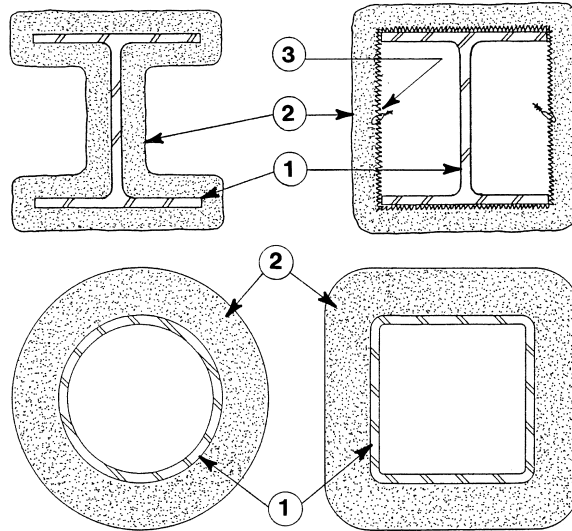


Design No. X795
 Ratings — 1, 1-1/2, 2, 3 and 4 Hr



- 1. Steel Column, Steel Pipe or Steel Tube** — Wide flange steel column (W) or steel circular pipe (SP) or steel square or rectangular tube (ST) with a W/D ratio ranging from 0.33 to 6.76 or an A/P ratio ranging from 0.18 to 2.0 respectively
- 2. 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 40/36 pcf respectively for Types Avikote AV 650, Z-146, Z-146PC and Z-146T cementitious mixture. Min avg and min ind density of 50/45 pcf respectively for Type Avikote AV 800, Z-156, Z-156T and Z-156PC. For method of density determination, see Design Information Section, Sprayed Material.

The min thickness of Spray-Applied Fire Resistive Materials required for various fire resistance ratings of contours sprayed or boxed wide flange columns are shown in the table below:

Column Size In.	W/D Ratio	1 Hr	1-1/2 Hr	Min Thkns In. 2 Hr	3 Hr	4 Hr
W4x13	0.56	7/8	1-5/16	1-7/16	2-1/8	3
W5x16	0.55	7/8	1-5/16	1-1/2	2-1/8	3
W5x19	0.64	13/16	1-3/16	1-7/16	2-1/16	2-3/4
W6x9	0.34	1-1/16	1-7/16	1-1/2	2-1/4	3
W6x12	0.45	15/16	1-3/8	1-1/2	2-3/16	3
W6x15	0.43	1	1-7/16	1-1/2	2-3/16	3
W6x16	0.58	13/16	1-1/4	1-7/16	2-1/8	2-15/16
W6x20	0.56	7/8	1-5/16	1-7/16	2-1/8	3
W6x25	0.70	3/4	1-1/8	1-3/8	2	2-1/2
W8x10	0.33	1-1/16	1-7/16	1-1/2	2-1/4	3
W8x13	0.42	1	1-7/16	1-1/2	2-3/16	3
W8x15	0.48	15/16	1-3/8	1-1/2	2-3/16	3
W8x18	0.50	5/16	1-3/8	1-1/2	2-3/16	3
W8x21	0.58	13/16	1-1/4	1-7/16	2-1/8	2-15/16
W8x24	0.59	13/16	1-1/4	1-7/16	2-1/8	2-15/16
W8x28	0.69	3/4	1-3/16	1-3/8	2	2-1/2
W8x31	0.67	13/16	1-3/16	1-7/16	2-1/16	2-5/8
W8x35	0.75	3/4	1-1/8	1-3/8	2	2-5/16
W8x40	0.85	11/16	7/8	1-1/8	1-9/16	1-15/16
W8x48	1.00	5/8	7/8	1-1/8	1-9/16	1-15/16
W8x58	1.20	9/16	13/16	1-1/8	1-9/16	1-7/8
W8x67	1.37	1/2	3/4	1	1-1/2	1-7/8
W10x12	0.35	1-1/16	1-7/16	1-1/2	2-1/4	3
W10x15	0.43	1	1-7/16	1-1/2	2-3/16	3
W10x17	0.48	15/16	1-3/8	1-1/2	2-3/16	3
W10x19	0.54	7/8	1-5/16	1-1/2	2-1/8	3
W10x22	0.52	7/8	1-5/16	1-1/2	2-1/8	3
W10x26	0.61	13/16	1-1/4	1-7/16	2-1/8	2-14/16
W10x30	0.70	3/4	1-1/8	1-3/8	2	2-1/2
W10x33	0.66	13/16	1-3/16	1-7/16	2-1/16	2-11/16
W10x39	0.78	3/4	1-1/16	1-3/8	2	2-3/16
W10x45	0.89	11/16	7/8	1-1/8	1-9/16	1-15/16
W10x49	0.84	11/16	7/8	1-1/8	1-9/16	1-15/16
W10x54	0.92	11/16	7/8	1-1/8	1-9/16	1-15/16
W10x60	1.01	5/8	7/8	1-1/8	1-9/16	1-15/16
W10x68	1.15	9/16	7/8	1-1/8	1-9/16	1-7/8
W10x77	1.28	9/16	13/16	1-1/16	1-9/16	1-7/8
W10x88	1.45	1/2	3/4	1	1-7/16	1-13/16
W10x100	1.64	7/16	11/16	7/8	1-5/16	1-3/4
W10x112	1.81	7/16	5/8	13/16	1-1/4	1-5/8
W12x14	0.36	1-1/16	1-7/16	1-1/2	2-1/4	3
W12x16	0.41	1	1-7/16	1-1/2	2-1/4	3
W12x19	0.49	15/16	1-6/16	1-8/16	2-3/16	3
W12x22	0.56	7/8	1-5/16	1-7/16	2-1/8	3
W12x26	0.53	7/8	1-5/16	1-1/2	2-1/8	3
W12x30	0.61	13/16	1-1/4	1-7/16	2-1/8	2-14/16
W12x35	0.70	3/4	1-1/8	1-3/8	2	2-1/2
W12x40	0.73	3/4	1-1/8	1-3/8	2	2-3/8

FIRE RESISTANCE DIRECTORY - W R GRACE DESIGNS

FIRE-RESISTANCE RATINGS - ANSI/UL 263 (BXUV)

Column Size In.	W/D Ratio	Min Thkns In.				
		1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W12x45	0.83	11/16	1-1/16	1-3/8	1-15/16	2
W12x50	0.91	11/16	7/8	1-1/8	1-9/16	1-15/16
W12x53	0.86	11/16	7/8	1-1/8	1-9/16	1-15/16
W12x58	0.93	11/16	7/8	1-1/8	1-9/16	1-15/16
W12x65	0.93	11/16	7/8	1-1/8	1-9/16	1-15/16
W12x72	1.02	5/8	7/8	1-1/8	1-9/16	1-15/16
W12x79	1.11	5/8	7/8	1-1/8	1-9/16	1-7/8
W12x87	1.22	9/16	13/16	1-1/16	1-9/16	1-7/8
W12x96	1.34	1/2	3/4	1	1-1/2	1-7/8
W12x106	1.47	1/2	3/4	15/16	1-7/16	1-13/16
W12x120	1.65	7/16	11/16	7/8	1-5/16	1-3/4
W12x136	1.86	7/16	5/8	13/16	1-3/16	1-9/16
W12x152	2.04	3/8	9/16	3/4	1-1/8	1-1/2
W12x170	2.26	3/8	9/16	11/16	1-1/16	1/3/8
W12x190	2.50	5/16	1/2	5/8	15/16	1-1/4
W12x210	2.73	5/16	7/16	9/16	7/8	1-3/16
W12x230	2.96	5/16	7/16	9/16	13/16	1-1/8
W12x252	3.20	5/16	7/16	9/16	13/16	1-1/16
W12x279	3.50	1/4	3/8	1/2	3/4	15/16
W12x305	3.76	1/4	3/8	1/2	11/16	15/16
W12x336	4.06	1/4	5/16	7/16	5/8	7/8
W14x22	0.48	15/16	1-3/8	1-1/2	2-3/16	3
W14x26	0.56	7/8	1-5/16	1-7/16	2-1/8	3
W14x30	0.56	7/8	1-5/16	1-7/16	2-1/8	3
W14x34	0.63	13/16	1-3/16	1-7/16	2-1/16	2-3/4
W14x38	0.71	3/4	1-1/8	1-3/8	2	2-7/16
W14x43	0.75	3/4	1-1/8	1-3/8	2	2-5/16
W14x48	0.84	11/16	7/8	1-1/8	1-9/16	1-15/16
W14x53	0.92	11/16	7/8	1-1/8	1-9/16	1-15/16
W14x61	0.93	11/16	7/8	1-1/8	1-9/16	1-15/16
W14x68	1.04	5/8	7/8	1-1/8	1-9/16	1-15/16
W14x74	1.12	9/16	7/8	1-1/8	1-9/16	1-7/8
W14x82	1.23	9/16	13/16	1-1/16	1-9/16	1-7/8
W14x90	1.08	5/8	7/8	1-1/8	1-9/16	1-15/16
W14x99	1.18	9/16	13/16	1-1/8	1-9/16	1-7/8
W14x109	1.29	9/16	13/16	1-1/16	1-9/16	1-7/8
W14x120	1.42	1/2	3/4	1	1-7/16	1-13/16
W14x132	1.56	1/2	11/16	15/16	1-3/8	1-13/16
W14x145	1.64	7/16	11/16	7/8	1-5/16	1-3/4
W14x159	1.78	7/16	5/8	13/16	1-1/4	1-5/8
W14x176	1.96	3/8	9/16	3/4	1-1/8	1-1/2
W14x193	2.14	3/8	9/16	3/4	1-1/16	1-7/16
W14x211	2.32	3/8	1/2	11/16	1	1-3/8
W14x233	2.55	5/16	1/2	9/16	7/8	1-1/4
W14x257	2.78	5/16	7/16	9/16	7/8	1-3/16
W14x283	3.03	5/16	7/16	9/16	13/16	1-1/16
W14x311	3.30	1/4	3/8	1/2	3/4	1
W14x342	3.58	1/4	3/8	1/2	11/16	15/16
W14x370	3.84	1/4	3/8	7/16	11/16	7/8
W14x398	4.09	1/4	5/16	7/16	5/8	7/8
W14x426	4.32	1/4	5/16	7/16	5/8	13/16
W14x455	4.59	1/4	5/16	3/8	9/16	3/4
W14x500	4.95	1/4	5/16	3/8	9/16	3/4
W14x550	5.34	1/4	5/16	3/8	1/2	11/16
W14x605	5.82	1/4	5/16	5/16	1/2	5/8
W14x665	6.21	1/4	5/16	5/16	7/16	9/16
W14x730	6.76	1/4	5/16	5/16	3/8	9/16
W16x26	0.50	15/16	1-3/8	1-1/2	2-3/16	3
W16x31	0.59	13/16	1-1/4	1-7/16	2-1/8	2-15/16
W16x36	0.62	13/16	1-1/4	1-7/16	2-1/16	2-13/16
W16x40	0.69	3/4	1-3/16	1-3/8	2	2-1/2
W16x45	0.77	3/4	1-1/16	1-3/8	2	2-1/4
W16x50	0.85	11/16	7/8	1-1/8	1-9/16	1-15/16
W16x57	0.96	5/8	7/8	1-1/8	1-9/16	1-15/16
W16x67	0.94	11/16	7/8	1-1/8	1-9/16	1-15/16
W16x77	1.07	5/8	7/8	1-1/8	1-9/16	1-15/16
W16x89	1.22	9/16	13/16	1-1/16	1-9/16	1-7/8
W16x100	1.37	1/2	3/4	1	1-1/2	1-7/8
W18x35	0.60	13/16	1-1/4	1-7/16	2-1/8	2-14/16
W18x40	0.69	3/4	1-3/16	1-3/8	2	2-1/2
W18x46	0.79	3/4	1-1/16	1-3/8	2	2-1/8
W18x50	0.78	3/4	1-1/16	1-3/8	2	2-3/16
W18x55	0.85	11/16	7/8	1-1/8	1-9/16	1-15/16
W18x60	0.92	11/16	7/8	1-1/8	1-9/16	1-15/16
W18x65	1.00	5/8	7/8	1-1/8	1-9/16	1-15/16
W18x71	1.08	5/8	7/8	1-1/8	1-9/16	1-15/16
W18x76	0.97	5/8	7/8	1-1/8	1-9/16	1-15/16
W18x86	1.09	5/8	7/8	1-1/8	1-9/16	1-15/16
W18x97	1.22	9/16	13/16	1-1/16	1-9/16	1-7/8
W18x106	1.33	9/16	3/4	1	1-1/2	1-7/8
W18x119	1.48	1/2	3/4	15/16	1-7/16	1-13/16
W21x44	0.67	13/16	1-3/16	1-7/16	2-1/16	2-5/8
W21x50	0.75	3/4	1-1/8	1-3/8	2	2-5/16
W21x57	0.86	11/16	7/8	1-1/8	1-9/16	1-15/16
W21x62	0.85	11/16	7/8	1-1/8	1-9/16	1-15/16
W21x68	0.93	11/16	7/8	1-1/8	1-9/16	1-15/16
W21x73	0.99	10/16	7/8	1-1/8	1-9/16	1-15/16
W21x83	1.12	9/16	7/8	1-1/8	1-9/16	1-7/8

FIRE RESISTANCE DIRECTORY - W R GRACE DESIGNS

FIRE-RESISTANCE RATINGS - ANSI/UL 263 (BXUV)

Column Size In.	W/D Ratio	Min Thkns In.					
		1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr	
W21x93	1.24	9/16	13/16	1-1/16	1-9/16	1-7/8	
W21x101	1.13	9/16	7/8	1-1/8	1-9/16	1-7/8	
W21x111	1.24	9/16	13/16	1-1/16	1-9/16	1-7/8	
W21x122	1.35	1/2	3/4	1	1-1/2	1-7/8	
W21x132	1.45	1/2	3/4	1	1-7/16	1-13/16	
W21x147	1.61	7/16	11/16	7/8	1-5/16	1-3/4	
W24x55	0.75	3/4	1-1/8	1-3/8	2	2-5/16	
W24x62	0.84	11/16	7/8	1-1/8	1-9/16	1-15/16	
W24x68	0.84	11/16	7/8	1-1/8	1-9/16	1-15/16	
W24x76	0.93	11/16	7/8	1-1/8	1-9/16	1-15/16	
W24x84	1.02	5/8	7/8	1-1/8	1-9/16	1-15/16	
W24x94	1.14	9/16	7/8	1-1/8	1-9/16	1-7/8	
W24x104	1.07	5/8	7/8	1-1/8	1-9/16	1-15/16	
W24x117	1.20	9/16	13/16	1-1/8	1-9/16	1-7/8	
W24x131	1.33	9/16	3/4	1	1-1/2	1-7/8	
W24x146	1.48	1/2	3/4	15/16	1-7/16	1-13/16	
W24x162	1.63	7/16	11/16	7/8	1-5/16	1-3/4	
W27x84	0.92	11/16	7/8	1-1/8	1-9/16	1-15/16	
W27x94	1.03	5/8	7/8	1-1/8	1-9/16	1-15/16	
W27x102	1.11	5/8	7/8	1-1/8	1-9/16	1-7/8	
W27x114	1.23	9/16	13/16	1-1/16	1-9/16	1-7/8	
W27x146	1.35	1/2	3/4	1	1-1/2	1-7/8	
W27x161	1.48	1/2	3/4	15/16	1-7/16	1-13/16	
W27x178	1.63	7/16	11/16	7/8	1-5/16	1-3/4	
W30x99	1.00	5/8	7/8	1-1/8	1-9/16	1-15/16	
W30x108	1.09	5/8	7/8	1-1/8	1-9/16	1-15/16	
W30x116	1.16	9/16	7/8	1-1/8	1-9/16	1-7/8	
W30x124	1.24	9/16	13/16	1-1/16	1-9/16	1-7/8	
W30x132	1.32	9/16	13/16	1-1/16	1-9/16	1-7/8	
W30x173	1.47	1/2	3/4	15/16	1-7/16	1-13/16	
W30x191	1.62	7/16	11/16	7/8	1-5/16	1-3/4	
W30x211	1.76	7/16	5/8	7/8	1-1/4	1-11/16	
W33x118	1.08	5/8	7/8	1-1/8	1-9/16	1-15/16	
W33x130	1.18	9/16	13/16	1-1/8	1-9/16	1-7/8	
W33x141	1.28	9/16	13/16	1-1/16	1-9/16	1-7/8	
W33x152	1.37	1/2	3/4	1	1-1/2	1-7/8	
W33x201	1.58	1/2	11/16	15/16	1-3/8	1-13/16	
W33x221	1.73	7/16	5/8	7/8	1-1/4	1-11/16	
W33x241	1.87	7/16	5/8	13/16	1-3/16	1-9/16	
W36x135	1.15	9/16	7/8	1-1/8	1-9/16	1-7/8	
W36x150	1.27	9/16	13/16	1-1/16	1-9/16	1-7/8	
W36x160	1.35	1/2	3/4	1	1-1/2	1-7/8	
W36x170	1.43	1/2	3/4	1	1-7/16	1-13/16	
W36x182	1.52	1/2	11/16	15/16	1-3/8	1-13/16	
W36x194	1.62	7/16	11/16	7/8	1-5/16	1-3/4	
W36x210	1.74	7/16	5/8	7/8	1-1/4	1-11/16	
W36x230	1.69	7/16	11/16	7/8	1-5/16	1-11/16	
W36x245	1.79	7/16	5/8	13/16	1-1/4	1-5/8	
W36x260	1.90	7/16	5/8	13/16	1-3/16	1-9/16	
W36x280	2.03	3/8	9/16	3/4	1-1/8	1-1/2	
W36x300	2.17	3/8	9/16	3/4	1-1/16	1-7/16	

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 diameter 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 ratings of 3/4, 1, 1-1/2, 2, 3 and 4 h of a steel pipe or tube can be determined by the equation:

$$h = \frac{R - 0.2}{4.43 (A/P)}$$

Where:

R=the hourly rating (hrs)
h=Spray-Applied Fire Resistive Materials thickness in the range 0.25-3.875 in.

As an alternate to the equation, the min thickness of Spray-Applied Fire Resistive Materials required for various fire resistance ratings of contour sprayed steel pipes or tubes are shown on the table below:

Column Size In.	Min Thkns In.					
	1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr	
ST 4x4x3/16 in.	1	1-7/16	1-13/16	2-9/16	3-5/16	
ST 4x4x5/16 in.	5/8	1-1/16	1-7/16	2-3/16	2-15/16	
ST 4x4x3/8 in.	9/16	7/8	1-1/4	1-7/8	2-9/16	
ST 4x4x1/2 in.	7/16	11/16	15/16	1-7/16	2	
ST 20x20x3/4 in.	1/4	3/8	9/16	7/8	1-3/16	

FIRE RESISTANCE DIRECTORY - W R GRACE DESIGNS

FIRE-RESISTANCE RATINGS - ANSI/UL 263 (BXUV)

Column Size In.	Min Thkns In.				
	1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
ST 20x20x1 in.	1/4	5/16	7/16	11/16	15/16
ST 20x20x1-1/12 in.	1/4	1/4	5/16	1/2	5/8
ST 20x20x1-3/4 in.	1/4	1/4	5/16	7/16	9/16
ST 32x32x1-1/4 in.	1/4	1/4	3/8	9/16	3/4
ST 32x32x1-1/2 in.	1/4	1/4	5/16	1/2	5/8
ST 32x32x1-3/4 in.	1/4	1/4	1/4	7/16	9/16
ST 32x32x2 in.	1/4	1/4	1/4	3/8	1/2
ST 36x24x1/2 in.	3/8	5/8	7/8	1-5/16	1-3/4
SP 4x0.237 in.	13/16	1-3/8	1-13/16	2-5/8	3-1/2
SP 6x0.432 in.	1/2	3/4	1-1/16	1-5/8	2-3/16
SP 6x0.864 in.	1/4	3/8	9/16	7/8	1-3/16
SP 8x0.322 in.	5/8	1	1-5/16	2-1/16	2-13/16
SP 10x0.5 in.	3/8	5/8	7/8	1-3/8	1-13/16

ARABIAN VERMICULITE INDUSTRIES — Types Z-146, Z-146 NPP, ZZ-146PC, Z-146T, Z-156, Z-156PC, Z-156T, AV 650, AV 800. Investigated for exterior use.

GRACE KOREA INC — Types Z-146, Z-146 NPP, Z-146PC, Z-146T, Z-156, Z-156PC, Z-156T. Investigated for exterior use.

W R GRACE & CO - CONN — Types Z-146, Z-146 NPP, Z-146PC, Z-146T, Z-156, Z-156PC, Z-156T. Investigated for exterior use.

3. **Metal Lath** — (Optional for contour application) — 3.4 lbs per sq yd galv or painted expanded steel lath. Lath shall be lapped 1 in. and tied together with No. 18 SWG galv steel wire spaced vertically 6 in. O.C.

*Bearing the UL Classification Mark