

NFCA on Restrained/Unrestrained Assemblies & Effects on Fireproofing Thicknesses - What's the big deal?

=====



In the building codes, ASTM E119 *Standard Test Methods for Fire Tests of Building Construction* and UL 263 *Standard for Safety of Fire Tests of Building Construction* and CAN/ULC-S101, *Standard Method of Fire Endurance Tests of Building Construction and Materials*, acceptance criteria are one option to determine fire-resistance-ratings. Others include the International Building Code's Chapter 7 Prescriptive and Calculated methods used for fire-resistance. Both have data derived from one or both of the US based versions of these standards.

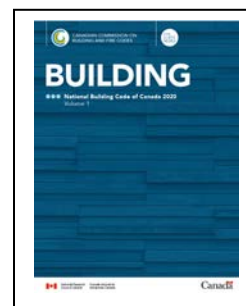
Required by the International Building Code (IBC), the design professional is to declare buildings restrained or unrestrained on the construction documents. This decision affects what happens with fireproofing – how thick it is - once declared.

703.2.1.3 Restrained classification. Fire-resistance-rated assemblies tested under ASTM E119 or UL 263 shall not be considered to be restrained unless evidence satisfactory to the *building official* is furnished by the *registered design professional* showing that the construction qualifies for a restrained classification in accordance with ASTM E119 or UL 263. Restrained construction shall be identified on the *construction documents*. [IBC 2021]



The National Building Code of Canada (NBCC) also has statements on Restrained and Unrestrained assemblies. The third paragraph of Division B, D-1.12.1, Restraint Effects on Fire-Resistance Ratings states:

The ratings for floors, roofs, and beams in this Appendix meet the conditions of CAN/ULC-S101, “Standard Method of Fire Endurance Tests of Building Construction and Materials,” for thermally unrestrained specimens. In a thermally restrained condition, the structural element or assembly would probably have greater fire resistance, but the extent of this increase can be determined only by reference to behavior in a standard test. [NBCC 2020]



Why? Fireproofing thicknesses required to protect structural building elements are thicker for unrestrained assemblies than they are for restrained assemblies.

In order to be deemed restrained, the structural building element must be thermally restrained by surrounding or supporting construction. Based on UL 263, Appendix C, the surrounding construction must be “... *capable of withstanding substantial thermal expansion throughout a range of anticipated elevated temperatures.*”

When the surrounding construction is capable of resisting thermal expansion, the building element locks itself into place under fire conditions and withstands the applied load beyond the time at which structural collapse should occur. This results in the need for less fireproofing in order to achieve the same fire-resistance-rating as an unrestrained assembly.



12

Beam has been locked in place, forming restrained conditions. UL Image.

What is the acceptance criteria from ASTM E 119 and UL 263/CAN-ULC-S101 as referenced in the IBC and NBCC building codes?

The restrained assembly acceptance criteria in ASTM E119 and UL 263/CAN-ULC-S101 is:

- Support Applied Load for the duration of the fire test.
- No flaming on unexposed side sufficient to ignite cotton waste.
- Max avg. beam temp. 1000°F, max individual point beam temp. 1300°F, for 1 hr or ½ the rating period
- Max avg. unexposed temp. rise 250°F and max individual temp rise 325°F.

The unrestrained assembly acceptance criteria in ASTM E119 and UL 263 is:

- Support Applied Load for the duration of the fire test.
- No flaming on unexposed side sufficient to ignite cotton waste.
- Max avg. beam temp. 1000°F, max individual point beam temp. 1300°F, for the FULL RATING PERIOD.
- **NOTE: Beam temp., FULL RATING PERIOD.**
- Max avg. unexposed temp. rise 250°F and max individual point temp rise 325°F.

Unrestrained assemblies are assumed to be *free to rotate and expand*. To get the same fire-resistance-rating as a restrained assembly, and reduce movement and expansion of these assemblies under fire, more fireproofing is therefore needed for unrestrained assemblies.

Rating Hr	Min Thkns In.	
	Restrained Beam Rating Hr	Unrestrained Beam Rating Hr
1	1/2	1/2
1-1/2	11/16	13/16
2	15/16	1-1/16
3	1-7/16	1-9/16
4	1-15/16	2

Chart shows the fireproofing thicknesses for a Restrained Beam are less than an Unrestrained Beam using Sprayed Fire-Resistive Materials. There are also reductions for Intumescent Fire-Resistive Material thicknesses. NFCA Image

If a building has been considered unrestrained, using Restrained Assembly or Restrained Beam Rating thicknesses reduces the fireproofing thickness and violates the International Building Code requirements that restrained ratings are used on restrained assemblies only!

A possible fire and life safety risk happens when restrained thicknesses of fireproofing are improperly applied. The risk is that the structural building element expands upon heat too much, causing sagging, breaking the connections at columns and possible progressive collapse.

BEWARE of submissions allowing for RESTRAINED RATINGS INSTEAD OF UNRESTRAINED RATINGS as for the most part, buildings constructed under the International Building Code and National Building Code of Canada are designed as unrestrained.

Code officials, design professionals, general contractors should only accept submittals that have fireproofing thicknesses from the correct section of the listing – Restrained or Unrestrained. The difference in price and performance is shocking.

© National Fireproofing Contractors Association – March 2024
www.NFCA-online.org – INFO@NFCA-online.org