

# Development Services

## From Concept to Construction

Phone: 503-823-7300 Email: [bds@portlandoregon.gov](mailto:bds@portlandoregon.gov) 1900 SW 4th Ave, Portland, OR 97201

More Contact Info (<http://www.portlandoregon.gov/bds/article/519984>)



### APPEAL SUMMARY

**Status:** Decision Rendered

<b>Appeal ID:</b> 21911	<b>Project Address:</b> 3255 SE 17th Ave
<b>Hearing Date:</b> 9/25/19	<b>Appellant Name:</b> David McLaughlin
<b>Case No.:</b> B-008	<b>Appellant Phone:</b> 503-810-6843
<b>Appeal Type:</b> Building	<b>Plans Examiner/Inspector:</b> John Cooley, Corey Stanley
<b>Project Type:</b> commercial	<b>Stories:</b> 4 <b>Occupancy:</b> R-2, S-1 <b>Construction Type:</b> V-A, V-A
<b>Building/Business Name:</b>	<b>Fire Sprinklers:</b> Yes - Throughout
<b>Appeal Involves:</b> Erection of a new structure	<b>LUR or Permit Application No.:</b> 18-243377-DFS-01-CO
<b>Plan Submitted Option:</b> pdf [File 1] [File 2] [File 3]	<b>Proposed use:</b> Multi-Family Apartments

### APPEAL INFORMATION SHEET

#### Appeal item 1

**Code Section** OSSC Section 703.2 Fire-Resistance Ratings

**Requires** Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced.

**Proposed Design** The proposed design utilizes INSULPRO MK-6 as a Spray-Applied Fire Resistive Material per UL Design No. Y710 for Steel Tube Columns and per UL Design No. X854 for Wide Flange Steel Columns and Beams.

Per UL Design No. Y710, the hourly rating of the structural member is dependent upon the ratio of A/P and the thickness of Spray-Applied Fire Resistive Materials, where A is the cross-sectional area of the pipe or tube and P is the heated perimeter.

The A/P ratio of a rectangular or square tube is determined by:

$$A/P \text{ tube} = (t(a+b-2t)) / (a+b)$$

Where:

a = the outer width of the tube (in.)

b = the outer length of the tube (in.)

t = the wall thickness of the tube (in.)

The thickness of Spray-Applied Fire Resistive Materials for rating of 3/4, 1, 1-1/2, 2, 3 and 4 hr of a steel tube can be determined by the equation:

$$h = (R - 0.20) / (4.43 (A/P))$$

Where:

R = the hourly rating (hrs)

h = the thickness of Spray-Applied Fire Resistive Materials, minimum 1/4 in., maximum 3-7/8 in.

The calculation in order to provide a minimum fire-resistance rating of 1 hr for a 4 x 4 x 5/16 steel tube column =

$$h = (1 - 0.20) / (4.43(A/P)); \&$$

$$A/P = ((5/16) * (4 + 4 - (2 * (5/16)))) / (4 + 4) = 0.288$$

THEREFORE:

$$h = (0.80) / (4.43 * 0.288) = 0.627" \text{ minimum thickness of Spray-Applied Fire Resistive Materials to achieve a 1 hr fire-resistance rating.}$$

UL Design No. X854 is a tested assembly for Wide Flange Steel Columns. The SFRM design proposes to utilize UL Design No. X854 to provide a fire-resistance rating for the exposed sides of Wide Flange Steel Beams, and applying the minimum thickness of SFRM Per Table 1 of UL Design No. X854 for the following sizes:

$$W8 \times 18 = 3/4"$$

$$W8 \times 28 = 5/8"$$

$$W8 \times 35 = 9/16"$$

$$W18 \times 40 = 5/8"$$

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**Reason for alternative** Table 601 of the 2014 Oregon Structural Specialty Code requires a 1-hr fire-resistance rating for the Primary Structural Frame in Type V-A Construction; with Sections 704.2 and 704.3 requiring individual encasement of columns and other members of the Primary Structural Frame.

The fire-resistance rating design for the Primary Structural Frame proposes to utilize Spray-Applied Fire Resistive Materials in accordance with UL Design No. Y710 and UL Design No. X854 to provide the required 1-hr rating and individual encasement protection for Steel Columns and Beams.

The chart provided in UL Design No. Y710 does not identify the minimum thickness of Spray-Applied Fire Resistive Materials required for 4 x 4 x 5/16 steel square tube columns, but does provide a calculation to determine the thickness of Spray-Applied Fire Resistive Materials using the A/P ratio of steel members. This building code appeal demonstrates the necessary calculations in specifying the minimum thickness of INSULPRO MK-6 to provide adequate fire protection for a 1 hr fire-resistance rating of 4 x 4 x 5/16 steel columns.

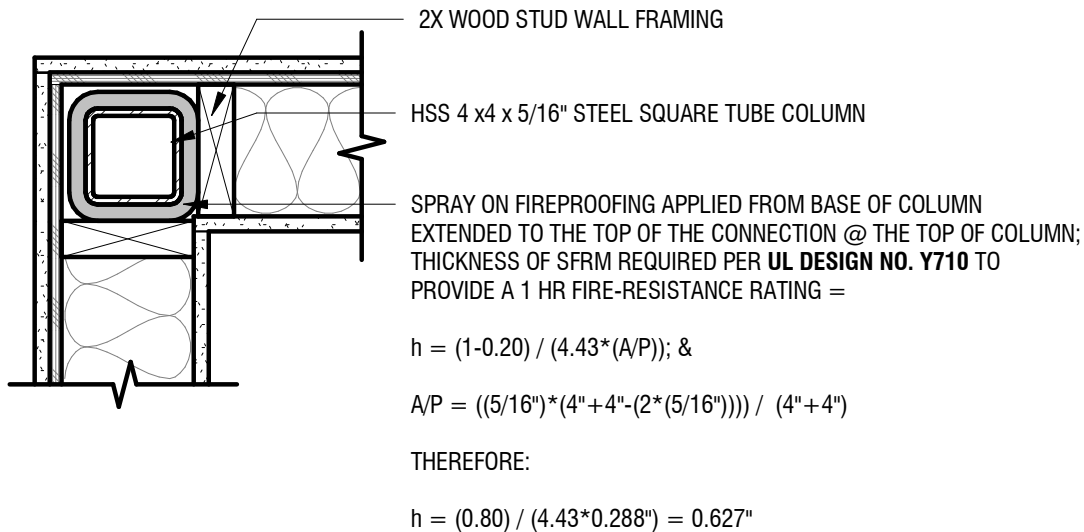
UL Design No. X854 is a tested assembly to achieve a fire-resistance rating using Spray-Applied Fire Resistive Materials on Wide Flange Steel Columns. This building code appeal is requesting to utilize UL Design No. X854 to provide a fire-resistance rating for Wide Flange Steel Beams using the minimum thickness of Spray-Applied Fire Resistive Material identified in Table 1 of the UL listing for adequate fire protection and individual encasement protection.

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**One hour fire rated design for HSS columns and wide flange beams and columns with architect's analysis: Granted as proposed.**

The Administrative Appeal Board finds that the information submitted by the appellant demonstrates that the approved modifications or alternate methods are consistent with the intent of the code; do not lessen health, safety, accessibility, life, fire safety or structural requirements; and that special conditions unique to this project make strict application of those code sections impractical.

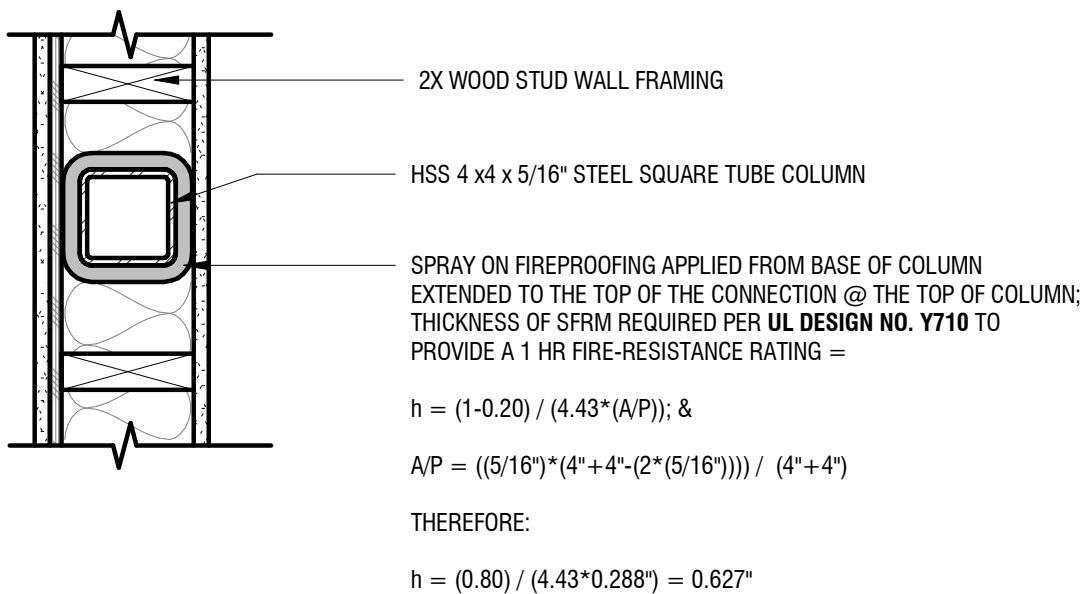
Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 90 calendar days of the date this decision is published. For information on the appeals process, go to [www.portlandoregon.gov/bds/appealsinfo](http://www.portlandoregon.gov/bds/appealsinfo), call (503) 823-7300 or come in to the Development Services Center.



#### SFRM 1-HR FIRE-RATING DETAIL - STEEL TUBE COLUMN

1 1/2" = 1'-0"

1



#### SFRM 1-HR FIRE-RATING DETAIL - STEEL TUBE COLUMN

1 1/2" = 1'-0"

2

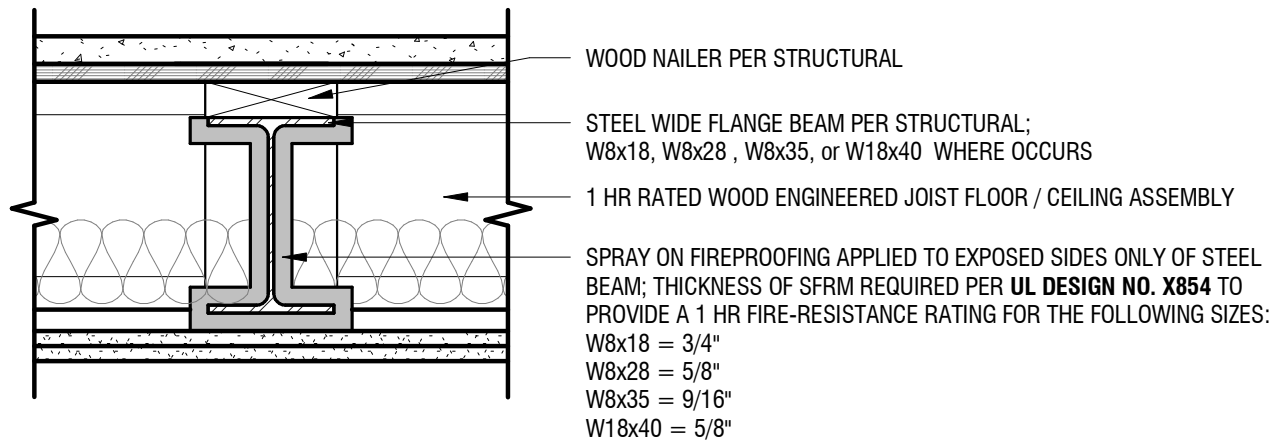


2019.09.17

THE DEAN RIVER APARTMENTS  
3314-3318 SE 16th Ave  
Portland, OR 97202

BCA-6

SFRM RATING DETAILS

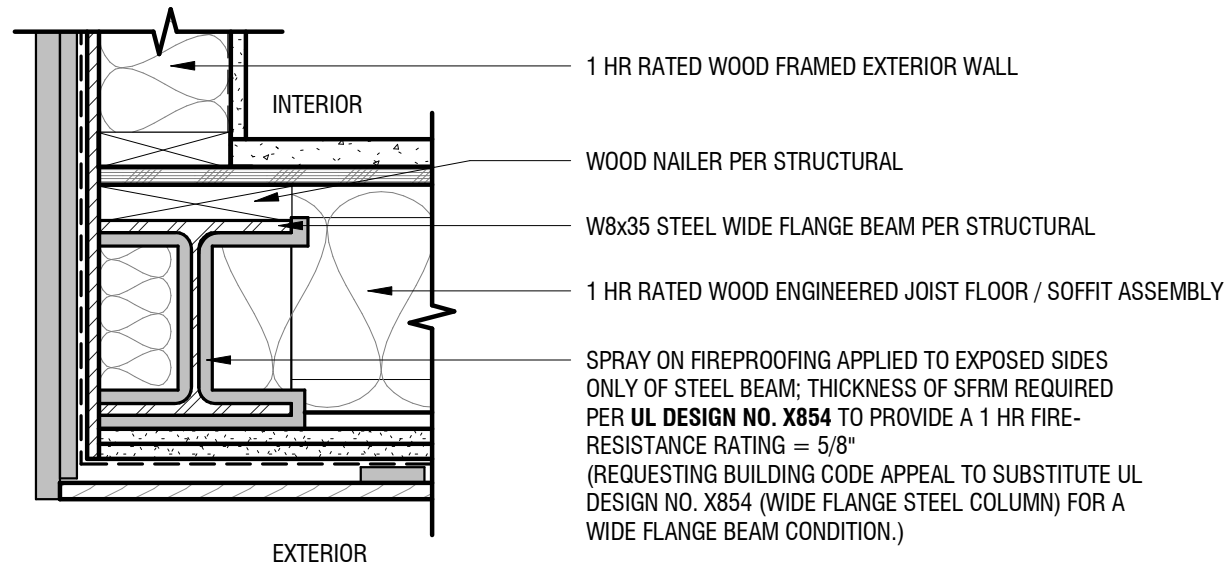


(REQUESTING BUILDING CODE APPEAL TO SUBSTITUTE UL DESIGN NO. X854 (WIDE FLANGE STEEL COLUMN) FOR A WIDE FLANGE BEAM CONDITION.)

## SFRM 1-HR FIRE-RATING DETAIL - STEEL BEAM

1 1/2" = 1'-0"

1



## SFRM 1-HR FIRE-RATING DETAIL - STEEL BEAM

1 1/2" = 1'-0"

2



2019.09.17

THE DEAN RIVER APARTMENTS  
3314-3318 SE 16th Ave  
Portland, OR 97202

BCA-7

SFRM RATING DETAILS

## FIRE-RESISTANCE DESIGN

### Assembly Usage Disclaimer

### **BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States**

### **BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada**

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States  
Design Criteria and Allowable Variances

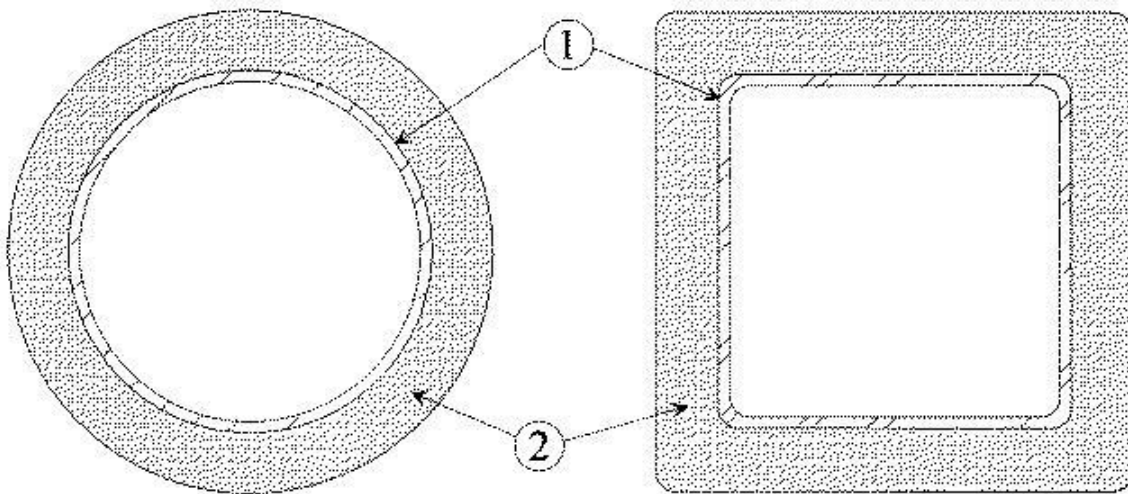
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada  
Design Criteria and Allowable Variances

### **Design No. Y710**

February 05, 2014

**Ratings — 1, 1-1/2, 2, 3 and 4 Hr**

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



**1. Steel Pipe or Tube Column** — Steel circular pipe (SP) or steel square or rectangular tube (ST). The A/P ratio of the steel pipe or tube (see Item 2) shall range from 0.18 to 2.0.

**2. Spray-Applied Fire Resistive Materials\*** — Prepared by mixing with water according to instructions and applying in one or more coats to the thicknesses shown below, to steel surfaces which are clean and free of dirt, loose scale, and oil. Min avg and min ind density for Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set and RG of 15/14 pcf, respectively. Min avg and min ind density for Types Z-106, Z-106/G, Z-106/HY of 22/19 pcf, respectively.

Column Size In.	A/P	Min Thkns In.				
		1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
ST 3x3x3/16	.18	1	1-11/16	2-5/16	3-9/16	NA

ST 3x3x5/16	.28	11/16	1-1/8	1-1/2	2-5/16	3-1/16
ST 3x3x1/2	.42	7/16	3/4	1	1-1/2	2-1/16
ST 8x8x5/8	.58	3/8	5/8	3/4	1-1/8	1-1/2
ST 20x20x3/4	.72	1/4	3/8	9/16	7/8	1-3/16
ST 20x20x1	.95	1/4	5/16	7/16	11/16	15/16
ST 32x32x1-1/4	1.20	1/4	1/4	3/8	9/16	3/4
ST 32x32x1-1/2	1.43	1/4	1/4	5/16	1/2	5/8
ST 32x32x1-3/4	1.65	1/4	1/4	1/4	7/16	9/16
ST 32x32x2	1.88	1/4	1/4	1/4	3/8	1/2
SP 3x.216	.20	15/16	1-1/2	2-1/16	3-1/8	NA
SP 8x.322	.31	5/8	1	1-5/16	2-1/16	2-13/16
SP 6x.432	.40	1/2	3/4	1	1-9/16	2-1/8
SP 10x.50	.48	3/8	5/8	7/8	1-3/8	1-13/16
SP 6x.864	.74	1/4	3/8	9/16	7/8	1-3/16

The hourly rating of the structural member is dependent upon the ratio of A/P and the thickness of Spray-Applied Fire Resistive Materials, where A is the cross sectional area of the pipe or tube and P is the heated perimeter.

The A/P ratio of a circular pipe is determined by:

$$A/P \text{ pipe} = \frac{t (d-t)}{d}$$

Where:

d = the outer diam of the pipe (in.)

t = the wall thickness of the pipe (in.)

The A/P ratio of a rectangular or square tube is determined by:

$$A/P \text{ tube} = \frac{t (a+b-2t)}{a+b}$$

Where:

a = the outer width of the tube (in.)

b = the outer length of the tube (in.)

t = the wall thickness of the tube (in.)

The thickness of Spray-Applied Fire Resistive Materials for rating of 3/4, 1, 1-1/2, 2, 3 and 4 h of a steel pipe or tube can be determined by the equation:

$$h = \frac{R - 0.20}{4.43 (A/P)}$$

Where:

R = the hourly rating (hrs)

h = the thickness of Spray-Applied Fire Resistive Materials, minimum 1/4 in., maximum 3-7/8 in.

**ARABIAN VERMICULITE INDUSTRIES** — Type MK-6GF, MK-6 GF Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set.

**GCP KOREA INC** — Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, MK-6GF, MK-6 GF Extended Set, MK-1000/HB, MK-1000/HB Extended Set, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G, Z-106/HY.

**GCP APPLIED TECHNOLOGIES INC** — Types MK-4, MK-5, MK-6/HY, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-1000/HB, MK-1000/HB Extended Set, Monokote Acoustic 1, Monokote Acoustic 5, RG, Z-106, Z-106/G, Z-106/HY.

**\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2014-02-05

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### Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

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The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product.

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## SFRM THICKNESS CALCULATION:

$$h = (R - 0.20) / (4.43 * (A/P))$$

## THE A/P RATIO CALCULATION FOR A STEEL SQUARE TUBE COLUMN:

$$A/P = ((t) * (a + b - (2 * (t)))) / (a + b)$$

MINIMUM THICKNESS OF SFRM REQUIRED PER UL DESIGN NO. Y710  
TO PROVIDE A 1 HR FIRE-RESISTANCE RATING FOR A 4" x 4" x 5/16"  
STEEL TUBE COLUMN:

$$h = (1 - 0.20) / (4.43 * (A/P)); \&$$

$$A/P = ((5/16") * (4" + 4" - (2 * (5/16")))) / (4" + 4") = 0.288"$$

THEREFORE:

$$h = (0.80) / (4.43 * 0.288") = 0.627" \text{ min}$$

## FIRE-RESISTANCE DESIGN

### Assembly Usage Disclaimer

#### **BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States**

#### **BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada**

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States  
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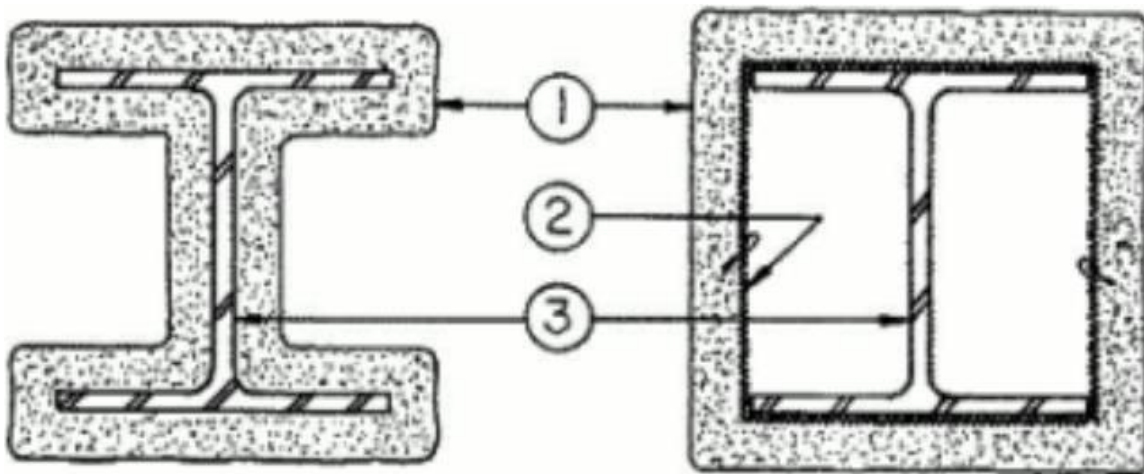
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada  
Design Criteria and Allowable Variances

#### **Design No. X854**

July 12, 2019

**Ratings — 1, 1-1/2, 2, 3 and 4 h.**

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



**1. Spray-Applied Fire Resistive Materials\*** — Applied by mixing with water and spraying in more than one coat to the thicknesses shown below, to steel surfaces which are clean and free of dirt, loose scale, and oil. Min avg and min ind density of 15/14 pcf respectively. Min avg and min ind density of 22/19 pcf respectively for Types Z-106, Z-106/G, Z-106/HY. Min avg and min ind density of 40/36 pcf respectively for Types Z-146, Z-146PC and Z-146T cementitious mixture. Min avg and min ind density of 50/45 pcf respectively for Types Z-156, Z-156T and Z-156PC. For method of density determination, see Design Information Section, Sprayed Material.

The thickness of Spray-Applied Fire Resistive Materials to be applied to all surfaces of the column (Item 1) required for rating periods of 1 h, 1-1/2 h, 2 h, 3 h, 4 h may be determined by the equation:

$$h = \frac{R}{1.05 (W/D) + 0.61}$$

Where:

h = Spray-Applied Fire Resistive Materials thickness in the range 0.25-3.875 in.

R = Fire resistance rating in hours (1 - 4 h)

D = Heated perimeter of steel column in inches

W = Weight of steel column in lbs per foot

W/D = 0.338 to 6.76

As an alternate to the equation, the minimum thickness of Spray-Applied Fire Resistive Materials required for various fire resistance ratings of contour sprayed or boxed columns may be determined from the table below:

**TABLE 1**

Col Size	W/D	Min Thk (In.)				
		1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W4x13	0.556	11/16	1-3/16	1-5/8	2-1/2	3-3/8
W5x16	0.55	11/16	1-3/16	1-5/8	2-1/2	3-3/8
W5x19	0.644	5/8	1-1/8	1-7/16	2-5/16	3-1/8
W6x9	0.338	15/16	1-1/2	2	2-1/2	3-13/16
W6x12	0.448	13/16	1-3/8	1-13/16	2-1/2	3-3/4
W6x15	0.431	13/16	1-3/8	1-13/16	2-1/2	3-13/16
W6x16	0.584	11/16	1-3/16	1-9/16	2-7/16	3-5/16
W6x20	0.563	11/16	1-3/16	1-9/16	2-1/2	3-3/8
W6x25	0.696	5/8	1-1/16	1-3/8	2	2-11/16
W8x13	0.421	13/16	1-3/8	1-7/8	2-1/2	3-13/16
W8x15	0.481	3/4	1-5/16	1-3/4	2-1/2	3-5/8
W8x18	0.499	3/4	1-1/4	1-11/16	2-1/2	3-1/2
W8x21	0.577	11/16	1-3/16	1-9/16	2-1/2	3-5/16
W8x24	0.591	11/16	1-1/8	1-9/16	2-7/16	3-5/16
W8x28	0.688	5/8	1-1/16	1-3/8	2	2-11/16
W8x31	0.665	5/8	1-1/16	1-7/16	2-5/16	3-1/16
W8x35	0.749	9/16	1	1-5/16	2	2-11/16
W8x40	0.849	9/16	3/4	1-1/8	1-11/16	2-1/2
W8x48	1	1/2	3/4	1	1-11/16	2-5/16
W8x58	1.2	7/16	3/4	13/16	1-3/8	1-15/16
W8x67	1.37	3/8	5/8	3/4	1-1/4	1-11/16

W10x12	0.347	7/8	1-1/2	2	2-1/2	3-13/16
W10x15	0.429	13/16	1-3/8	1-7/8	2-1/2	3-13/16
W10x17	0.482	3/4	1-5/16	1-3/4	2-1/2	3-5/8
W10x19	0.538	3/4	1-1/4	1-5/8	2-1/2	3 7/16
W10x22	0.523	3/4	1-1/4	1-11/16	2-1/2	3-1/2
W10x26	0.612	11/16	1-1/8	1-1/2	2-3/8	3-1/4
W10x30	0.699	5/8	1-1/16	1-3/8	2	2-11/16
W10x33	0.661	5/8	1-1/16	1-7/16	2-5/16	3-1/8
W10x39	0.78	9/16	1	1-1/4	2	2-11/16
W10x45	0.888	1/2	3/4	1-1/8	1-11/16	2-1/2
W10x49	0.84	9/16	3/4	1-1/8	1-11/16	2-1/2
W10x54	0.922	1/2	3/4	1-1/16	1-11/16	2-1/2
W10x60	1.01	1/2	3/4	1	1-5/8	2-5/16
W10x68	1.15	7/16	3/4	7/8	1-7/16	2
W10x77	1.28	7/16	11/16	3/4	1-5/16	1-13/16
W10x88	1.45	3/8	5/8	11/16	1-3/16	1-5/8
W10x100	1.64	3/8	9/16	11/16	1-1/8	1-1/2
W10x112	1.81	5/16	1/2	11/16	1-1/8	1-1/2
W12x14	0.363	7/8	1-1/2	2	2-1/2	3-13/16
W12x16	0.41	13/16	1-7/16	1-7/8	2-1/2	3-13/16
W12x19	0.485	3/4	1-5/16	1-3/4	2-1/2	3-5/8
W12x22	0.56	11/16	1-3/16	1-5/8	2-1/2	3-3/8
W12x26	0.531	3/4	1-1/4	1-5/8	2-1/2	3 7/16
W12x30	0.607	11/16	1-1/8	1-1/2	2-7/16	3-1/4
W12x35	0.703	5/8	1-1/16	1-3/8	2	2-11/16
W12x40	0.734	5/8	1	1-5/16	2	2-11/16
W12x45	0.829	9/16	15/16	1-3/16	1-15/16	2-11/16
W12x50	0.909	1/2	3/4	1-1/16	1-11/16	2-1/2
W12x53	0.855	9/16	3/4	1-1/8	1-11/16	2-1/2
W12x58	0.925	1/2	3/4	1-1/16	1-11/16	2-7/16
W12x65	0.925	1/2	3/4	1-1/16	1-11/16	2-7/16
W12x72	1.02	1/2	3/4	15/16	1-5/8	2-1/4
W12x79	1.11	7/16	3/4	7/8	1-1/2	2-1/8
W12x87	1.22	7/16	11/16	13/16	1-3/8	1-15/16
W12x96	1.34	3/8	11/16	3/4	1-1/4	1-3/4

W12x106	1.47	3/8	5/8	11/16	1-3/16	1-5/8
W12x120	1.65	5/16	9/16	11/16	1-1/8	1-1/2
W12x136	1.86	5/16	1/2	11/16	1-1/8	1-1/2
W12x152	2.04	5/16	1/2	11/16	1-1/16	1-7/16
W12x170	2.26	1/4	7/16	5/8	15/16	1-5/16
W12x190	2.5	1/4	5/16	9/16	7/8	1-3/16
W12x210	2.73	1/4	5/16	1/2	13/16	1-1/8
W12x230	2.96	1/4	5/16	1/2	3/4	1-1/16
W12x252	3.2	1/4	5/16	7/16	3/4	1
W12x279	3.5	1/4	5/16	7/16	11/16	7/8
W12x305	3.76	1/4	5/16	3/8	5/8	7/8
W12x336	4.06	1/4	1/4	3/8	9/16	13/16
W14x22	0.476	3/4	1-5/16	1-3/4	2-1/2	3-5/8
W14x26	0.559	11/16	1-3/16	1-5/8	2-1/2	3-3/8
W14x30	0.562	11/16	1-3/16	1-9/16	2-1/2	3-3/8
W14x34	0.633	5/8	1-1/8	1-7/16	2-3/8	3 3/16
W14x38	0.706	5/8	1-1/16	1-3/8	2	2-11/16
W14x43	0.752	9/16	1	1-5/16	2	2-11/16
W14x48	0.835	9/16	15/16	1-3/16	1-15/16	2-11/16
W14x53	0.915	1/2	3/4	1-1/16	1-11/16	2-1/2
W14x61	0.928	1/2	3/4	1-1/16	1-11/16	2-7/16
W14x68	1.04	1/2	3/4	15/16	1-5/8	2-1/4
W14x74	1.12	7/16	3/4	7/8	1-1/2	2-1/16
W14x82	1.23	7/16	11/16	13/16	1-3/8	1-7/8
W14x90	1.08	7/16	3/4	7/8	1-9/16	2-1/8
W14x99	1.18	7/16	3/4	13/16	1-7/16	2
W14x109	1.29	7/16	11/16	3/4	1-5/16	1-13/16
W14x120	1.42	3/8	5/8	3/4	1-3/16	1-11/16
W14x132	1.56	3/8	9/16	11/16	1-1/8	1-9/16
W14x145	1.64	3/8	9/16	11/16	1-1/8	1-1/2
W14x159	1.78	5/16	9/16	11/16	1-1/8	1-1/2
W14x176	1.96	5/16	1/2	11/16	1-1/16	1-1/2
W14x193	2.14	5/16	7/16	5/8	1	1-3/8
W14x211	2.32	1/4	7/16	5/8	15/16	1-5/16
W14x233	2.55	1/4	5/16	9/16	7/8	1-3/16

W14x257	2.78	1/4	5/16	1/2	13/16	1-1/8
W14x283	3.03	1/4	5/16	1/2	3/4	1
W14x311	3.3	1/4	5/16	7/16	11/16	15/16
W14x342	3.58	1/4	5/16	7/16	5/8	7/8
W14x370	3.84	1/4	5/16	3/8	5/8	13/16
W14x398	4.09	1/4	1/4	3/8	9/16	13/16
W14x426	4.32	1/4	1/4	3/8	9/16	3/4
W14x455	4.59	1/4	1/4	5/16	1/2	11/16
W14x500	4.95	1/4	1/4	5/16	1/2	11/16
W14x550	5.34	1/4	1/4	5/16	7/16	5/8
W14x605	5.82	1/4	1/4	1/4	7/16	9/16
W14x665	6.21	1/4	1/4	1/4	3/8	9/16
W14x730	6.76	1/4	1/4	1/4	3/8	1/2
W16x26	0.499	3/4	1-1/4	1-11/16	2-1/2	3-1/2
W16x31	0.592	11/16	1-1/8	1-9/16	2-7/16	3-1/4
W16x36	0.617	11/16	1-1/8	1-1/2	2-3/8	3 3/16
W16x40	0.686	5/8	1-1/16	1-3/8	2-1/4	3-1/16
W16x45	0.767	9/16	1	1-1/4	2	2-11/16
W16x50	0.846	9/16	3/4	1-1/8	1-11/16	2-1/2
W16x57	0.963	1/2	3/4	1	1-11/16	2-3/8
W16x67	0.936	1/2	3/4	1-1/16	1-11/16	2-7/16
W16x77	1.07	7/16	3/4	15/16	1-9/16	2-3/16
W16x89	1.22	7/16	11/16	13/16	1-3/8	1-15/16
W16x100	1.37	3/8	5/8	3/4	1-1/4	1-11/16
W18x35	0.602	11/16	1-1/8	1-1/2	2-7/16	3-1/4
W18x40	0.688	5/8	1-1/16	1-3/8	2	2-11/16
W18x46	0.786	9/16	15/16	1-1/4	2	2-11/16
W18x50	0.778	9/16	1	1-1/4	2	2-11/16
W18x55	0.85	9/16	3/4	1-1/8	1-11/16	2-1/2
W18x60	0.923	1/2	3/4	1-1/16	1-11/16	2-7/16
W18x65	0.997	1/2	3/4	1	1-11/16	2-5/16
W18x71	1.08	7/16	3/4	7/8	1-9/16	2-1/8
W18x76	0.971	1/2	3/4	1	1-11/16	2-3/8
W18x86	1.09	7/16	3/4	7/8	1-9/16	2-1/8
W18x97	1.22	7/16	11/16	13/16	1-3/8	1-15/16

W18x106	1.33	3/8	11/16	3/4	1-1/4	1-3/4
W18x119	1.48	3/8	5/8	11/16	1-3/16	1-5/8
W21x44	0.672	5/8	1-1/16	1-3/8	2-1/4	3-1/16
W21x50	0.754	9/16	1	1-1/4	2	2-11/16
W21x57	0.857	9/16	3/4	1-1/8	1-11/16	2-1/2
W21x62	0.846	9/16	3/4	1-1/8	1-11/16	2-1/2
W21x68	0.926	1/2	3/4	1-1/16	1-11/16	2-7/16
W21x73	0.989	1/2	3/4	1	1-11/16	2-5/16
W21x83	1.12	7/16	3/4	7/8	1-1/2	2-1/16
W21x93	1.24	7/16	11/16	13/16	1-3/8	1-7/8
W21x101	1.13	7/16	3/4	7/8	1-1/2	2-1/16
W21x111	1.24	7/16	11/16	13/16	1-3/8	1-7/8
W21x122	1.35	3/8	11/16	3/4	1-1/4	1-3/4
W21x132	1.45	3/8	5/8	11/16	1-3/16	1-5/8
W21x147	1.61	3/8	9/16	11/16	1-1/8	1-1/2
W24x55	0.749	9/16	1	1-5/16	2	2-11/16
W24x62	0.844	9/16	3/4	1-1/8	1-11/16	2-1/2
W24x68	0.837	9/16	15/16	1-3/16	1-15/16	2-11/16
W24x76	0.933	1/2	3/4	1-1/16	1-11/16	2-7/16
W24x84	1.02	1/2	3/4	15/16	1-5/8	2-1/4
W24x94	1.14	7/16	3/4	7/8	1-1/2	2-1/16
W24x104	1.07	7/16	3/4	15/16	1-9/16	2-3/16
W24x117	1.2	7/16	3/4	13/16	1-3/8	1-15/16
W24x131	1.33	3/8	11/16	3/4	1-1/4	1-3/4
W24x146	1.48	3/8	5/8	11/16	1-3/16	1-5/8
W24x162	1.63	3/8	9/16	11/16	1-1/8	1-1/2
W27x84	0.921	1/2	3/4	1-1/16	1-11/16	2-1/2
W27x94	1.03	1/2	3/4	15/16	1-5/8	2-1/4
W27x102	1.11	7/16	3/4	7/8	1-1/2	2-1/8
W27x114	1.23	7/16	11/16	13/16	1-3/8	1-7/8
W27x146	1.35	3/8	11/16	3/4	1-1/4	1-3/4
W27x161	1.48	3/8	5/8	11/16	1-3/16	1-5/8
W27x178	1.63	3/8	9/16	11/16	1-1/8	1-1/2
W30x99	1	1/2	3/4	1	1-11/16	2-5/16
W30x108	1.09	7/16	3/4	7/8	1-9/16	2-1/8

W30x116	1.16	7/16	3/4	13/16	1-7/16	2
W30x124	1.24	7/16	11/16	13/16	1-3/8	1-7/8
W30x132	1.32	3/8	11/16	3/4	1-1/4	1-3/4
W30x173	1.47	3/8	5/8	11/16	1-3/16	1-5/8
W30x191	1.62	3/8	9/16	11/16	1-1/8	1-1/2
W30x211	1.76	5/16	9/16	11/16	1-1/8	1-1/2
W33x118	1.08	7/16	3/4	7/8	1-9/16	2-1/8
W33x130	1.18	7/16	3/4	13/16	1-7/16	2
W33x141	1.28	7/16	11/16	3/4	1-5/16	1-13/16
W33x152	1.37	3/8	5/8	3/4	1-1/4	1-11/16
W33x201	1.58	3/8	9/16	11/16	1-1/8	1-1/2
W33x221	1.73	5/16	9/16	11/16	1-1/8	1-1/2
W33x241	1.87	5/16	1/2	11/16	1-1/8	1-1/2
W36x135	1.15	7/16	3/4	7/8	1-7/16	2
W36x150	1.27	7/16	11/16	3/4	1-5/16	1-7/8
W36x160	1.35	3/8	11/16	3/4	1-1/4	1-3/4
W36x170	1.43	3/8	5/8	3/4	1-3/16	1-5/8
W36x182	1.52	3/8	5/8	11/16	1-1/8	1-9/16
W36x194	1.62	3/8	9/16	11/16	1-1/8	1-1/2
W36x210	1.74	5/16	9/16	11/16	1-1/8	1-1/2
W36x230	1.69	5/16	9/16	11/16	1-1/8	1-1/2
W36x245	1.79	5/16	9/16	11/16	1-1/8	1-1/2
W36x260	1.9	5/16	1/2	11/16	1-1/8	1-1/2
W36x280	2.03	5/16	1/2	11/16	1-1/16	1-7/16
W36x300	2.17	1/4	7/16	5/8	1	1-3/8

The thicknesses contained in the table below are applicable when the Spray-Applied Fire Resistant Materials applied to columns' flange tips are reduced to one-half that shown in the table below:

**TABLE 2**

Member		Half Flange Tip Thickness				
Min Col Size	W/D	1 hr	1.5 hr	2 hr	3 hr	4 hr
W4x13	0.556	7/8	1 5/16	1-11/16	2 9/16	3 3/8
W5x16	0.550	7/8	1 5/16	1-11/16	2 9/16	3 3/8
W5x19	0.644	13/16	1 3/16	1 9/16	2 3/8	3 1/8
W6x9	0.338	1-1/8	1 5/8	2 1/16	3 1/8	4 3/16
W6x12	0.440	1 5/16	1 7/16	1 7/8	2 13/16	2 13/16



W6x12	0.448	15/16	1 7/16	1 7/8	2 13/16	3-13/16
W6x15	0.431	1	1 7/16	1-15/16	2 7/8	3-14/16
W6x16	0.584	7/8	1 1/4	1-11/16	2 1/2	3 5/16
W6x20	0.563	7/8	1 1/4	1-11/16	2 1/2	3 3/8
W6x25	0.696	3/4	1 1/8	1 1/2	2 1/4	2 15/16
W8x13	0.421	1	1 7/16	1-15/16	2 7/8	3-14/16
W8x15	0.481	15/16	1 3/8	1-13/16	2 3/4	3 11/16
W8x18	0.499	15/16	1 3/8	1-13/16	2-11/16	3 9/16
W8x21	0.577	7/8	1 1/4	1-11/16	2 1/2	3 5/16
W8x24	0.591	7/8	1 1/4	1-11/16	2 1/2	3 5/16
W8x28	0.688	13/16	1 3/16	1 1/2	2 1/4	2 15/16
W8x31	0.665	13/16	1 3/16	1 9/16	2 5/16	3 1/16
W8x35	0.749	3/4	1 1/8	1 7/16	2 3/16	2 7/8
W8x40	0.849	11/16	1	1 3/8	2	2-11/16
W8x48	1.000	5/8	15/16	1 1/4	1-13/16	2 7/16
W8x58	1.200	9/16	13/16	1 1/8	1 5/8	2 3/16
W8x67	1.370	1/2	3/4	1	1 1/2	2
W10x12	0.347	1-1/16	1 9/16	2 1/16	3 1/8	4 3/16
W10x15	0.429	1	1 7/16	1-15/16	2 7/8	3-14/16
W10x17	0.482	15/16	1 3/8	1-13/16	2 3/4	3 11/16
W10x19	0.538	7/8	1 5/16	1 3/4	2 9/16	3 7/16
W10x22	0.523	7/8	1 5/16	1 3/4	2 5/8	3 1/2
W10x26	0.612	13/16	1 1/4	1 5/8	2 7/16	3 1/4
W10x30	0.699	3/4	1 1/8	1 1/2	2 1/4	2 15/16
W10x33	0.661	13/16	1 3/16	1 9/16	2 5/16	3 1/8
W10x39	0.780	3/4	1 1/16	1 7/16	2 1/8	2 13/16
W10x45	0.888	11/16	1	1 5/16	2	2 5/8
W10x49	0.840	11/16	1 1/16	1 3/8	2 1/16	2-11/16
W10x54	0.922	11/16	1	1 5/16	1-15/16	2 9/16
W10x60	1.010	5/8	15/16	1 1/4	1-13/16	2 7/16
W10x68	1.150	9/16	7/8	1 1/8	1-11/16	2 1/4
W10x77	1.280	9/16	13/16	1 1/16	1 9/16	2 1/16
W10x88	1.450	1/2	3/4	1	1 7/16	1-15/16
W10x100	1.640	7/16	11/16	7/8	1 5/16	1 3/4
W10x112	1.810	7/16	5/8	13/16	1 1/4	1 5/8
W12x14	0.363	1-1/16	1 9/16	2 1/16	3 1/16	4 1/8

W12x17	0.300	1 1/16	1 3/16	2 1/16	3 1/16	4 1/8
W12x16	0.410	1	1 1/2	1-15/16	2 15/16	3-15/16
W12x19	0.485	15/16	1 3/8	1-13/16	2-11/16	3 5/8
W12x22	0.560	7/8	1 5/16	1-11/16	2 9/16	3 3/8
W12x26	0.531	7/8	1 5/16	1 3/4	2 5/8	3 7/16
W12x30	0.607	13/16	1 1/4	1 5/8	2 7/16	3 1/4
W12x35	0.703	3/4	1 1/8	1 1/2	2 1/4	2 15/16
W12x40	0.734	3/4	1 1/8	1 1/2	2 3/16	2 15/16
W12x45	0.829	11/16	1 1/16	1 3/8	2 1/16	2 3/4
W12x50	0.909	11/16	1	1 5/16	1-15/16	2 9/16
W12x53	0.855	11/16	1	1 3/8	2	2-11/16
W12x58	0.925	11/16	1	1 5/16	1-15/16	2 9/16
W12x65	0.925	11/16	1	1 5/16	1-15/16	2 9/16
W12x72	1.020	5/8	15/16	1 1/4	1-13/16	2 7/16
W12x79	1.110	5/8	7/8	1 3/16	1 3/4	2 5/16
W12x87	1.220	9/16	13/16	1 1/16	1 5/8	2 1/8
W12x96	1.340	1/2	3/4	1	1 1/2	2
W12x106	1.470	1/2	3/4	15/16	1 7/16	1 7/8
W12x120	1.650	7/16	11/16	7/8	1 5/16	1 3/4
W12x136	1.860	7/16	5/8	13/16	1 3/16	1 9/16
W12x152	2.040	3/8	9/16	3/4	1 1/8	1 1/2
W12x170	2.260	3/8	9/16	11/16	1 1/16	1 3/8
W12x190	2.500	5/16	1/2	5/8	15/16	1 1/4
W12x210	2.730	5/16	7/16	5/8	7/8	1 3/16
W12x230	2.960	5/16	7/16	9/16	13/16	1 1/8
W12x252	3.200	5/16	7/16	9/16	13/16	1 1/16
W12x279	3.500	1/4	3/8	1/2	3/4	15/16
W12x305	3.760	1/4	3/8	1/2	11/16	15/16
W12x336	4.060	1/4	5/16	7/16	5/8	7/8
W14x22	0.476	15/16	1 3/8	1-13/16	2 3/4	3 11/16
W14x26	0.559	7/8	1 5/16	1-11/16	2 9/16	3 3/8
W14x30	0.562	7/8	1 1/4	1-11/16	2 1/2	3 3/8
W14x34	0.633	13/16	1 3/16	1 5/8	2 3/8	3 3/16
W14x38	0.706	3/4	1 1/8	1 1/2	2 1/4	2 15/16
W14x43	0.752	3/4	1 1/8	1 7/16	2 3/16	2 7/8
W14x48	0.835	11/16	1 1/16	1 3/8	2 1/16	2 3/4

W14x53	0.915	11/16	1	1 5/16	1-15/16	2 9/16
W14x61	0.928	11/16	1	1 5/16	1-15/16	2 9/16
W14x68	1.040	5/8	15/16	1 3/16	1-13/16	2 3/8
W14x74	1.120	9/16	7/8	1 1/8	1-11/16	2 1/4
W14x82	1.230	9/16	13/16	1 1/16	1 5/8	2 1/8
W14x90	1.080	5/8	7/8	1 3/16	1 3/4	2 5/16
W14x99	1.180	9/16	13/16	1 1/8	1 5/8	2 3/16
W14x109	1.290	9/16	13/16	1 1/16	1 9/16	2 1/16
W14x120	1.420	1/2	3/4	1	1 7/16	1-15/16
W14x132	1.560	1/2	11/16	15/16	1 3/8	1-13/16
W14x145	1.640	7/16	11/16	7/8	1 5/16	1 3/4
W14x159	1.780	7/16	5/8	13/16	1 1/4	1 5/8
W14x176	1.960	3/8	9/16	3/4	1 1/8	1 1/2
W14x193	2.140	3/8	9/16	3/4	1 1/16	1 7/16
W14x211	2.320	3/8	1/2	11/16	1	1 3/8
W14x233	2.550	5/16	1/2	5/8	15/16	1 1/4
W14x257	2.780	5/16	7/16	5/8	7/8	1 3/16
W14x283	3.030	5/16	7/16	9/16	13/16	1 1/16
W14x311	3.300	1/4	3/8	1/2	3/4	1
W14x342	3.580	1/4	3/8	1/2	11/16	15/16
W14x370	3.840	1/4	3/8	7/16	11/16	7/8
W14x398	4.090	1/4	5/16	7/16	5/8	7/8
W14x426	4.320	1/4	5/16	7/16	5/8	13/16
W14x455	4.590	1/4	5/16	3/8	9/16	3/4
W14x500	4.950	1/4	5/16	3/8	9/16	3/4
W14x550	5.340	1/4	1/4	3/8	1/2	11/16
W14x605	5.820	1/4	1/4	5/16	1/2	5/8
W14x665	6.210	1/4	1/4	5/16	7/16	9/16
W14x730	6.760	1/4	1/4	5/16	7/16	9/16
W16x26	0.499	15/16	1 3/8	1-13/16	2-11/16	3 9/16
W16x31	0.592	13/16	1 1/4	1 5/8	2 7/16	3 1/4
W16x36	0.617	13/16	1 1/4	1 5/8	2 7/16	3 3/16
W16x40	0.686	13/16	1 3/16	1 9/16	2 5/16	3 1/16
W16x45	0.767	3/4	1 1/16	1 7/16	2 1/8	2 7/8
W16x50	0.846	11/16	1 1/16	1 3/8	2 1/16	2-11/16

W16x57	0.963	5/8	15/16	1 1/4	1 7/8	2 1/2
W16x67	0.936	11/16	1	1 5/16	1-15/16	2 9/16
W16x77	1.070	5/8	7/8	1 3/16	1 3/4	2 5/16
W16x89	1.220	9/16	13/16	1 1/16	1 5/8	2 1/8
W16x100	1.370	1/2	3/4	1	1 1/2	2
W18x35	0.602	13/16	1 1/4	1 5/8	2 7/16	3 1/4
W18x40	0.688	13/16	1 3/16	1 1/2	2 1/4	2 15/16
W18x46	0.786	3/4	1 1/16	1 7/16	2 1/8	2 13/16
W18x50	0.778	3/4	1 1/16	1 7/16	2 1/8	2 13/16
W18x55	0.850	11/16	1	1 3/8	2	2-11/16
W18x60	0.923	11/16	1	1 5/16	1-15/16	2 9/16
W18x65	0.997	5/8	15/16	1 1/4	1-13/16	2 7/16
W18x71	1.080	5/8	7/8	1 3/16	1 3/4	2 5/16
W18x76	0.971	5/8	15/16	1 1/4	1 7/8	2 1/2
W18x86	1.090	5/8	7/8	1 3/16	1 3/4	2 5/16
W18x97	1.220	9/16	13/16	1 1/16	1 5/8	2 1/8
W18x106	1.330	1/2	3/4	1	1 1/2	2
W18x119	1.480	1/2	3/4	15/16	1 7/16	1 7/8
W21x44	0.672	13/16	1 3/16	1 9/16	2 5/16	3 1/16
W21x50	0.754	3/4	1 1/8	1 7/16	2 3/16	2 7/8
W21x57	0.857	11/16	1	1 3/8	2	2-11/16
W21x62	0.846	11/16	1 1/16	1 3/8	2 1/16	2-11/16
W21x68	0.926	11/16	1	1 5/16	1-15/16	2 9/16
W21x73	0.989	5/8	15/16	1 1/4	1 7/8	2 7/16
W21x83	1.120	9/16	7/8	1 1/8	1-11/16	2 1/4
W21x93	1.240	9/16	13/16	1 1/16	1 5/8	2 1/8
W21x101	1.130	9/16	7/8	1 1/8	1-11/16	2 1/4
W21x111	1.240	9/16	13/16	1 1/16	1 5/8	2 1/8
W21x122	1.350	1/2	3/4	1	1 1/2	2
W21x132	1.450	1/2	3/4	1	1 7/16	1-15/16
W21x147	1.610	7/16	11/16	7/8	1 5/16	1 3/4
W24x55	0.749	3/4	1 1/8	1 7/16	2 3/16	2 7/8
W24x62	0.844	11/16	1 1/16	1 3/8	2 1/16	2-11/16
W24x68	0.837	11/16	1 1/16	1 3/8	2 1/16	2-11/16
W24x76	0.933	11/16	1	1 5/16	1-15/16	2 9/16

W24x84	1.020	5/8	15/16	1 1/4	1-13/16	2 7/16
W24x94	1.140	9/16	7/8	1 1/8	1-11/16	2 1/4
W24x104	1.070	5/8	7/8	1 3/16	1 3/4	2 5/16
W24x117	1.200	9/16	13/16	1 1/8	1 5/8	2 3/16
W24x131	1.330	1/2	3/4	1	1 1/2	2
W24x146	1.480	1/2	3/4	15/16	1 7/16	1 7/8
W24x162	1.630	7/16	11/16	7/8	1 5/16	1 3/4
W27x84	0.921	11/16	1	1 5/16	1-15/16	2 9/16
W27x94	1.030	5/8	15/16	1 3/16	1-13/16	2 3/8
W27x102	1.110	5/8	7/8	1 3/16	1 3/4	2 5/16
W27x114	1.230	9/16	13/16	1 1/16	1 5/8	2 1/8
W27x146	1.350	1/2	3/4	1	1 1/2	2
W27x161	1.480	1/2	3/4	15/16	1 7/16	1 7/8
W27x178	1.630	7/16	11/16	7/8	1 5/16	1 3/4
W30x99	1.000	5/8	15/16	1 1/4	1-13/16	2 7/16
W30x108	1.090	5/8	7/8	1 3/16	1 3/4	2 5/16
W30x116	1.160	9/16	7/8	1 1/8	1-11/16	2 1/4
W30x124	1.240	9/16	13/16	1 1/16	1 5/8	2 1/8
W30x132	1.320	9/16	13/16	1 1/16	1 9/16	2 1/16
W30x173	1.470	1/2	3/4	15/16	1 7/16	1 7/8
W30x191	1.620	7/16	11/16	7/8	1 5/16	1 3/4
W30x211	1.760	7/16	5/8	7/8	1 1/4	1-11/16
W33x118	1.080	5/8	7/8	1 3/16	1 3/4	2 5/16
W33x130	1.180	9/16	13/16	1 1/8	1 5/8	2 3/16
W33x141	1.280	9/16	13/16	1 1/16	1 9/16	2 1/16
W33x152	1.370	1/2	3/4	1	1 1/2	2
W33x201	1.580	1/2	11/16	15/16	1 3/8	1-13/16
W33x221	1.730	7/16	5/8	7/8	1 1/4	1-11/16
W33x241	1.870	7/16	5/8	13/16	1 3/16	1 9/16
W36x135	1.150	9/16	7/8	1 1/8	1-11/16	2 1/4
W36x150	1.270	9/16	13/16	1 1/16	1 9/16	2 1/16
W36x160	1.350	1/2	3/4	1	1 1/2	2
W36x170	1.430	1/2	3/4	1	1 7/16	1-15/16
W36x182	1.520	1/2	11/16	15/16	1 3/8	1 7/8
W36x194	1.620	7/16	11/16	7/8	1 5/16	1 3/4

W36x210	1.740	7/16	5/8	7/8	1 1/4	1-11/16
W36x230	1.690	7/16	11/16	7/8	1 5/16	1-11/16
W36x245	1.790	7/16	5/8	13/16	1 1/4	1 5/8
W36x260	1.900	7/16	5/8	13/16	1 3/16	1 9/16
W36x280	2.030	3/8	9/16	3/4	1 1/8	1 1/2
W36x300	2.170	3/8	9/16	3/4	1 1/16	1 7/16

**ARABIAN VERMICULITE INDUSTRIES** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/GF, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, Z-106, Z-106/G, Z-106/HY.

**GCP KOREA INC** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/GF, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, Z-106, Z-106/G, Z-106/HY.

**GCP APPLIED TECHNOLOGIES INC** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/GF, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, RG, Z-106, Z-106/G, Z-106/HY, MK-1000/HB, MK-1000/HB Extended Set, Z-146, Z-146PC, Z-146T, Z-156, Z-156T and Z-156PC (Types Z-146, Z-146PC, Z-146T, Z-156, Z-156PC, Z-156T also investigated for exterior use).

2. **Metal Lath** — (Required for box application - Optional for contour application) — 3.4 lb/sq yd galvanized or painted expanded steel lath. For box applications, lath shall be lapped 1 in. and tied together with No. 18 SWG galvanized steel; wire spaced vertically 6 in. O.C. For contour applications, lath is installed vertically with joints butted together and secured to the column with powder actuated fasteners located 18 inches on center at joints and as necessary to have the lath follow the column contour. As an alternate, either welded fixing or high temperature adhesive referenced "HTA Adhesive" (supplied by HTA Ltd), fixing of pins to steel column are permitted.

3. **Steel Column** — Wide flange steel columns (36 ksi yield), min/max sizes as specified above.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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