

TO: CAFCO® SALES TEAM
FROM: Phil Mancuso *PM*
DATE: October 17, 2007
SUBJECT: UL and ICC Restrained Beam Rating Requirements

Recently there has been numerous inquiries as to the correct use of the of Restrained Beam ratings in accordance with International Building Code (IBC) and Underwriters Laboratories, Inc. (UL) guidelines.

In order to determine if your building construction is restrained, Section 703.2.3 restrained classification in the 2006 International Building Code indicates the following:

“Fire-resistance-rated assemblies tested under ASTM E 119 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 E 119. Restrained construction shall be identified on the plans.”

In addition, in order to meet restrained conditions per Underwriters Laboratories, Inc. (UL) 263 Guidelines, Page 7, Item 9 of the Fire Resistance Directory indicates the following:

Classifications of floor-ceiling and roof-ceiling assemblies and individual beams include restrained and unrestrained ratings. ANSI/UL 263 and, specifically, Appendix C, provides general information with respect to the concept of these classifications.

Appendix C of ANSI/UL 263 defines restraint in buildings as: “Floor-ceiling and roof-ceiling assemblies and individual beams in buildings shall be considered restrained when the surrounding or supporting structure is capable of resisting substantial thermal expansion throughout the range of anticipated elevated temperatures. Constructions not complying with this definition are assumed to be free to rotate and expand and shall be therefore considered as unrestrained.”

Restrained conditions for the fire test assemblies are provided by constructing floor, beam and roof test assemblies within nominal 14 ft by 17 ft frames of composite steel/concrete cross sections having an approximate stiffness (EI/L) of 850,000 kip-in. and 700,000 kip-in. along the 14 ft and 17 ft sides, respectively. The frame stiffness remains constant throughout the fire test because the test frame is insulated from the fire environment.

When applying the published restrained ratings, it is recognized that the individual responsible for the design of the fire-rated construction may ascertain that a different degree of restraint may be provided to the building assembly during a fire condition than was provided to the test sample during the fire test. Under these conditions, the designer may review the Conditions of Acceptance for restrained and unrestrained assemblies and beams in ANSI/UL 263 for additional guidance when determining whether restrained or unrestrained ratings should be specified.

Once the building is determined to be restrained, we must now determine the proper thicknesses of fire protection material on the beams. Therefore, the introductory portion of the UL Fire Resistance Directory, Volume 1 indicates the following:

Classifications resulting from a tested assembly containing a full representation of a floor or roof construction may include: (1) Restrained Assembly Ratings and (2) Unrestrained Assembly Ratings. Results from test of these assemblies are identified as Design Nos. A _____, D _____, G _____, J _____, or P _____. Tested assemblies supported by beams may also include an Unrestrained Beam Rating, but do not include a Restrained Beam Rating. A Restrained Beam Rating is determined only from a test on an assembly with a restrained beam and a partial representation of a floor or roof. Results from tests on this type of assembly are identified as Design Nos. N _____ or S _____.

In summary, this means that the only way to achieve a "restrained beam" rating is to utilize beam substitution. Restrained beam ratings cannot be found in an assembly (*i.e.* D, G, J and P Series Designs). They can only be located in "beam only" designs (*i.e.* N and S Series Designs)

- Floor Construction: N Series "beam only" → D, G, or J Series Assembly
- Roof Construction: S Series "beam only" → P Series Assembly

To get the ICC interpretation of this section, we have recently requested that ICC confirmed the proper use of restrained assemblies for Table 601 of the IBC.

Please find attached documentation from ICC Dated April 12, 2007. Please take time to carefully read this document.

The document clearly indicates that the use of a 1 hour unrestrained beam for a 2 hour restrained assembly (as noted in D Series UL Assemblies) will **NOT** provide the 2 hour restrained assembly requirements. The hourly ratings as listed in Table 601 of the IBC must be met for all components of the assembly.

In order to maintain the restrained assembly, the beam component of the assembly must have at least an equal fire rating as that listed for the assembly.

In most if not all cases, this results in a reduced thickness for floor beams (N Series). Note however, that some Isolatek roof assemblies (P series) may contain lesser thicknesses for the unrestrained beams of equal hourly rating than the substituted restrained beam of equal hourly rating. Unrestrained beam thicknesses in this case is considered more conservative, thus typically accepted means of determining thickness.

Should you have any questions on the above, please contact the Technical Services Department at 1-800-631-9600 (option 1).

Attachment – ICC Letter Dated April 12, 2007



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April 12, 2007

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**RE: Sections 703.2 and 703.2.3 along with Table 601 of the
ICC International Building Code/2003**

Dear Mr. Nuzzo:

On April 9, 2007 we were forwarded a copy of your e-mail of the same date concerning fire-resistance ratings and restrained classifications for structural steel building elements. Our answers to your letter are contained herein and are based on the above referenced code sections.

We understand your situation involves a structural steel-framed building of Type I construction. Its floor construction is required to be fire-resistance rated for 2 hours in accordance with Table 601. The floors will comply with a specific listing from a fire-resistance directory printed by a qualified independent testing agency. The floor construction consists of a concrete deck poured over a steel fluted decking that is directly supported by open-web steel joists or structural steel beams. To achieve the required 2 hour rating, the steel decking, joists and beams are sprayed with the necessary fire-resistant materials. Further, we understand that the floor construction of this building has been designed and fire-resistance tested with a restrained classification in accordance with Section 703.2.3. You are specifically asking whether the structural steel beams can be protected for just 1 hour via a different listing for just beams in the same fire-resistance directory. The answer is No.

Typically, Table 601 specifies the fire-resistance ratings for all building elements based on a building or structure's type of construction classification. The second to last entry in that table contains the fire-resistance ratings for floor construction.

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This building element includes not only the floor deck itself but also the beams or joists (repetitive members) that provide the direct bearing support for the deck. Conversely, the main steel girders of this building that transfer the loading from the floor beams and joists into the steel columns are part of the “structural frame”.

When a floor/ceiling assembly is required to be fire-resistance rated, all of its components are required to be rated the same, regardless of whether the assembly or even a portion of the assembly is designed and tested as a restrained element. For your information, referenced standard ASTM E119 defines the differences between “restrained” and “unrestrained” structural elements. This distinction is not to be used to determine which components of a floor/ceiling assembly are required to be 2 hour fire-resistance rated versus just 1 hour.

Those assemblies or building components that have been fire tested by an approved, qualified and independent testing agency must be constructed in the same fashion without any substitutions or modifications. The open-web steel joists or structural steel beams of this listed floor/ceiling assembly must be sprayed with the necessary fire-resistant materials to achieve the required 2 hour rating. Other listings for 1 hour rated beams cannot be substituted.

We hope this answers your letter in full. If you have any further questions, please call. These opinions are based on the information which you have provided. We have made no independent effort to verify the accuracy of your submitted information nor have we conducted a review beyond the scope of your questions. As this interpretation is only advisory, please consult with the authority having jurisdiction, the building official.

Very truly yours,

A handwritten signature in black ink, appearing to read "Gary L. Nelson".

Gary L. Nelson, P.E.
Senior Staff Engineer

cc: Mr. David A. Bowman - ICC Chicago District Office
Mr. Gary G. Nichols - ICC-ES Birmingham District Office