

**Technical Bulletin #161104**  
**International Building Code Compliance**  
**Asymmetrical Testing of Fire Rated Ventilation Ductwork**

**The Problem:**

Many fire-rated ventilation duct assemblies currently marketed in the US are not Code compliant. While presented as 2-HR fire resistive, they cannot withstand the attack of fire exposures as prescribed by the Code, wherever symmetry testing is mandated.

*IBC Section 703.2.1-Nonsymmetrical Wall Assemblies* requires non-symmetrical assemblies to be exposed to the furnace from both sides and this may be being overlooked as it relates to fire rated ductwork. AHJs across the country are now taking a hard look at this legacy code requirement, and are beginning to mandate and enforce compliance. This change will have significant impact on how to properly evaluate and regulate these systems going forward.

To expand, many fire-rated duct assembly manufacturers have not tested their products to all 4 conditions of the complete ISO 6944 or ASTM E2816 test protocols:

1. fire outside horizontal duct orientation,
2. fire inside horizontal duct orientation,
3. fire outside vertical duct orientation and
4. fire inside vertical duct orientation.

Yet, these products are being marketed, sold, and installed across the US market, as if these assemblies were fully tested to meet IBC Section 703.2.1. They are not.

These manufacturers have an assembly sample tested for fire exposure from the outside. They do not always test for fire attacking the assembly from fire inside – a much more stringent test. IBC Section 703.2.1 requires that inside fire exposure test. Due to inconsistency in format, manufacturers' Laboratory listing cards do not always highlight this limitation clearly. In practice, many designers, builders, and regulators miss this crucial information – and, as a result they may believe their projects are fully compliant.

Today, more than ever, designers, builders, and regulators across the country must be aware of this critical, but overlooked, aspect of Code compliance. The industry can no longer view fire rated HVAC systems affirmatively on the basis of past practices alone.

**A Brief History:**

Horizontal and vertical shafts have historically been constructed with fire rated drywall to form a 2-hour enclosure around a ventilation duct. Over time, the industry gradually introduced fire rated duct wrap assemblies as an alternate to the earlier 'built on site' drywall enclosures, which allowed duct to be installed without a separate fire resistive rated enclosure.

This made construction less labor intensive and saved space – but it reduced life safety. And its fire performance as a proper alternate was quietly overlooked.

### **The Code Rationale:**

Fire rated enclosures protect the building from both - a fire outside the shaft from entering into the shaft - and from a fire inside a shaft from exiting the shaft. Both situations risk spreading a fire within a structure. In addition, there are many scenarios where supply air ducts become conduits for fire spread, including those intended for smoke control. There is no exception to IBC 703.2.1 for supply air ducts.

Vertical shafts branch out into horizontal ventilation ducts. The IBC Building Code mandates that horizontal assemblies must be protected the same as vertical assemblies (shafts). Therefore, IBC Section 703 must be consulted for the appropriate fire resistance rating.

In the IBC Code, assemblies that have different materials on the inside than on the outside, are known as non-symmetrical assemblies. Since materials are attacked by a fire in a different sequence depending on which side is exposed to the fire, IBC Section 703.2.1 requires nonsymmetrical assemblies to be tested with both inside and outside exposures in the test furnace. The weaker side achieves the governing fire resistance rating (hours).

By mandating fire resistive performance from either side of non-symmetrical assemblies, the shaft cannot become a “conduit” to move a fire from compartment to compartment (or floor to floor), independent of the performance of the HVAC equipment. Just as importantly, the shaft remains intact in its ability to protect occupants and first responders during a fire.

### **Alternate Means and Methods:**

In the past, the industry has used alternate means and methods arguments to move away from ‘built on site’ drywall enclosures toward fire rated duct assemblies. Today, these alternate assemblies consist primarily of fire wrapped duct, coated duct, or composite duct assemblies. In all cases, the duct assembly is intended to replace and perform similarly to the equivalent drywall enclosure.

In meeting IBC Code requirements, any Alternate Means and Methods approach must meet the same fire resistance rating of an enclosure, such that it is fully equivalent to the Code requirements for a ‘built’ assembly, which means the equivalent of that prescribed in the Code in quality, strength, effectiveness, fire resistance, durability and safety.

All fire rated duct assemblies used in the US market today, utilizing Alternate Means and Methods approaches, are non-symmetrical, and, therefore, must be tested to all 4 exposures in the furnace. Further, they must be tested in both vertical and horizontal orientations in order to be safely applied in that orientation.

### **The Test Standards:**

Two basic test standards have been recognized for the fire rated ductwork assemblies used for ventilation:

- ISO 6944 (1985), ISO 6944-1 (2008)
- ASTM E2816

Neither standard is currently recognized by the ICC-Series Codes, but these standards are necessary because just like ASTM E119/UL 263 they test fire resistance, but further, they also test the ductwork's ability to ventilate during that fire exposure.

Both standards have 4 conditions of testing:

- Fire outside the Duct (Duct Sample horizontal)
- Fire outside the Duct (Duct Sample vertical)
- Fire inside the Duct (Duct Sample horizontal)
- Fire inside the Duct (Duct Sample vertical)

### **Fire Rating Equivalence:**

Because current fire rated duct assemblies are non-symmetrical, in order to meet the symmetry testing conditions, as referenced in IBC Sections 703 and 703.2.1, they must be tested to all 4 conditions.

Because fire rated duct assemblies are an alternate to assemblies directly named in the IBC Code, they must maintain the same equivalent fire resistance rating as the 'built on site' drywall enclosures that they replace. Since the IBC Code requires symmetry testing for 'built on site' assemblies, that means the Code also requires symmetry testing for Alternate Assemblies – equal performance for all systems.

### **The Solution:**

Recognition of asymmetrical test standards per IBC section 703.2.1 for all fire rated duct systems used in US markets. It's in the IBC Code. Alternate Means and Methods assemblies, including fire wrapped assemblies, must demonstrate to the local AHJ, testing to the complete ISO 6944 or ASTM E 2816 test protocol, in order to be used in projects currently under construction.

### **Justification for Action Now:**

In a fire event, systems that are not fully tested do not meet the intent of the IBC Code for property protection or for the safety of the occupants and first responders.