

USE OF THE W/D THICKNESS MANUAL

This “W/D Thickness Manual” primarily provides Spray-Applied Fire Resistive Material (SFRM) thicknesses for structural steel shapes to achieve various hourly fire resistance ratings. Thicknesses are listed under specific Underwriters Laboratories, Inc. (UL) Designs for CAFCO® BLAZE-SHIELD® II, BLAZE-SHIELD HP, CAFCO 300, CAFCO 300SB, CAFCO 300ES, CAFCO 400 and Fendolite® M-II and TG SFRMs. Also included are designs and thicknesses for CAFCO-BOARD™ and CAFCO SprayFilm® – WB 3 and WB 4 Intumescent Coatings.

Structural steel shapes or members are identified by an American Institute of Steel Construction (A.I.S.C.) designation (For example: “W8 x 28”). This nomenclature describes the section number and weight of a structural steel member. “W8” indicates that the section is a wide flange beam or column with a nominal depth of 8-inches. The “28” represents the weight (lbs. per lineal foot) of the member.

The thickness of the SFRM is a function of the W/D ratio of the member, where “W” refers to the weight per lineal foot (lbs.) and “D” refers to the heated perimeter (inches) at the interface of the fire protection material and the steel. The W/D ratio is determined by dividing the “W” value by the “D” value.

To assist those who prefer to use metric values, “M/D” and “HP/A” values are the Canadian and European metric equivalent to the W/D respectively.

For the specified UL Designs, tables have been provided with the A.I.S.C. designation followed by its corresponding W/D ratio, along with the M/D and Hp/A ratios. SFRM thicknesses are then listed for the various desired hourly ratings.

This information has been prepared with the intent of providing the user with the most competitive structural steel fire protection thicknesses for various construction types.

The points outlined below illustrate some of the ways in which this manual allows for higher degree of competitiveness. It is recommended that time be taken to become familiar with the format.

- (a) Some designs have been broken down to list separate tables of protection thicknesses applicable to certain variations of construction within the design. The best possible thicknesses have been chosen, and other potentially advantageous features such as the “T/2 Option” and “plugging” of flutes (versus filling) have been footnoted where applicable.

IT IS IMPORTANT THAT THE CORRECT DESIGN BE SELECTED TO MATCH THE CONSTRUCTION, OR ELSE THE WRONG THICKNESS MAY BE USED. An example of “incorrect” selection is the use of a table pertaining to steel beams supporting cellular floor deck when the project consists of all-fluted deck. Not using the table for “all-fluted deck” may result in higher than necessary protection thicknesses. The reverse condition i.e. selecting a thickness pertaining to “all-fluted” deck when the project involves cellular deck may result in insufficient fire protection.

NOTE: The construction features listed on top of the pages in this Manual are not intended to replace careful UL design scrutiny for the details of the construction and appropriateness of use. It is assumed that before using the tables in this manual, the appropriate design has been selected. The manual allows “fine-tuning” of thicknesses after design selection.

- (b) In determining the best available thicknesses for D, G, and P-series designs, the benefits of substitutions from N-series and S-series designs are utilized where a lower thickness is available in the N or S design.

For further clarification, please do not hesitate to contact our Technical Service Department at (800) 631-9600, (973) 347-1200 or technical@isolatek.com.

Thickness Adjustment for CAFCO® Spray-Applied Fire Resistive Materials

BEAMS:

The equation used to adjust Spray-Applied Fire Resistive Material (SFRM) thicknesses on steel beams is as follows:

$$T_1 = \frac{(W_2/D_2 + 0.6) \times T_2}{(W_1/D_1 + 0.6)}$$

Where:

T = Thickness (in.) of spray-applied fire resistive material

W = Weight of beam (lb/ft)

D = Perimeter of protection, at the interface of the protection material and the steel through which heat is transferred to steel (in.)

Subscript 1 = Refers to desired beam size and required material thickness.

Subscript 2 = Refers to given beam size and material thickness shown on the individual design.

COLUMNS:

The tables and / or equations used to adjust Spray-Applied Fire Resistive Material thicknesses on steel columns are listed in each respective column design.

MISCELLANEOUS SHAPES:

The equations used to adjust Spray-Applied Fire Resistive Material thicknesses on miscellaneous shapes are listed in the wide flange column design for the respective SFRM.

PROPER USE OF RESTRAINED RATINGS

In order to use restrained assemblies and restrained beam ratings, you must meet the following International Building Code (IBC) and Underwriters Laboratories, Inc. (UL) guidelines. If these criteria are not maintained, the unrestrained assemblies and unrestrained beam ratings must be utilized.

1. 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.”

2. 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 requested that ICC confirm 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 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 are considered more conservative.

Please note that the restrained thicknesses listed the W/D Thickness Manual include all American Institute of Steel Construction (AISC) beam sizes. When used to adjust the material thickness for a restrained beam, the use of the UL beam thickness adjustment formula procedure is limited to steel sections classified as compact in accordance with the Specification for the Design of Structural Steel Buildings by the American Institute of Steel Construction, Load and Resistance Factor Design (Third Ed.).

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