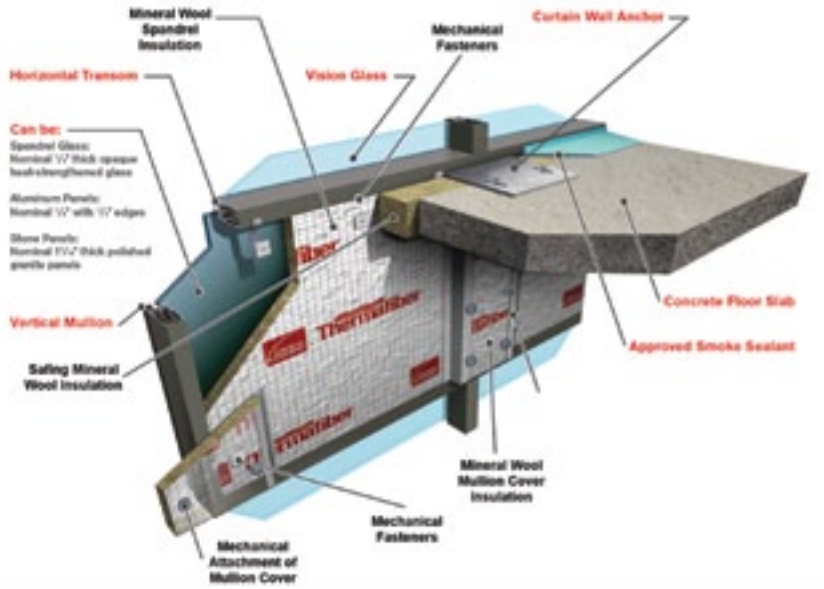
The perimeter fire barrier is a system, a compilation of installed materials, that when tested to the rigorous conditions of ASTM E 2307 (the Standard Test Method for Determining Fire-Resistance of Perimeter Fire Barriers Using the Intermediate-Scale, Multi-Story Test Apparatus) must remain securely in place for the time period equal to the fire-resistance-rating of the floor assembly.

Although the joint is the subject area for determining whether the assembly passes or fails, longevity of the wall is critical for holding the joint materials in place during the duration of the fire test. Most curtain wall assemblies are designed around a tested and listed third-party system.

These systems, although diverse when it comes to exterior spandrel panels, heights and locations relative to the floor, all of them share a common denominator -- the six basic components that are required to successfully achieve the published hourly rating.

THESE SIX COMPONENTS ARE:

1. **Install mineral wool as the insulation for the perimeter fire containment barrier,** both within the curtain wall spandrel AND the interior joint. Mineral wool insulation, at the required densities and thickness, is the only tested and proven material that will provide protection to the spandrel and interior joint.
2. **Mechanical attachment of mineral wool curtain wall insulation.** There is no "one size fits all" when it comes to mechanical fasteners. Specific mechanical fastening methods, as per the tested assembly, must be installed to the manufacturers' installation instructions to assure that the system operates as designed under the duress of fire, thermal and structural movement consequential to the rigorous exposure of ASTM E 2307.
3. **Provide backer reinforcement at the safe-off line.** Most listed systems reference either a 20-gauge steel T-Bar, L-Angle or hat channel. Other systems utilize other components to provide the required reinforcement of the curtain wall insulation. This detail is critical to prevent the spandrel insulation from bowing due to the force of compression at the safing joint. Again, the common factor is that all systems require some form of reinforcement behind the mineral wool spandrel insulation at the safe-off line. This is also critical for providing a tight seal at the interior joint. The lack of reinforcement causes the spandrel insulation to flex, creating even the smallest of gaps or seams which allows flame and hot gases to penetrate the safe-off opening and potentially engage combustibles on the floor above.



The illustration shows design criteria of perimeter fire barrier systems. Illustration provided by Owens Corning.

There is another common misconception that metal panels, such as aluminum or steel back pans, will provide the necessary reinforcement. Regardless of whether they are steel or aluminum, testing has proven these panels to be a failure point at the safing line if not properly reinforced.

4. **Compression-fit mineral wool safing insulation** within the void between the horizontal floor assembly and the exterior curtain wall insulation. The correct density and compression are required to be installed to establish the proper seal at the interior joint.
5. **Protect exposed vertical aluminum framing with mineral wool insulation mullion covers.** This a detail that is often removed from the system as it is perceived to be a minor contributor to the performance of the assembly, particularly when it obstructs interior finishes or window shade pockets. Again, another common error in design is to eliminate the element that covers and protects the mechanical fasteners that keep the spandrel insulation in place, as well as help to retain the exterior wall in position so that the safing joint materials continue to block fire and smoke. Elimination of this component results in a shorter fail rate of the exterior curtain wall element.
6. **Prevent the passage of smoke through the safe-off area.** Another critical component is needed to impede the passage of smoke is the application of an approved smoke sealant. The smoke sealant is applied over top of the safing insulation on the non-exposed side of the perimeter fire containment system.

In the perfect world, it would be nice if architects/designers could simply reference a third-party laboratory's fire-resistance directory and select a system that would match up exactly to their construction details.

However, due to ever-evolving architectural design, that is rarely, if ever, the case. Securing an engineering judgment, in many cases, is a very common occurrence in the submittal process. Just as important as making sure that the six design components are incorporated, it is important to make certain that the engineering judgment addresses every detail of the curtain wall construction to support the hourly fire-resistance judgment rendered. Not addressing or substantiating the variances in the actual construction when compared to an assembly chosen as the basis of design, could provide the potential for a disastrous outcome in the event of a fire.

THE CRITICAL COMPONENTS OF ENGINEERING JUDGMENTS FOR PERIMETER FIRE CONTAINMENT

Thermafiber, Inc., an Owens Corning company, has identified the following critical components when providing a quality engineering judgment for Perimeter Fire Containment:

1. The engineering judgment must be project specific and represent the project conditions being evaluated.
2. At least one third-party tested system (evaluated to test standard ASTM E 2307 or appropriate standard based on requirement of the applicable jurisdiction) that most closely represents the project construction details must be referenced as the basis of design in order to properly evaluate the hourly F-rating.
3. Engineering judgments must provide a complete description of the critical elements of the system and must include the tested and listed system's design criteria that are required to make the system work. The engineering judgment must be based on interpolation of previously tested perimeter fire barrier systems that are similar to the conditions upon which the judgment is given.
4. An engineering judgment is not to be used as a way to circumvent testing new fire containment assemblies. Engineering judgments that do not have data to interpolate and/or extrapolate, within the boundaries of good design practices of the condition in question, should initiate the need for fire testing.
5. An engineering judgment must state that it is such and is not a tested and listed system.

In addition to the critical components of engineering judgments highlighted above, we strongly abide by The International Firestop Council (IFC) provided recommendations on writing engineering judgments, titled "Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments." Below is an outline of a few of the requirements (not all included here) for engineering judgments:

- All elements of a tested and listed firestop system, including the assembly into which the system is installed, constitutes a specific and inseparable engineered unit that must be utilized as such. Firestop system designs are tested and listed by independent testing agencies such as UL® and Intertek. The specific elements of each design become integral to the listing.
- According to the IFC, engineering judgments should be based upon interpolation of previously tested firestop systems that are either sufficiently **similar in nature or clearly bracket the conditions upon which the judgment is to be given.**
- Engineering judgments should be limited only to specific conditions and configurations upon which the engineering judgment was rendered, and should be based upon reasonable performance expectations for the recommended firestop system under those conditions.
- For more information, reference http://www.firestop.org http://www.firestop.org/uploads/2/4/5/4/24544763/ifc_engineering_judgment_guidelines_perimeter_fire_barrier_systems.pdf

Angela M. Ogino is the Technical Services Leader for Thermafiber, Inc. (an Owens Corning Company). Angie has over 19 years of experience in the mineral wool and fire-stopping industry, providing engineering judgments and technical assistance on mineral wool product performance for architects, building officials and contractors in the fire containment area. She is also the developer and coordinator of all perimeter fire containment testing for Thermafiber at Underwriters Laboratories, Southwest Research and Intertek/Omega Point Laboratories, as well as is the developer of Thermafiber's educational programs on perimeter fire containment. Ms. Ogino has presented perimeter fire containment programs to audiences throughout North America. She can be reached at angela.ogino@owenscorning.com.