

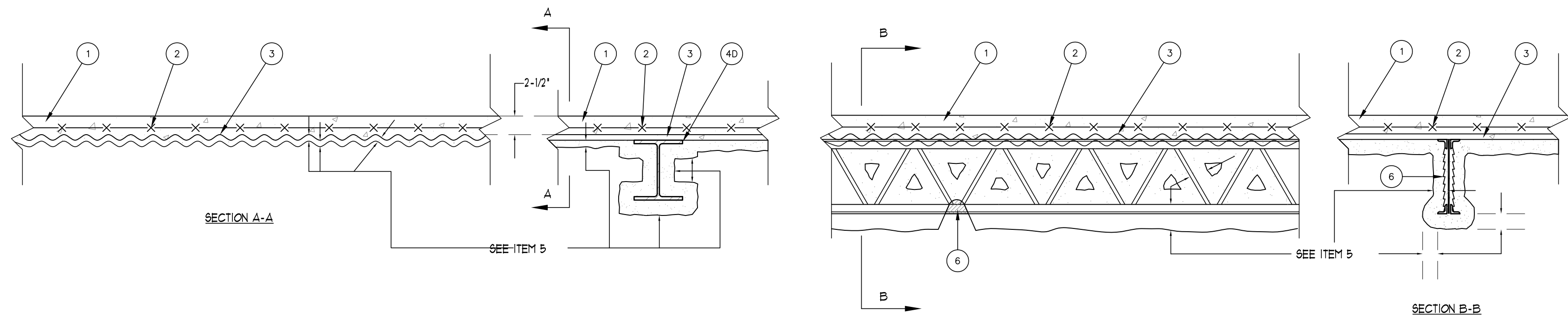
FIRE RESISTANCE RATINGS - ANSI/UL 263  
ROOF/CEILING - FIBER FIREPROOFING

U.L. DESIGN NO. D780

RESTRAINED ASSEMBLY RATING- 1, 1-1/2, 2 OR 3 H

UNRESTRAINED ASSEMBLY RATING- 1, 1-1/2, 2 OR 3 H (SEE ITEM 5)

UNRESTRAINED BEAM RATINGS- 1, 1-1/2, 2 OR 3 H (SEE ITEM 5)



1. NORMAL WEIGHT OR LIGHTWEIGHT AGGREGATE CONCRETE -- NORMAL WEIGHT CARBONATE OR SILICEOUS AGGREGATE CONCRETE, 150 PLUS OVER MINUS 3 PCF UNIT WEIGHT, 3500 PSI COMPRESSIVE STRENGTH, VIBRATED, LIGHTWEIGHT CONCRETE, EXPANDED SHALE, CLAY OR SLATE AGGREGATE BY READY-MIX METHOD, 100 PLUS OVER MINUS 3 PCF UNIT WEIGHT, 3500 PSI COMPRESSIVE STRENGTH, 4 TO 1 PERCENT ENTRAPPED AIR.

2. WELDED WIRE FABRIC -- 6 X 6 -- W20 X W20

3. STEEL FLOOR AND FORM UNITS -- NO. 28 MSG GALV CORRUGATED SHEET STEEL, MINIMUM THE DESCRIPTION AND SIZES OF THE CORRUGATED SHEET STEEL UNITS AND THE MAX BEAM SPACING ARE AS FOLLOWS:

Steel Deck Unit In.	Nom Pitch In.	Sheet Steel Gauge MSG	Max Beam Spacing
9/16	2-1/2	28	3 ft, 6 in. O.C.
1-5/16	3-3/4	26	5 ft, 0 in. O.C.
1-5/16	5	26	6 ft, 6 in. O.C.
1-5/16	5	24	7 ft, 0 in. O.C.
1-5/16	5	22	7 ft, 6 in. O.C.
1-5/16	5	20	8 ft, 0 in. O.C.

UNITS WELDED TO EACH STEEL BEAM, 36 WELDS PER 100 SQ FT. OF FORM UNITS WITH AT LEAST ONE WELD AT EACH SIDE JOINT, WELDING OF DECK SIDE JOINT BETWEEN BEAMS FOR DECK SPANS RANGING BETWEEN 3 FT. 6 IN. AND 6 FT. 6 IN. O.C. SHALL BE AT LEAST TWO WELDS OF EACH SIDE JOINT, WELDING OF SIDE JOINTS FOR SPANS GREATER THAN 6 FT. 6 IN. O.C. SHALL BE A MINIMUM OF THREE WELDS OF EACH SIDE JOINT.

ANY MANUFACTURER -- CORRUGATED DECK HAVING CROSS-SECTION SIMILAR TO ABOVE DESCRIPTION.

- 3A. STEEL FLOOR AND FORM UNITS -- AS AN ALTERNATE TO ITEM 3, COMPOSITE 1-1/2, 2, OR 3 IN DEEP GALV FLUTED UNITS, MIN GAUGE IS NO. 22 MSG, SPACING OF WELDS ATTACHING UNITS TO SUPPORTS SHALL BE AT EACH SIDE OF JOINT AND NOT TO EXCEED 12 IN. O.C. BETWEEN JOINTS, ADJACENT UNITS BUTT PUNCHED OR WELDED TOGETHER 36 IN. O.C. AT JOINTS.

VULCRAFT, DIV OF NUCOR CORP -- 24, 30 AND 36 IN WIDE TYPE 15X16, 24 OR 36 IN WIDE TYPES 2VL, 3VL, TYPES 1-5LV, 2VL, AND 3VL UNITS MAY BE PH08/PTD.

WHEELING-PITTSBURGH STEEL CORP, DIV OF WHEELING CORRUGATING CO -- TYPE BU 36 SLOTTED DECK.

4. STEEL JOISTS -- 10K1 OR 16K2 MIN SIZE WITH A MAX TENSILE STRESS OF 30,000 PSI OR 16K3 MIN SIZE WITH MAX TENSILE STRESS OF 24,000 PSI.

- 4A. AS AN ALTERNATE TO ITEM 4, LH SERIES JOISTS SPANNING NO GREATER THAN 60 FT. FOR SPANS GREATER THAN 60 FT, DEFLECTION UNDER THE PUBLISHED TOTAL LOAD SHALL NOT BE GREATER THAN 1/121 OF THE JOIST SPAN.

- 4B. COMPOSITE JOISTS -- (NOT SHOWN) -- AS AN ALTERNATE TO ITEMS 4 AND 4A, STEEL JOISTS DESIGNED FOR FULL COMPOSITE ACTION WITH THE CONCRETE SLAB, MIN OVERALL DEPTH IS 16 IN, MIN AREA OF JOIST MEMBERS SHALL BE 0.108 SQUARE IN FOR TOP AND BOTTOM CHORD ANGLES AND 0.441 SQUARE IN FOR WEB, DESIGNED IN ACCORDANCE WITH AISC SPECIFICATIONS FOR K-SERIES JOISTS AS REVISED TO NOVEMBER 18, 1989.

- 4C. STRUCTURAL STEEL MEMBERS -- (NOT SHOWN) -- AS AN ALTERNATE TO ITEMS 4, 4A AND 4B -- (NOT SHOWN) -- COMPOSITE JOISTS WITH TOP CHORD EMBEDDED IN CONCRETE SLAB, WELDED TO END SUPPORTS, MIN AREA OF JOIST MEMBERS SHALL BE 0.108 SQUARE IN FOR TOP AND BOTTOM CHORD ANGLES AND 0.441 SQUARE IN FOR WEB.

VECOM STRUCTURAL SYSTEMS INC -- TYPE V.

- 4D. STEEL BEAMS -- W8X28 MIN SIZE, AS AN ALTERNATE TO STEEL JOISTS, ITEMS 4, 4A, 4B AND 4C.

- 4E. HORIZONTAL BRIDGING -- (NOT SHOWN) -- MIN 1/4 BY 1/4 BY 1/8 IN THICK STEEL ANGLES FOR USE WITH NONCOMPOSITE JOISTS (ITEM 4), NUMBER AND SPACING PER STEEL JOIST INSTITUTE SPECIFICATIONS, WELDED TO TOP AND BOTTOM CHORD OF THE JOISTS, MIN THICKNESS OF SPRAY-APPLIED FIRE RESISTIVE MATERIALS ON BRIDGING ANGLES IS 1-1/2 IN.

5. SPRAY-APPLIED FIRE RESISTIVE MATERIALS -- APPLIED BY MIXING WITH WATER AND SPRAYING IN NO MORE THAN ONE COAT TO A FINAL THICKNESS AS SHOWN BELOW TO STEEL SURFACES WHICH MUST BE FREE OF DIRT, LOOSE SCALE AND OIL, MIN AVG AND MIN MD DENSITY OF 15/4 PCF, RESPECTIVELY, FOR METHOD OF DENSITY DETERMINATION, SEE DESIGN INFORMATION SECTION, SPRAYED MATERIALS.

Restrainted Assembly	Unrestrained Assembly	Unrestrained Beam	on Deck	on Beam
Rating Hr	Rating Hr	Rating Hr		
1	1	1	3/8	7/16
1-1/2		1	1/2	7/16
1-1/2	1-1/2	1-1/2	1/2	3/4
2	1	1	1/2	7/16
2	2	2	5/8	1
3	1-1/2	1-1/2	1/2	3/4
3		3	7/8	1-5/16

Restrainted Assembly	Unrestrained Assembly	Unrestrained Beam	LH Joist	Joint Thickness
Rating Hr	Rating Hr	Rating Hr		10K1 10K1 16K2 16K2
1	1	1	1-1/8	15/16 15/16 3/16
1-1/2	1	1	1-1/8	15/16 15/16 3/16
1-1/2	1-1/2	1-1/2	1/2	15/16 15/16 3/16
2	1	1	1-1/8	15/16 15/16 3/16
2	2	2	1/2	15/16 15/16 3/16
3	1-1/2	1-1/2	1/2	15/16 15/16 3/16
3	3	3	1/4	13/16 13/16 2-1/4 2-1/8

ARABIAN VERMICULITE INDUSTRIES -- TYPES MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY EXTENDED SET, MK-6S.

W R GRACE 4 CO - CONN

CONSTRUCTION PRODUCTS DIV -- TYPES MK-6/HY, MK-6/HY EXTENDED SET, MK-6S, RG.

GRACE KOREA INC -- TYPES MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY EXTENDED SET, MK-6S.

5A. SPRAY-APPLIED FIRE RESISTIVE MATERIALS -- APPLIED BY MIXING WITH WATER AND SPRAYING IN MORE THAN ONE COAT TO A FINAL THICKNESS AS SHOWN BELOW TO STEEL SURFACES WHICH MUST BE FREE OF DIRT, LOOSE SCALE AND OIL, WHEN STEEL DECK IS USED, THE AREA BETWEEN THE STEEL DECK AND THE BEAMS TOP FLANGE SHALL BE FILLED, MIN AVG AND MIN DENSITY OF 22/8 PCF, RESPECTIVELY FOR TYPES Z-106, Z-106/HY AND Z-106/G, MIN AVG AND MIN MD DENSITY OF 40/8 PCF, RESPECTIVELY FOR Z-146, APPLICATION TO STEEL DECK REQUIRES THE INSTALLATION OF EXPANDED METAL LATH WITH TYPE Z-146. (SEE ITEM 6B) FOR METHOD OF DENSITY DETERMINATION, SEE DESIGN INFORMATION SECTION, SPRAYED MATERIALS.

Restrainted Assembly	Unrestrained Assembly	Unrestrained Beam	on Deck	on Beam
Rating Hr	Rating Hr	Rating Hr		
1	1	1	7/16	7/16
1-1/2		1	9/16	7/16
1-1/2	1-1/2	1-1/2	9/16	3/4
2	1	1	9/16	7/16
2	2	2	5/8	1
3	1-1/2	1-1/2	9/16	3/4
3		3	7/8	1-5/16

Restrainted Assembly	Unrestrained Assembly	Unrestrained Beam	LH Joist	Joint Thickness
Rating Hr	Rating Hr	Rating Hr		10K1 10K1 16K2 16K2
1	1	1	1-1/8	15/16 15/16 3/16
1-1/2	1	1	1-1/8	15/16 15/16 3/16
1-1/2	1-1/2	1-1/2	1/2	15/16 15/16 3/16
2	1	1	1-1/8	15/16 15/16 3/16
2	2	2	1/2	15/16 15/16 3/16
3	1-1/2	1-1/2	1/2	15/16 15/16 3/16
3	3	3	1/4	13/16 13/16 2-1/4 2-1/8

ARABIAN VERMICULITE INDUSTRIES -- TYPES Z-106, Z-106/G, Z-106/HY, Z-146 INVESTIGATED FOR EXTERIOR USE.

W R GRACE 4 CO - CONN

CONSTRUCTION PRODUCTS DIV -- TYPES Z-106, Z-106/G, Z-106/HY, Z-146 INVESTIGATED FOR EXTERIOR USE.

GRACE KOREA INC -- TYPES Z-106, Z-106/G, Z-106/HY, Z-146 INVESTIGATED FOR EXTERIOR USE.

5B. ALTERNATE SPRAY-APPLIED FIRE RESISTIVE MATERIALS -- APPLIED BY MIXING WITH WATER AND SPRAYING IN MORE THAN ONE COAT TO FINAL THICKNESSES AS SHOWN IN THE ILLUSTRATION ABOVE AND IN THE TABLE BELOW TO STEEL SURFACES WHICH MUST BE CLEAN AND FREE OF DIRT, LOOSE SCALE AND OIL FOR MINIMUM AND MAXIMUM DENSITY OF TYPES MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY EXTENDED SET, MK-6S SEE ITEM 5; Z-106, Z-106/G, Z-106/HY, Z-146 SEE ITEM 5A.

Restrainted Assembly	Unrestrained Assembly	Unrestrained Beam	Joint thickness
Rating Hr	Rating Hr	Rating Hr	12K3** 12K3** more than 4 ft OC 4 ft OC
1	1	1	15/16 15/16
1-1/2	1-1/2	1-1/2	1-1/4 1-3/16
2	2	2	1-9/16 1-1/2
3	3	3	2-1/4 2-1/8

\*\*DESIGN LOAD SHALL STRESS THE 12K3 JOIST TO A MAXIMUM TENSILE STRENGTH OF 24,000 PSI, WHICH REPRESENTS 80% OF THE MAXIMUM ALLOWABLE DESIGN LOADING, BASED ON THE STEEL JOIST INSTITUTE (SJI) PUBLICATION, CATALOG OF STANDARD SPECIFICATIONS AND LOAD TABLES FOR STEEL JOISTS AND JOIST GIRDERS FOR GUIDANCE ON HOW TO INCREASE THE DESIGN LOADING ACCORDINGLY.

ARABIAN VERMICULITE INDUSTRIES -- TYPES MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY EXTENDED SET, MK-6S, Z-106, Z-106/G, Z-106/HY, Z-146 INVESTIGATED FOR EXTERIOR USE.

W R GRACE 4 CO - CONN

CONSTRUCTION PRODUCTS DIV -- TYPES MK-6/HY, MK-6/HY EXTENDED SET, MK-6S, RG, Z-106, Z-106/G, Z-106/HY, Z-146 INVESTIGATED FOR EXTERIOR USE.

GRACE KOREA INC -- TYPES MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY EXTENDED SET, MK-6S, Z-106, Z-106/G, Z-106/HY, Z-146 INVESTIGATED FOR EXTERIOR USE.

6. METAL LATH -- (OPTIONAL) -- METAL LATH MAY BE USED TO FACILITATE THE SPRAY APPLICATION OF SPRAY-APPLIED RESISTIVE MATERIALS TO STEEL BAR JOISTS AND TRUSSES, THE DIAMOND MESH 3/8 IN EXPANDED STEEL LATH, 11 TO 34 LB PER SQ YD IS REQUIRED TO ONE SIDE OF EACH STEEL JOIST WITH NO. 8 B&G GALV STEEL WIRE AT JOIST WEB AND BOTTOM CHORD MEMBERS, SPACED 18 IN. OC MAX, WHEN USED, THE METAL LATH IS TO BE FULLY COVERED WITH SPRAY-APPLIED RESISTIVE MATERIALS WITH NO MIN THICKNESS REQUIREMENTS.

6A. NONMETALLIC FABRIC MESH -- (OPTIONAL, NOT SHOWN) -- GLASS FIBER MESH WEIGHING APPROX 125 OZ PER SQ YD, POLYPROPYLENE FABRIC MESH WEIGHING APPROX 125 OZ PER SQ YD OR EQUIVALENT, MAY BE USED TO FACILITATE THE SPRAY APPLICATION. THE MESH IS SECURED TO ONE SIDE OF EACH JOIST WEB MEMBER, THE METHOD OF ATTACHING THE MESH MUST BE SUFFICIENT TO HOLD THE MESH AND THE SPRAY-APPLIED RESISTIVE MATERIALS IN PLACE DURING APPLICATION UNTIL IT HAS CURED. AN ACCEPTABLE METHOD TO ATTACH THE MESH IS BY EMBEDDING THE MESH IN MIN 1/4 IN LONG BEADS OF NOT MELTED GLUE. THE BEADS OF GLUE SHALL BE SPACED A MAX OF 12 IN OC ALONG THE TOP CHORD OF THE BAR JOIST, ANOTHER METHOD TO SECURE THE MESH IS BY 1/4 IN LONG BY 1/2 IN WIDE HAIRPIN CLIPS FORCED FROM NO. 18 B&G OR HEAVIER STEEL WIRE.

6B. METAL LATH -- (NOT SHOWN) -- (REQUIRED WITH Z-146, SONOPHONE 35, AND MONOKOTE ACOUSTIC 35, OTHERWISE OPTIONAL) -- METAL LATH SHALL BE 3/8 IN EXPANDED DIAMOND MESH WEIGHING 15 LB PER SQ YD, SECURED TO UNDERSIDE OF STEEL DECK WITH NO. 12 BY 3/8 IN PAN HEAD SELF-DRILLING, SELF-TAPPING SCREWS AND STEEL WASHERS WITH AN OUTSIDE DIAM OF 1/2 IN, SCREWS SPACED 12 IN OC IN BOTH DIRECTIONS WITH LATH EDGES OVERLAPPED APPROX 3 IN.

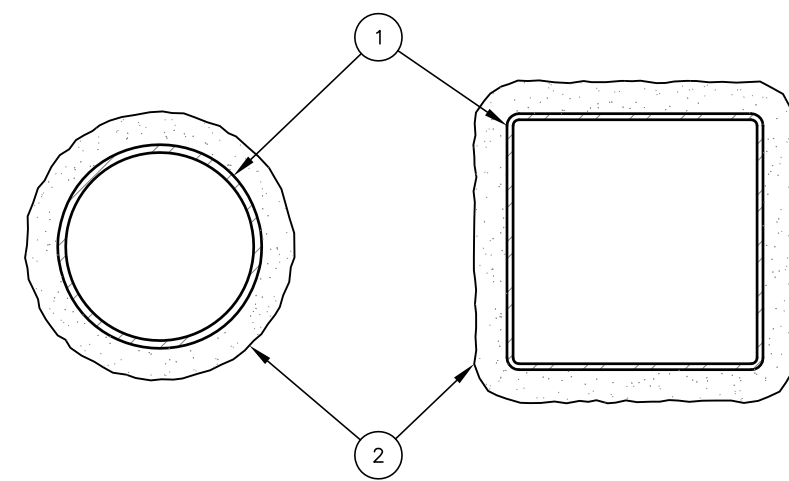
7. SHEAR CONNECTOR -- STUDS -- (OPTIONAL, NOT SHOWN) -- STUDS 3/4 IN DIAMETER BY 3 IN LONG HEADED TYPE OR EQUIVALENT PER AISC SPECIFICATIONS, WELDED TO THE TOP FLANGE OF BEAM THROUGH THE STEEL FORT UNITS.

\*BEARING THE UL CLASSIFICATION MARK

FIRE RESISTANCE RATINGS - ANSI/UL 263  
COLUMN- FIBER FIREPROOFING

U.L. DESIGN NO. X827

RATINGS- 1, 1-1/2, 2, 3, 4 HR.



1. STEEL PIPE OR TUBE COLUMN -- STEEL CIRCULAR PIPE (SP) WITH DIAMETER (D) RANGING FROM A MINIMUM OF 3 IN. TO A MAXIMUM OF 32 IN. WITH A MINIMUM WALL THICKNESS OF 3/16 IN.

STEEL SQUARE OR RECTANGULAR TUBE (ST) WITH OUTSIDE WALL DIMENSIONS RANGING FROM MINIMUM 3 IN. TO A MAXIMUM OF 36 IN. AND A MINIMUM WALL THICKNESS OF 3/16 IN.

THE A/P RATIO OF THE STEEL PIPE OR TUBE (SEE ITEM 2) SHALL RANGE FROM Ø18 TO 2.0.

2. SPRAY-APPLIED FIRE RESISTIVE MATERIALS -- APPLIED BY SPRAYING WITH WATER IN ONE OR MORE UNTAMPED COATS AT THE THICKNESS SHOWN IN THE TABLE BELOW TO STEEL SURFACES WHICH ARE FREE OF DIRT, OIL OR SCALE, USE OF ADHESIVE IS OPTIONAL, MIN AVG UNTAMPED DENSITY IS 13 PCF WITH MIN MD UNTAMPED DENSITY OF 11 PCF FOR TYPES D-C/F OR 11, MIN AVG AND MIN MD UNTAMPED DENSITIES OF 22 AND 19 PCF, RESPECTIVELY, FOR TYPE HP, TAMPING IS OPTIONAL, FOR METHOD OF DENSITY DETERMINATION REFER TO DESIGN INFORMATION SECTION.

THE THICKNESS OF SPRAYED FOR RATINGS OF 1-1/2, 2, 3, AND 4 H OF A STEEL PIPE OR TUBE MAY BE DETERMINED BY THE EQUATION:

$$H = R \times \frac{\sqrt{350}}{350} \left( \frac{A}{P} \right)$$

WHERE:

R = THE HOURLY RATING (HRS)

H = THE THICKNESS OF PROTECTION MATERIAL, MIN Ø35 - MAX 350 IN.

A = THE CROSS SECTIONAL AREA (SQ IN)

P = THE HEATED PERIMETER (IN)

THE A/P RATIO OF A CIRCULAR PIPE IS DETERMINED BY:

$$A/P = \frac{\pi(D - T)}{D}$$

WHERE:

D = THE OUTER DIAMETER OF THE PIPE (IN)

T = THE WALL THICKNESS OF THE PIPE (IN)

THE A/P RATIO OF A RECTANGULAR TUBE IS DETERMINED BY:

$$A/P = \frac{1}{4} \left( \frac{A + B}{A + B + 2T} \right)$$

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)

Min Column Size	A/P	1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
SP 3x0.188	0.18	1	1-3/4	2-9/16	---	---
ST 3x3x0.188	0.18	1	1-3/4	2-9/16	---	---
SP 4x0.237	0.22	13/16	1-7/16	2-3/16	3-3/8	---
ST 4x4x0.188	0.18	1	1-9/16	2-3/16	4	---
ST 4x4x0.375	0.34	9/16	13/16	1-1/4	2-5/16	3-1/4
ST 36x24x0.5	0.49	3/8	7/16	11/16	1-1/8	1-5/8

CIL GROUP LTD -- TYPE D-C/F OR TYPE II, INVESTIGATED FOR EXTERIOR USE, TYPE EBS OR TYPE X ADHESIVE/SEALER OPTIONAL.

ISOLATE INTERNATIONAL -- TYPE HP, D-C/F OR II, TYPE D-C/F, HP OR II, INVESTIGATED FOR EXTERIOR USE, TYPE EBS OR TYPE X ADHESIVE/SEALER OPTIONAL.

\*BEARING THE UL CLASSIFICATION MARK

three eighths inch = one foot  
one eighth inch = one foot  
one quarter inch = one foot  
three quarters inch = one foot  
one half inch = one foot  
one and one half inches = one foot  
two inches = one foot  
three inches = one foot  
four inches = one foot  
five inches = one foot  
six inches = one foot  
seven inches = one foot  
eight inches = one foot  
nine inches = one foot  
ten inches = one foot  
eleven inches = one foot  
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sixty five inches = one foot  
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sixty seven inches = one foot  
sixty eight inches = one foot  
sixty nine inches = one foot  
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ninety seven inches = one foot  
ninety eight inches = one foot  
ninety nine inches = one foot  
one hundred inches = one foot  
one hundred one inches = one foot  
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one hundred three inches = one foot  
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one hundred six inches = one foot  
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one hundred thirty five inches = one foot  
one hundred thirty six inches = one foot  
one hundred thirty seven inches = one foot  
one hundred thirty eight inches = one foot  
one hundred thirty nine inches = one foot  
one hundred forty inches = one foot  
one hundred forty one inches = one foot  
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one hundred forty five inches = one foot  
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one hundred fifty four inches = one foot  
one hundred fifty five inches = one foot  
one hundred fifty six inches = one foot  
one hundred fifty seven inches = one foot  
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one hundred fifty nine inches = one foot  
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one hundred ninety seven inches = one foot  
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two hundred thirty inches = one foot  
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two hundred thirty two inches = one foot  
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two hundred thirty five inches = one foot  
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