

2



CITY OF PORTLAND, OREGON - BUREAU OF DEVELOPMENT SERVICES

1900 SW Fourth Avenue, Suite 5000 • Portland, Oregon 97201 • www.portlandonline.com/bds • Fax 503-823-7425



Facility Permit Plan Intake Form

FOR INTAKE, STAFF USE ONLY		Building/Mechanical	TOM K
Date Received		Electrical	
Building Registration #		Plumbing	
Fixed Bid	NO	Fire	GARY
Bin #	B1	Planning	
Building Permit #	11-125470 DFS 01 FA	BES	
Mechanical #		PDOT	
Plumbing Permit #		Structural	
Electrical Permit #		Other	

MICRO

APPLICANT: Complete all sections below that apply to the project. Please print legibly.

Print Name RALPH SCHULTZ Sign Name Ralph Schultz
 Street Address 5500 SW ARCTIC DRIVE
 City BEAVERTON State OR Zip Code 97005
 Day Phone 503.520.9991 FAX 503.626.9991 email R.SCHULTZ@FRESHHEARER.COM

Plans / permits available for pick up at 1900 SW 4th Avenue, 2nd floor between 8:00 am to 5:00 pm

Contact Name for plan/permit pick up RALPH SCHULTZ
 Day Phone 503.520.9991 email R.SCHULTZ@FRESHHEARER.COM

Project Building Name / # WELLS FARGO TOWER
 Project Address or Location 1300 SW 5TH AVE PDX, OR
 Project Name and Description DP-3 FIRE PROOFING

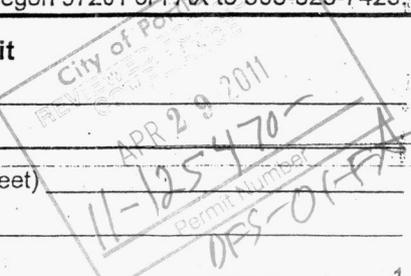
Total Project Value 50,000 Project Reference #/Billing ID # _____
 Building Contractor FIRE PROOFING FRESH HEARER & SONS CCB # 357
 Mechanical Contractor _____ CCB # _____
 Electrical Contractor _____ CCB# _____ License # _____
 Plumbing Contractor _____ CCB# _____ License # _____

Building Permit
 No. of Stories _____
 Const. Type _____
 [Y] [N] Alarms Required
 [Y] [N] Smoke Det. Req'd
 [Y] [N] Sprinklers Req'd
 [Y] [N] Struct. Eng / Calcs Submitted

Electrical Permit
 Please provide a completed standard electrical permit application form. You may mail or deliver it to 1900 SW 4th Avenue, Portland, Oregon 97201 or FAX to 503-823-7425.

Mechanical Permit
 Mechanical Valuation _____
 Description _____

Plumbing Permit
 Number of Fixtures _____
 Back Flow Devices _____
 Water Service (# of Feet) _____
 Medical Gas _____
 Other _____



11-125470-DFS-01-FA

R1

FRED SHEARER
& SONS, INC.
CONTRACTOR
Established 1916

2

Wells Fargo Tower DP-3

**Submittal For Sections:
Applied Fireproofing**

11-125470 DFS 01 FA

April 13, 2011

This Shop Drawing (product Data, sample, etc.) has been prepared by FRED SHEARER & SONS, INC. in its capacity as a contractor and not as a licensed design professional. It is submitted in reliance on the accuracy of the information contained in the Contract Documents and for the sole purpose of illustrating the portion of the work indicated. FRED SHEARER & SONS, INC. expressly disclaims any responsibility for ascertaining whether the information contained in the contract documents is in accordance with applicable laws, statutes, ordinances, building codes, rules and regulations and/or standards. Any comparison of contract documents, field measurements and observation of site conditions by FRED SHEARER & SONS, INC. has been for the sole purpose of facilitating construction and not for the purpose of discovering errors, omissions or inconsistencies with the contract drawings.

PROJECT INFORMATION

Project: Wells Fargo Tower DP-3
1300 SW 5th Ave
Portland, OR 97201

General Contractor: P&C Construction
2133 NW York Street
Portland, OR 97210

Fireproofing Subcontractor: Fred Shearer & Sons, Inc.
5500 SW Arctic Drive.
Beaverton, OR 97005 Phone: (503) 520-9991

Inspection Agency: Carlson Testing Inc.
PO Box 23814
Tigard, OR 97281 Fax: (503) 684-0954

TABLE OF CONTENTS

Transmittal of transfer of a marked set of structural drawing showing thickness of fireproofing, and product data	Section 1
UL Design D779	Section 2
Grace Product Announcement	Section 3
Approved ICBO Evaluation Report ESR 1186	Section 4
Letter from manufacturer that equipment is approved to pump material	Section 5
Fireproofing Manufacturer Product Data Sheet	Section 6
Manufacturer winter or cold weather conditions procedures	Section 7
Inspection of Sprayed Applied Fireproofing	Section 8

Section # 1:

- Structural Drawings showing the shaded area of the outline of the project and at same time showing the area of deck to be sprayed @ 3/8"
- Structural drawings showing the thicknesses of the columns and beams to be sprayed.

SECTION I:

TRANSMITTAL OF TRANSFER OF MARKED SET OF STRUCTURAL
DRAWING SHOWING THICKNESS OF FIREPROOFING, AND PRODUCT
DATA.

Fireproofing Thickness Schedule

23 Fireproofing DP-3 Wells Fargo - Base Bid

Section: Entire Job
Page: Floor Plan SH 13'
Condition: Monokote Calcs Floor

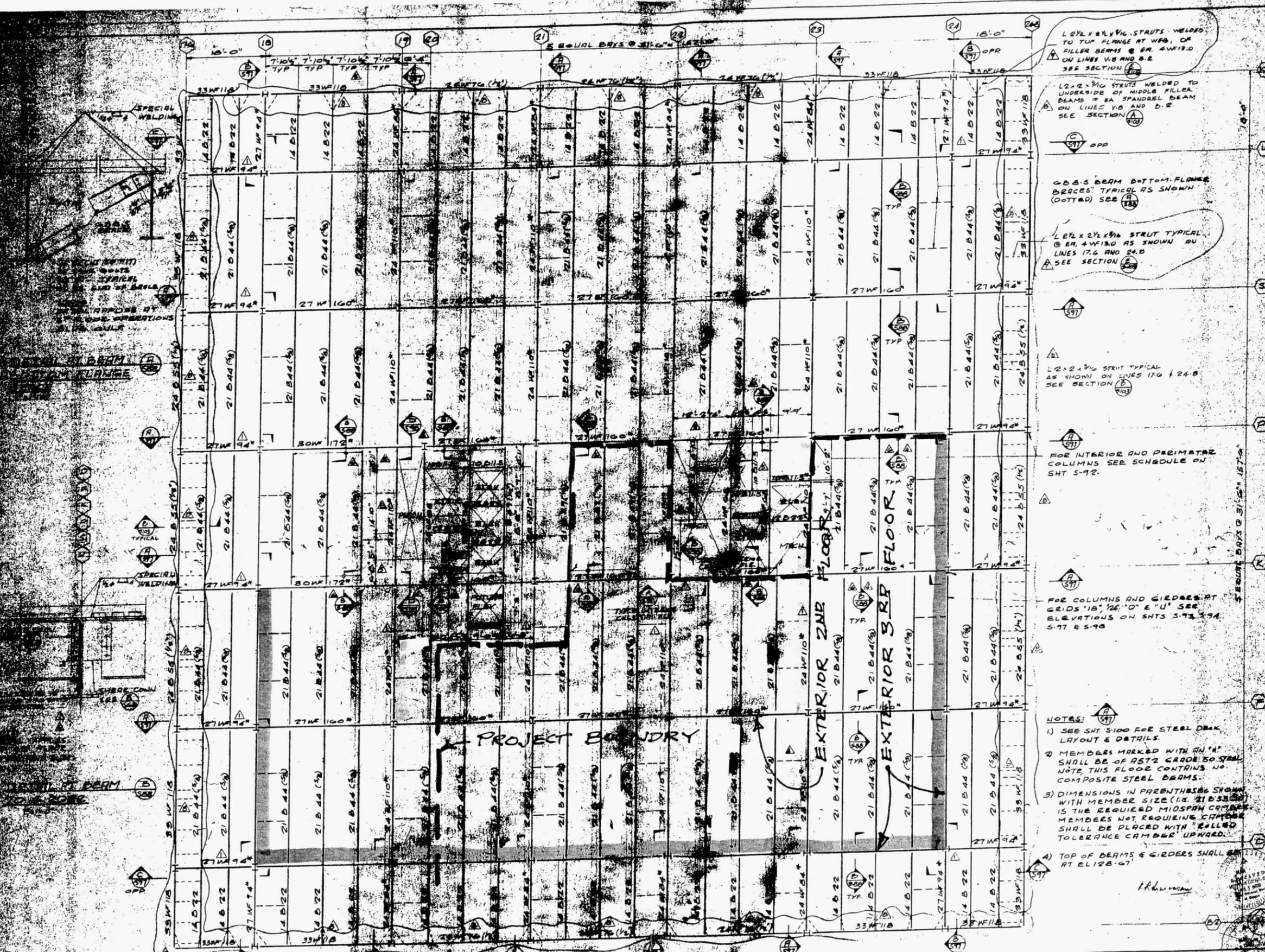
Description	Test	Hours	Thickness
V 33 X 118 - PRM BM	D779 Unrestrained	3.00	1-1/16"
W 27 X 161 - PRM BM	D779 Unrestrained	3.00	13/16"
V 24 X 104 - PRM BM	D779 Unrestrained	3.00	1-1/16"
W 27 X 94 - PRM BM	D779 Unrestrained	3.00	1-1/16"
V 11 X 44 - PRM BM	D779 Unrestrained	3.00	1-7/16"
W 21 X 44 - SEC BM	D779 Unrestrained	2.00	1-1/8"
STEEL DECK TYPE 3 (1.72 Exp Factor)	D779 Unrestrained	2.00	3/8"

Fireproofing Thickness Schedule

23 Fireproofing DP-3 Wells Fargo - Base Bid

Section: Entire Job
Page: Columns
Condition: Monokote Calcs Floor

Description	Test	Hours	Thickness
V 14 X 145 - COLUMN	X772 (cols)	3.00	1-5/16"
W 14 X 176 - COLUMN	X772 (cols)	3.00	1-3/16"



L2x2x3/16 STRUTS WELDED TO TOP FLANGE AT WFB, OF FILLER BEAMS @ EA 4WF130 ON LINES V-8 AND B-2 SEE SECTION (A) 597

L2x2x3/16 STRUTS WELDED TO UNDERSIDE OF MIDDLE FILLER BEAMS @ EA SPANDEL BEAM ON LINES V-8 AND B-2 SEE SECTION (A) 597

C.B.S BEAM BOTTOM FLANGE BRACES TYPICAL AS SHOWN (OOTTED) SEE (A) 597

L2x2x3/16 STRUT TYPICAL @ EA 4WF130 AS SHOWN ON LINES 17.6 AND 24.8 SEE SECTION (B) 597

L2x2x3/16 STRUT TYPICAL AS SHOWN ON LINES 17.6 + 24.8 SEE SECTION (B) 597

FOR INTERIOR AND PERIMETER COLUMNS SEE SCHEDULE ON SHT 5-92.

FOR COLUMNS AND GIRDERS AT GRIDS '18', '24', 'D' & 'U' SEE ELEVATIONS ON SHTS 5-93, 5-94, 5-97 & 5-98

NOTES:

- 1) SEE SHT 5-100 FOR STEEL DECK LAYOUT & DETAILS.
- 2) MEMBERS MARKED WITH AN "M" SHALL BE OF A572 GRADE 50 STEEL. NOTE THIS FLOOR CONTAINS NO COMPOSITE STEEL BEAMS.
- 3) DIMENSIONS IN PARENTHESES SHOWN WITH MEMBER SIZE (e.g. 21B55) IS THE REQUIRED MIDSPAN CAMBER. MEMBERS NOT REQUIRING CAMBER SHALL BE PLACED WITH "ROLLED TOLERANCE CAMBER" UPWARD.
- 4) TOP OF BEAMS & GIRDERS SHALL BE AT EL 128.07

STRUTS MODED

4TH FLOOR FRAMING OPERATIONS BLDG

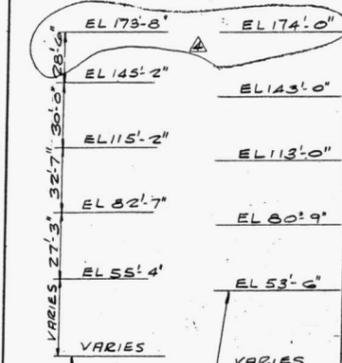
NO.	DESCRIPTION	DATE	BY	CHECKED
1	STRUTS MODED			
2	STRUTS ADDED - REV DIMS			
3	REV DIMS			
4	REV LOCATION W/SS			
5	REV DETAIL W/SS			
6	UNASS BMT SIZE			
7				
8				
9				
10				

NATIONAL BANK OF OREGON
OREGON

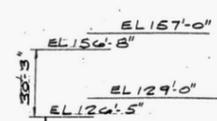
4TH FLOOR FRAMING OPERATIONS BLDG

CORE COLUMN SCHEDULE

PERIMETER COLUMN SCHEDULE



LEVEL	COLUMN LOCATION	CORE COLUMN SCHEDULE											
		5-19	5-21	5-22 P-23 K-23 F-22	5-23 F-23	P-20	P-21	P-22 K-22	K-20	K-21	F-19	F-21	
5TH - PENTHOUSE ROOF	EL 173'-8" to EL 174'-0" / EL 145'-2" to EL 143'-0"	PDEAD 472 PTOTAL 709 GRADE 50 SECT. 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	472 709 50 111	
3RD - 5TH	EL 115'-2" to EL 113'-0"	PDEAD 711 PTOTAL 1067 GRADE 50 SECT. 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	711 1067 50 150	
PLAZA - 3RD	EL 82'-7" to EL 80'-9"	PDEAD 866 PTOTAL 1301 GRADE 50 SECT. 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	866 1301 50 184	
1ST PRK'G - PLAZA	EL 53'-6" to EL 53'-6"	PDEAD 1200 PTOTAL 1799 GRADE 50 SECT. 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	1200 1799 50 228	
TOP OF BASE #1	VARIES	PDEAD 1409 PTOTAL 2107 GRADE 50 SECT. 287	1409 2107 50 287	1445 2174 50 287	1445 2174 50 287	1409 2107 50 287	1470 2200 50 287	1470 2200 50 287	1533 2300 50 314	1533 2300 50 314	1470 2200 50 287	1445 2174 50 287	
TOP OF BASE # ELEV.	VARIES	29'-6"	30'-9"	32'-0"	32'-0"	29'-9"	30'-9"	32'-0"	30'-0"	30'-0"	29'-6"	26'-0"	



LEVEL	COLUMN LOCATION	PERIMETER COLUMN SCHEDULE		
		B-2-19, B-2-21	D-17-6	B-2-18
4TH - ROOF	EL 156'-8" to EL 129'-0" / EL 129'-0" to EL 126'-5"	PDEAD 239 PTOTAL 359 GRADE 50 SECT. 103	298 448 50 147	344 500 50 150

TOP & BOTTOM ELEVATIONS OF COLUMNS

- NOTES:
- 1) COLUMNS ARE DESIGNED FOR A FUTURE ADDITION OF 3 LEVELS, INCLUDING A MECHANICAL FLOOR AND A ROOF.
 - 2) ALL COLUMNS SHALL BE 14WF SECTIONS OF WEIGHT PER FOOT AS SHOWN AND OF A572 GRADE 50 STEEL.
 - 3) COLUMN ALSO CARRIES MOMENTS (DOUBLE CURVATURE ABOUT MAJOR AXIS) M_{DEAD} = 160 K-FT, M_{TOTAL} = 240 K-FT.
 - 4) COLUMN ALSO CARRIES MOMENTS (DOUBLE CURVATURE ABOUT MINOR AXIS) M_{DEAD} = 272 K-FT, M_{TOTAL} = 410 K-FT.

- NOTES:
- 1) COLUMNS ARE DESIGNED FOR A FUTURE ADDITION OF 3 LEVELS, INCLUDING A MECHANICAL FLOOR AND A ROOF.
 - 2) ALL COLUMNS SHALL BE 14WF SECTIONS OF WEIGHT PER FOOT AS SHOWN AND OF A572 GRADE 50 STEEL.
 - 3) COLUMN ALSO CARRIES MOMENTS (DOUBLE CURVATURE ABOUT MINOR AXIS) M_{DEAD} = 60 K-FT, M_{TOTAL} = 120 K-FT.
 - 4) FOR COLUMN SPLICE DETAILS AT CORE COLUMNS SEE C/S-02

FLOOR ELEVATION (NOMINAL)
SPLICE ELEVATIONS

CHARLES LUCKMAN ASSOCIATES
 planning architecture engineering
 9220 sunset boulevard, los angeles, california 90069



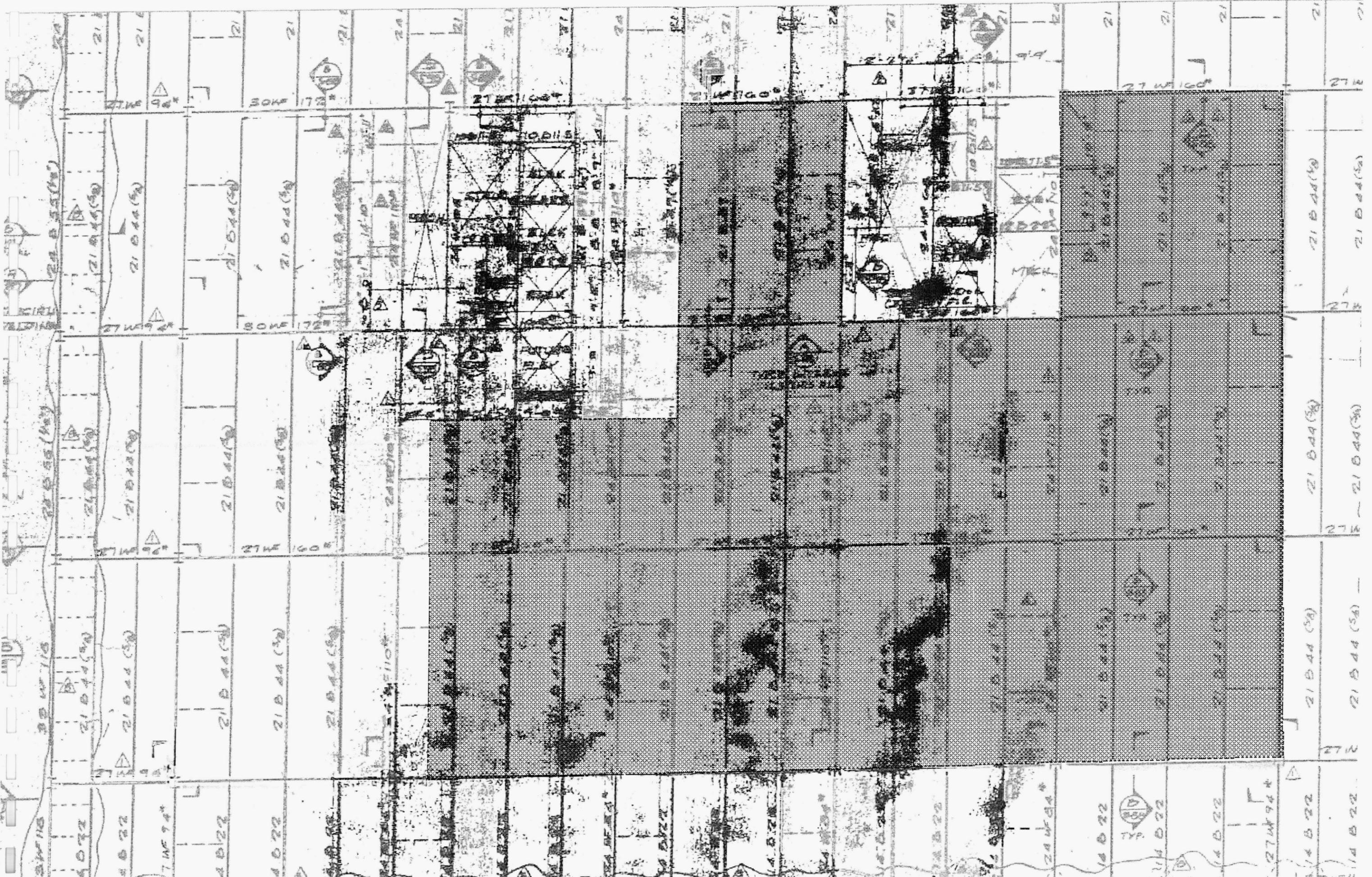
PROJECT: Am G
 SHEET: FE
 PROJECT CAPTAIN: [Signature]
 CHECKED: [Signature]
 APPROVED BY: [Signature]
 PROJECT ARCHITECT: [Signature]
 ENGINEER: [Signature]
 JOB NO.:

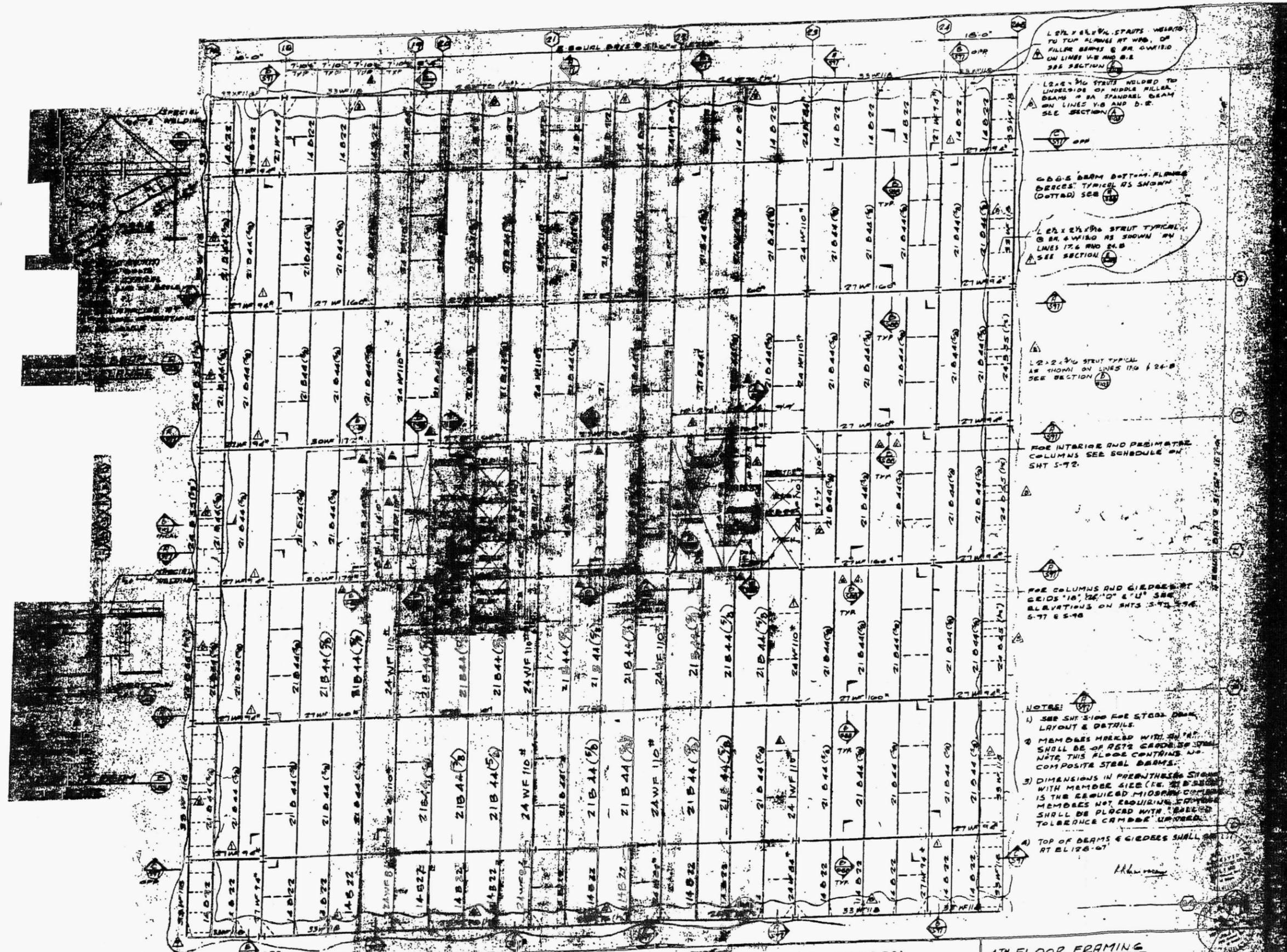
NO.	DATE	REVISION	BY	CHK.	NO.	DATE	REVISION	BY	CHK.
1		REV. PENTHOUSE ROOF EL.	K						
2		REV BASE # ELEV.	K						
3		REV. NOTE #1	R						
4		REVISE CORE COL. SCHED. ADD NOTE #4	R						

FIRST NATIONAL BANK OF OREGON
PORTLAND OREGON

CORE COLUMN SCHEDULE & PERIMETER COLUMN SCHEDULE OPERATIONS BLDG.

3-92
MAR 11-10-69





L 2 1/2 x 2 1/2 STUITS WELDED TO TOP FLANGES AT WBS, OF FILLER BEAMS & BR. CURVED ON LINES 14 & D-E SEE SECTION A-A

L 2 x 2 1/2 STUITS WELDED TO UNDERSIDE OF MIDDLE FILLER BEAM TO BR. SPANDED BEAM ON LINES 14 & D-E SEE SECTION B-B

6 D.G.S BEAM BOTTOM FLANGES BRACES TYPICAL AS SHOWN (DOTTED) SEE SECTION C-C

L 2 1/2 x 2 1/2 STUITS TYPICAL @ BR. & WBS AS SHOWN ON LINES 17 & AND 24-B SEE SECTION D-D

L 2 x 2 1/2 STUITS TYPICAL AS SHOWN ON LINES 17 & 24-B SEE SECTION E-E

FOR INTERIOR AND PERIMETER COLUMNS SEE SCHEDULE ON SHT 5-72

FOR COLUMNS AND GIRDES AT GRIDS 18, 22, 24 & 28 ELEVATIONS ON SHTS 5-72, 5-74, 5-76 & 5-78

NOTES:

1) SEE SHT 5-100 FOR STEEL DECK LAYOUT & DETAILS

2) MEMBERS MARKED WITH "M" SHALL BE OF A572 GRADE STEEL NOTE THIS FLOOR CONTAINS NO COMPOSITE STEEL DECK

3) DIMENSIONS IN PARENTHESES SHOWN WITH MEMBER SIZE (E.G. 21B44(7)) IS THE REQUIRED MIDSPAN COMPOSITE MEMBERS NOT EQUIPPED TO BE PLACED WITH "B" TOLERANCE CLASSE UNLESS

4) TOP OF BEAMS & GIRDES SHALL BE AT EL 126'-0"

NO.	REVISION	DATE	BY	CHKD.
1	STUITS ADDED - REV DIM			
2	REV DIMS			
3	REV DIMS			
4	REV DIMS			
5	REV DIMS			

FIRST NATIONAL BANK OF OREGON
PORTLAND OREGON

4TH FLOOR FRAMING
OPERATIONS BLDG

SECTION II:

DECKS: UL DESIGN D779

COLUMNS: UL DESIGN X772

UL Design No. D779

Decks



**BXUV.D779
Fire Resistance Ratings - ANSI/UL 263**

Page Bottom

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 Listed or Classified 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 as Classified, Listed, or Recognized.

Fire Resistance Ratings - ANSI/UL 263

See General Information for Fire Resistance Ratings - ANSI/UL 263

Design No. D779

February 15, 2010

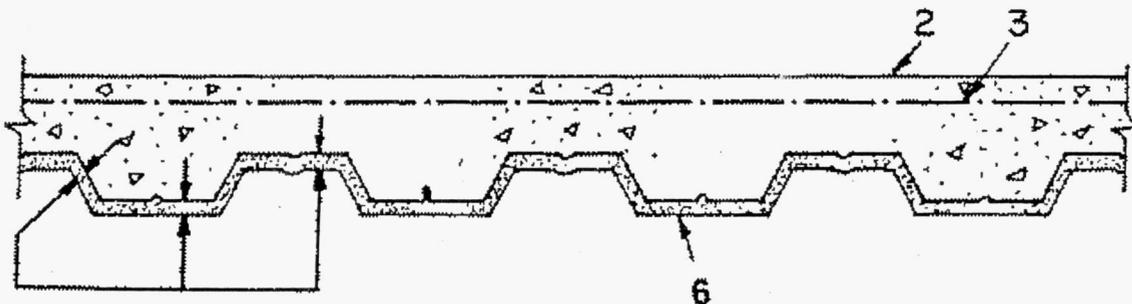
Restrained Assembly Ratings — 1, 1-1/2, 2, 3 & 4 H

Unrestrained Assembly Ratings — 1, 1-1/2, 2, 3 & 4 H

Unrestrained Beam Ratings — 1, 1-1/2, 2, 3 & 4 H

Restricted Load Condition — See Items 1 and 6

Load Restricted for Canadian Applications — See Guide BXUV7



1. Supports — W8 x 28 or alternate (per Section IV.6 in the front of the Fire Resistance Directory) steel beam or min 8K1 steel joists when joist substitution applied.

Note: Joists from the N series designs may be substituted for the listed beam (Item 1). When joists are substituted, the restrained rating of the joist must be equal to or greater than the restrained rating of the assembly. Additional joist substitution requirements are contained in the front of the Fire Resistance Directory.

2. Normal Weight or Lightweight Concrete — Normal weight concrete, carbonate or siliceous aggregate, 145 pcf plus or minus 3 pcf unit weight, 3000 psi compressive strength, vibrated. Lightweight concrete, expanded shale, clay, or slate aggregate by rotary-kiln method 102-120 pcf unit weight, 3000 psi compressive strength, vibrated, 4 to 7 percent air. Min thickness as measured to crests of steel floor and form units, 2-1/2 in.

3. **Welded Wire Fabric** — 6 x 6 - W1.4 x W1.4.

3A. **Fiber Reinforcement** — As an alternate to Item 3, engineered synthetic fibers added to concrete mix to control shrinkage cracks in concrete. See Fiber Reinforcement (CBXQ) category in the Fire Resistance Directory for names of manufacturers and rates of application.

4. **Steel Floor and Form Units** — Composite 1-1/2, 2, or 3 in. deep galv units. Min gauge is 22 MSG.

ASC STEEL DECK, DIV OF ASC PROFILES

INC — 24 through 36 in. wide, Types B Hi-Form, N Hi-Form, 2W Hi-Form, 3W Hi-Form.

CANAM STEEL CORP — 24 in. wide Type P-2432 composite or 36 in. wide Type P-3623, P-3606 and P-3615

CENTRIA — 24 in. wide, QL-3, 24 or 36 in. wide, 2 or 3 in. deep QL-99. Units may be welded or fastened together with No. 10 self-drilling, self-tapping screws 60 in. OC. The length of the screws shall be sufficient to fully penetrate adjacent floor units.

CMC JOIST & DECK - MANUFACTURERS

OF UNITED STEEL DECK PRODUCTS — 24, 30 or 36 in. wide Type BL; 24 or 36 in. wide Types LF1.5, LF2, LF3; 24, 36 in. wide Types LF2, -3 may be welded or fastened together with min 1 in. long No. 10 self-drilling, self-tapping steel screws 36 in. OC. Types BL, LF2, -3, N-Lok may be phos/ptd.

CONSOLIDATED SYSTEMS INC — 24 in. wide Types CFD-2, 3, 24, 30, or 36 in. wide Type CFD-1.5. Units may be phos/ptd.

DECK WEST INC — 36 in. Type 2-DW, 3-DW, B-DW or BA-DW. Units may be welded or fastened together with No. 10 self-drilling, self-tapping screws 60 in. OC. The length of the screws shall be sufficient to fully penetrate adjacent floor units.

EPIC METALS CORP — 24 in. wide Types EC150, EC366, 36 in. wide Type EC266.

NEW MILLENNIUM BUILDING SYSTEMS L L C — Type 1.5CD, 2.0CD, or 3.0CD. Units may be phos/painted or galvanized.

VERCO DECKING INC - A NUCOR CO — 24, 30, or 36 in. wide Type PLB , B, BR; 24 or 36 in. wide Types PLW2 , W2, PLW3 , W3. Units may be phos/ptd.

VULCRAFT, DIV OF NUCOR CORP — 24, 30 or 36 in. wide Type 1.5VL1; 24 or 36 in. wide Types 2VL1, 3VL1. Units may be phos/ptd.

WHEELING-PITTSBURGH STEEL CORP, DIV

OF WHEELING CORRUGATING CO — 30 in. wide Types SB150, -150N, -150NR, -150R; 24 in. wide Type SB200 or -300; 24 or 36 in. wide Types P20LF, SB-P21LF, -P31LF; 36 in. wide Types 1.5 SB, 1.5 SBR; 24 or 36 in wide Types 2.0 SB, 3.0 SB, 36 in. wide Type High Strength 1.5 SBI, 36 in. wide Type High Strength 1.5 SBN; Units may be phos/ptd. 24 or 36 in. wide Types 212 V-Grip, 312 V-Grip, 30 or 36 in. wide 1-1/2 V-Grip. Types 1-1/2 V-Grip, 212 V-Grip, and 312 V-Grip may be phos/ptd.

5. **Shear Connectors** — (Optional) — Studs, 3/4 in. diam by 4-1/2 in. long, headed type or equivalent per AISC specification. Welded to top flange of the beam, or top chord of the joist, through the deck.

6. **Spray-Applied Fire Resistive Materials** — Applied by mixing with water and spraying to steel surfaces which must be clean and 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 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. Application to steel deck requires the installation of expanded metal lath with Type Z-146, Z-146T, Z146PC, Z-156, Z-156T and Z-156PC only. See Item 7. For method of density determination, refer to Design Information Section.

			Spray Applied Fire Resistive Mtl
--	--	--	----------------------------------

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Thkns In. on Steel Deck		Concrete Type
			Crests	Valley	
1	0	1	0	0	LW
1	1	1	5/16	5/16	NW or LW
1-1/2	1	1	5/16(a)	5/16(a)	NW or LW
1-1/2	1-1/2	1-1/2	5/16(a)	5/16(a)	NW or LW
2	1	1	3/8(b)	3/8	NW or LW
2	2	2	3/8(b)	3/8	NW or LW
3	1-1/2	1-1/2	11/16	1/2	NW or LW
3	3	3	11/16	1/2	NW or LW
4	2	2	1-1/2	1-1/8	LW
4	4	4	1-1/2	1-1/8	LW
4	2	2	1-7/16	13/16	NW
4	4	4	1-7/16	13/16	NW

(a) — Min thickness of 3/8 in. required when 1-1/2 in. deep fluted units are used.

(b) — Min thickness of 1/2 in. is required in crests of 1-1/2 in. deep fluted units for the 2 h Restrained Assembly Rating.

			Beam Thickness			
			Light Weight Concrete		Normal Weight Concrete	
Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	full flange W8x28 Beam	1/2 flange## W8x28 Beam	full flange W8x28 Beam	1/2 flange## W8x28 Beam
1	0	1	5/16	7/16	5/16	7/16
1	1	1	5/16	7/16	5/16	7/16
1 1/2	1	1	5/16	7/16	5/16	7/16
1 1/2	1 1/2	1 1/2	11/16	3/4	5/8	3/4
2	1	1	5/16	7/16	5/16	7/16
2	2	2	1	1	7/8	1-1/16
3	1 1/2	1 1/2	11/16	3/4	5/8	3/4
3	3	3	1-5/16	1-7/16	1-7/16	1-11/16
4	2	2	1	1	7/8	1-1/16
4	4	4	1-5/8	1-15/16	2	2-5/16

Applicable when the thickness applied to the beams' lower flange edges is reduced to one-half. Thickness applied to beams' lower flange edges shall be a min of 1/4 in.

ARABIAN Vermiculite Industries — Types 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 & Co - Conn — Types MK-6/HY, MK-6/HY Extended Set, MK-6s, RG, Z-106, Z-106/G, Z-106/HY, Z-146, Z-146T, Z146PC, Z-156, Z-156T and Z-156PC investigated for exterior use.

Grace Korea Inc — Types MK-6/HY, MK-6/HY Extended Set, MK-6s, Z-106, Z-106/G, Z-106/HY, Z-146 investigated for exterior use.

7. **Metal Lath** — (Not Shown) —(Required with Z-146, Z-146T, Z146PC, Z-156, Z-156T and Z-156PC, otherwise optional)—Metal lath shall be 3/8 in. expanded diamond mesh, weighing 2.5 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.

*Bearing the UL Classification Mark

Last Updated on 2010-02-15

[Questions?](#)

[Print this page](#)

[Notice of Disclaimer](#)

[Page Top](#)

[Copyright © 2010 Underwriters Laboratories Inc.®](#)

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 Listed and covered under UL's Follow-Up Service. Always look for the Mark on the product.

UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions: 1. The Guide Information, Designs and/or Listings (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings). 2. The statement "Reprinted from the Online Certifications Directory with permission from Underwriters Laboratories Inc." must appear adjacent to the extracted material. In addition, the reprinted material must include a copyright notice in the following format: "Copyright © 2010 Underwriters Laboratories Inc.®"

An independent organization working for a safer world with integrity, precision and knowledge.



Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G,
Z-106/HY, Z-146 and Retro-Guard® RG **Unrestrained Beam**
Flange Protection: Full and Half Flange Thickness **U.L. Design No. D779**
Concrete Weight: NWC or LWC **ICBO 4607 Table 2A**

FULL FLANGE TIP THICKNESS					HALF FLANGE TIP THICKNESS					
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member	1 hr	1.5 hr	2 hr	3 hr	4 hr
					Size x Wt. W/D					
3/8	13/16	1 1/8	1 1/2	1 7/8	W4 x 13 0.670	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	13/16	1 1/8	1 1/2	1 7/8	W5 x 16 0.664	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	3/4	1 1/16	1 3/8	1 11/16	W5 x 19 0.776	1/2	13/16	1 1/16	1 1/2	2
1/2	1	1 7/16	1 7/8	2 5/16	W6 x 9 0.398	5/8	1 1/16	1 7/16	2 1/16	2 13/16
7/16	7/8	1 5/16	1 11/16	2 1/16	W6 x 12 0.526	9/16	1	1 5/16	1 13/16	2 1/2
7/16	7/8	1 5/16	1 11/16	2 1/16	W6 x 15 0.521	9/16	1	1 5/16	1 7/8	2 1/2
3/8	13/16	1 1/8	1 1/2	1 13/16	W6 x 16 0.684	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	13/16	1 1/8	1 1/2	1 13/16	W6 x 20 0.678	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	11/16	1	1 5/16	1 5/8	W6 x 25 0.839	7/16	3/4	1	1 7/16	1 15/16
1/2	1 1/16	1 1/2	1 15/16	2 3/8	W8 x 10 0.375	11/16	1 1/8	1 1/2	2 1/8	2 7/8
7/16	15/16	1 5/16	1 3/4	2 3/16	W8 x 13 0.483	5/8	1	1 5/16	1 15/16	2 9/16
7/16	7/8	1 1/4	1 5/8	2 1/16	W8 x 15 0.551	9/16	15/16	1 1/4	1 13/16	2 7/16
3/8	7/8	1 1/4	1 5/8	2	W8 x 18 0.583	9/16	15/16	1 1/4	1 3/4	2 3/8
3/8	13/16	1 1/8	1 1/2	1 13/16	W8 x 21 0.675	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	3/4	1 1/8	1 7/16	1 13/16	W8 x 24 0.704	1/2	13/16	1 1/8	1 5/8	2 1/8
5/16	11/16	1	1 5/16	1 5/8	W8 x 28 0.819	7/16	3/4	1	1 7/16	1 15/16
3/8	3/4	1 1/16	1 3/8	1 11/16	W8 x 31 0.803	1/2	13/16	1 1/16	1 1/2	2
3/8	11/16	1	1 1/4	1 9/16	W8 x 35 0.907	7/16	3/4	1	1 3/8	1 7/8
3/8	5/8	7/8	1 3/16	1 7/16	W8 x 40 1.030	7/16	11/16	7/8	1 5/16	1 11/16
3/8	9/16	13/16	1 1/16	1 5/16	W8 x 48 1.210	3/8	5/8	13/16	1 3/16	1 9/16
3/8	1/2	3/4	15/16	1 3/16	W8 x 58 1.440	3/8	9/16	3/4	1	1 3/8
3/8	7/16	11/16	7/8	1 1/16	W8 x 67 1.650	3/8	1/2	11/16	15/16	1 1/4
1/2	1	1 7/16	1 7/8	2 3/8	W10 x 12 0.392	11/16	1 1/8	1 7/16	2 1/16	2 13/16
7/16	15/16	1 5/16	1 3/4	2 3/16	W10 x 15 0.484	5/8	1	1 5/16	1 15/16	2 9/16
7/16	7/8	1 1/4	1 5/8	2 1/16	W10 x 17 0.543	9/16	15/16	1 1/4	1 13/16	2 7/16
3/8	13/16	1 3/16	1 9/16	1 15/16	W10 x 19 0.607	9/16	15/16	1 3/16	1 3/4	2 5/16
3/8	13/16	1 3/16	1 9/16	1 15/16	W10 x 22 0.606	9/16	15/16	1 3/16	1 3/4	2 5/16
3/8	3/4	1 1/8	1 7/16	1 13/16	W10 x 26 0.708	1/2	13/16	1 1/8	1 9/16	2 1/8
3/8	3/4	1 1/16	1 3/8	1 11/16	W10 x 30 0.809	1/2	13/16	1 1/16	1 1/2	2
3/8	3/4	1 1/16	1 3/8	1 11/16	W10 x 33 0.786	1/2	13/16	1 1/16	1 1/2	2
3/8	11/16	15/16	1 1/4	1 9/16	W10 x 39 0.929	7/16	3/4	15/16	1 3/8	1 13/16
3/8	5/8	7/8	1 1/8	1 7/16	W10 x 45 1.060	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	15/16	1 3/16	1 7/16	W10 x 49 1.010	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	7/8	1 1/8	1 3/8	W10 x 54 1.110	3/8	5/8	7/8	1 1/4	1 5/8
3/8	9/16	13/16	1 1/16	1 5/16	W10 x 60 1.220	3/8	5/8	13/16	1 1/8	1 9/16
3/8	1/2	3/4	15/16	1 3/16	W10 x 68 1.380	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	7/8	1 1/8	W10 x 77 1.540	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1	W10 x 88 1.740	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	9/16	3/4	15/16	W10 x 100 1.970	3/8	7/16	9/16	13/16	1 1/8
3/8	3/8	9/16	11/16	7/8	W10 x 112 2.170	3/8	7/16	9/16	3/4	1
1/2	1	1 7/16	1 7/8	2 5/16	W12 x 14 0.405	5/8	1 1/16	1 7/16	2 1/16	2 3/4
7/16	15/16	1 3/8	1 3/4	2 3/16	W12 x 16 0.457	5/8	1	1 3/8	1 15/16	2 5/8
7/16	7/8	1 1/4	1 5/8	2 1/16	W12 x 19 0.540	9/16	15/16	1 1/4	1 13/16	2 7/16
3/8	13/16	1 3/16	1 9/16	1 15/16	W12 x 22 0.623	9/16	7/8	1 3/16	1 11/16	2 1/4
3/8	13/16	1 3/16	1 9/16	1 15/16	W12 x 26 0.612	9/16	7/8	1 3/16	1 11/16	2 5/16
3/8	13/16	1 1/8	1 7/16	1 13/16	W12 x 30 0.699	1/2	7/8	1 1/8	1 5/8	2 1/8
3/8	3/4	1 1/16	1 5/16	1 11/16	W12 x 35 0.810	1/2	3/4	1 1/16	1 1/2	2
3/8	11/16	1	1 5/16	1 5/8	W12 x 40 0.860	7/16	3/4	1	1 7/16	1 15/16
3/8	5/8	15/16	1 3/16	1 1/2	W12 x 45 0.974	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	7/8	1 1/8	1 7/16	W12 x 50 1.060	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	15/16	1 3/16	1 7/16	W12 x 53 1.020	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	7/8	1 1/8	1 3/8	W12 x 58 1.100	3/8	5/8	7/8	1 1/4	1 5/8
3/8	5/8	7/8	1 1/8	1 3/8	W12 x 65 1.110	3/8	5/8	7/8	1 1/4	1 5/8
3/8	9/16	13/16	1 1/16	1 5/16	W12 x 72 1.230	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	3/4	1	1 1/4	W12 x 79 1.340	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	15/16	1 1/8	W12 x 87 1.470	3/8	9/16	11/16	1	1 3/8
3/8	1/2	11/16	7/8	1 1/16	W12 x 96 1.610	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	5/8	13/16	1	W12 x 106 1.770	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	9/16	3/4	15/16	W12 x 120 1.990	3/8	7/16	9/16	13/16	1 1/16
3/8	3/8	9/16	11/16	7/8	W12 x 136 2.230	3/8	3/8	9/16	3/4	1
3/8	3/8	1/2	5/8	13/16	W12 x 152 2.450	3/8	3/8	1/2	11/16	15/16
3/8	3/8	7/16	9/16	3/4	W12 x 170 2.720	3/8	3/8	7/16	5/8	7/8

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G,
 Z-106/HY, Z-146 and Retro-Guard® RG **Unrestrained Beam**
Flange Protection: Full and Half Flange Thickness **U.L. Design No. D779**
Concrete Weight: NWC or LWC **ICBO 4607 Table 2A**

FULL FLANGE TIP THICKNESS					HALF FLANGE TIP THICKNESS					
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member	1 hr	1.5 hr	2 hr	3 hr	4 hr
					Size x Wt.					
					W/D					
3/8	3/8	7/16	9/16	11/16	W12 x 190 3.000	3/8	3/8	7/16	5/8	13/16
3/8	3/8	3/8	1/2	5/8	W12 x 210 3.270	3/8	3/8	3/8	9/16	3/4
3/8	3/8	3/8	1/2	9/16	W12 x 230 3.550	3/8	3/8	3/8	1/2	11/16
3/8	3/8	3/8	7/16	9/16	W12 x 252 3.840	3/8	3/8	3/8	1/2	5/8
3/8	3/8	3/8	7/16	1/2	W12 x 279 4.190	3/8	3/8	3/8	7/16	5/8
3/8	3/8	3/8	3/8	1/2	W12 x 305 4.490	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	7/16	W12 x 336 4.850	3/8	3/8	3/8	3/8	9/16
7/16	7/8	1 5/16	1 11/16	2 1/16	W14 x 22 0.534	9/16	15/16	1 5/16	1 13/16	2 7/16
3/8	13/16	1 3/16	1 9/16	1 15/16	W14 x 26 0.628	9/16	7/8	1 3/16	1 11/16	2 1/4
3/8	13/16	1 3/16	1 1/2	1 7/8	W14 x 30 0.644	1/2	7/8	1 3/16	1 11/16	2 1/4
3/8	3/4	1 1/8	1 7/16	1 3/4	W14 x 34 0.725	1/2	13/16	1 1/8	1 9/16	2 1/8
3/8	3/4	1 1/16	1 3/8	1 11/16	W14 x 38 0.809	1/2	13/16	1 1/16	1 1/2	2
3/8	11/16	1	1 5/16	1 5/8	W14 x 43 0.874	7/16	3/4	1	1 7/16	1 7/8
3/8	5/8	15/16	1 3/16	1 1/2	W14 x 48 0.970	7/16	11/16	15/16	1 5/16	1 13/16
3/8	5/8	7/8	1 1/8	1 7/16	W14 x 53 1.060	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W14 x 61 1.100	3/8	5/8	7/8	1 1/4	1 5/8
3/8	9/16	13/16	1 1/16	1 5/16	W14 x 68 1.220	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	3/4	1	1 1/4	W14 x 74 1.320	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	15/16	1 1/8	W14 x 82 1.450	3/8	9/16	3/4	1	1 3/8
3/8	9/16	3/4	1	1 1/4	W14 x 90 1.310	3/8	9/16	3/4	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W14 x 99 1.430	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W14 x 109 1.570	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1	W14 x 120 1.710	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	3/4	15/16	W14 x 132 1.890	3/8	7/16	5/8	7/8	1 1/8
3/8	7/16	9/16	3/4	15/16	W14 x 145 1.990	3/8	7/16	9/16	13/16	1 1/16
3/8	3/8	9/16	11/16	7/8	W14 x 159 2.160	3/8	7/16	9/16	3/4	1
3/8	3/8	1/2	5/8	13/16	W14 x 176 2.380	3/8	3/8	1/2	11/16	15/16
3/8	3/8	1/2	5/8	3/4	W14 x 193 2.600	3/8	3/8	1/2	11/16	7/8
3/8	3/8	7/16	9/16	11/16	W14 x 211 2.810	3/8	3/8	7/16	5/8	13/16
3/8	3/8	7/16	9/16	11/16	W14 x 233 3.080	3/8	3/8	7/16	9/16	3/4
3/8	3/8	3/8	1/2	5/8	W14 x 257 3.360	3/8	3/8	3/8	9/16	3/4
3/8	3/8	3/8	7/16	9/16	W14 x 283 3.660	3/8	3/8	3/8	1/2	11/16
3/8	3/8	3/8	7/16	9/16	W14 x 311 3.980	3/8	3/8	3/8	1/2	5/8
3/8	3/8	3/8	7/16	1/2	W14 x 342 4.320	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	1/2	W14 x 370 4.630	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	7/16	W14 x 398 4.930	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	7/16	W14 x 426 5.210	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	7/16	W14 x 455 5.530	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	3/8	W14 x 500 5.950	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	W14 x 550 6.430	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	W14 x 605 6.960	3/8	3/8	3/8	3/8	3/8
3/8	3/8	3/8	3/8	3/8	W14 x 665 7.490	3/8	3/8	3/8	3/8	3/8
3/8	3/8	3/8	3/8	3/8	W14 x 730 8.080	3/8	3/8	3/8	3/8	3/8
7/16	7/8	1 1/4	1 5/8	2	W16 x 26 0.558	9/16	15/16	1 1/4	1 13/16	2 3/8
3/8	13/16	1 3/16	1 1/2	1 7/8	W16 x 31 0.661	1/2	7/8	1 3/16	1 5/8	2 3/16
3/8	3/4	1 1/8	1 7/16	1 13/16	W16 x 36 0.702	1/2	13/16	1 1/8	1 5/8	2 1/8
3/8	3/4	1 1/16	1 3/8	1 11/16	W16 x 40 0.780	1/2	13/16	1 1/16	1 1/2	2
3/8	11/16	1	1 5/16	1 5/8	W16 x 45 0.870	7/16	3/4	1	1 7/16	1 7/8
3/8	5/8	15/16	1 3/16	1 1/2	W16 x 50 0.962	7/16	11/16	15/16	1 5/16	1 13/16
3/8	5/8	7/8	1 1/8	1 3/8	W16 x 57 1.090	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W16 x 67 1.090	3/8	11/16	7/8	1 1/4	1 11/16
3/8	9/16	13/16	1	1 1/4	W16 x 77 1.250	3/8	5/8	13/16	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W16 x 89 1.430	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/16	W16 x 100 1.590	3/8	1/2	11/16	15/16	1 5/16
3/8	13/16	1 1/8	1 1/2	1 7/8	W18 x 35 0.672	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	3/4	1 1/16	1 3/8	1 11/16	W18 x 40 0.768	1/2	13/16	1 1/16	1 1/2	2 1/16
3/8	11/16	1	1 5/16	1 9/16	W18 x 46 0.876	7/16	3/4	1	1 7/16	1 7/8
3/8	11/16	1	1 1/4	1 9/16	W18 x 50 0.880	7/16	3/4	1	1 7/16	1 7/8
3/8	5/8	15/16	1 3/16	1 1/2	W18 x 55 0.963	7/16	11/16	15/16	1 5/16	1 13/16
3/8	5/8	7/8	1 3/16	1 7/16	W18 x 60 1.040	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W18 x 65 1.130	3/8	5/8	7/8	1 3/16	1 5/8

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G,
 Z-106/HY, Z-146 and Retro-Guard® RG **Unrestrained Beam**
Flange Protection: Full and Half Flange Thickness **U.L. Design No. D779**
Concrete Weight: NWC or LWC **ICBO 4607 Table 2A**

FULL FLANGE TIP THICKNESS					HALF FLANGE TIP THICKNESS						
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member		1 hr	1.5 hr	2 hr	3 hr	4 hr
					Size x Wt.	W/D					
3/8	9/16	13/16	1 1/16	1 5/16	W18 x 71	1.220	3/8	5/8	13/16	1 1/8	1 9/16
3/8	5/8	7/8	1 1/8	1 3/8	W18 x 76	1.130	3/8	5/8	7/8	1 3/16	1 5/8
3/8	9/16	13/16	1	1 1/4	W18 x 86	1.270	3/8	5/8	13/16	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W18 x 97	1.420	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W18 x 106	1.550	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1	W18 x 119	1.720	3/8	1/2	5/8	15/16	1 3/16
3/8	3/4	1 1/16	1 3/8	1 3/4	W21 x 44	0.746	1/2	13/16	1 1/16	1 9/16	2 1/16
3/8	11/16	1	1 5/16	1 5/8	W21 x 50	0.838	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	15/16	1 1/4	1 1/2	W21 x 57	0.952	7/16	11/16	15/16	1 3/8	1 13/16
3/8	11/16	15/16	1 1/4	1 1/2	W21 x 62	0.952	7/16	11/16	15/16	1 3/8	1 13/16
3/8	5/8	7/8	1 3/16	1 7/16	W21 x 68	1.040	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W21 x 73	1.110	3/8	5/8	7/8	1 1/4	1 5/8
3/8	9/16	13/16	1	1 1/4	W21 x 83	1.260	3/8	5/8	13/16	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W21 x 93	1.400	3/8	9/16	3/4	1 1/16	1 3/8
3/8	9/16	3/4	1	1 1/4	W21 x 101	1.300	3/8	9/16	3/4	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W21 x 111	1.430	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W21 x 122	1.570	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1 1/16	W21 x 132	1.680	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	3/4	15/16	W21 x 147	1.870	3/8	7/16	5/8	7/8	1 1/8
3/8	11/16	1	1 5/16	1 5/8	W24 x 55	0.828	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	15/16	1 1/4	1 9/16	W24 x 62	0.934	7/16	3/4	15/16	1 3/8	1 13/16
3/8	11/16	15/16	1 1/4	1 1/2	W24 x 68	0.942	7/16	11/16	15/16	1 3/8	1 13/16
3/8	5/8	7/8	1 1/8	1 7/16	W24 x 76	1.050	7/16	11/16	7/8	1 1/4	1 11/16
3/8	9/16	13/16	1 1/16	1 3/8	W24 x 84	1.150	3/8	5/8	13/16	1 3/16	1 5/8
3/8	9/16	13/16	1	1 1/4	W24 x 94	1.280	3/8	9/16	13/16	1 1/8	1 1/2
3/8	9/16	13/16	1 1/16	1 5/16	W24 x 104	1.240	3/8	5/8	13/16	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W24 x 117	1.380	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	7/8	1 1/8	W24 x 131	1.540	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1 1/16	W24 x 146	1.700	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	3/4	15/16	W24 x 162	1.880	3/8	7/16	5/8	7/8	1 1/8
3/8	5/8	7/8	1 3/16	1 7/16	W27 x 84	1.030	7/16	11/16	7/8	1 5/16	1 11/16
3/8	9/16	13/16	1 1/16	1 3/8	W27 x 94	1.150	3/8	5/8	13/16	1 3/16	1 5/8
3/8	9/16	13/16	1 1/16	1 5/16	W27 x 102	1.240	3/8	5/8	13/16	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W27 x 114	1.390	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	7/8	1 1/8	W27 x 129	1.560	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/8	W27 x 146	1.550	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1 1/16	W27 x 161	1.700	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	3/4	15/16	W27 x 178	1.870	3/8	7/16	5/8	7/8	1 1/8
3/8	5/8	15/16	1 3/16	1 7/16	W30 x 90	1.020	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	7/8	1 1/8	1 3/8	W30 x 99	1.120	3/8	5/8	7/8	1 3/16	1 5/8
3/8	9/16	13/16	1 1/16	1 5/16	W30 x 108	1.210	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	3/4	1	1 1/4	W30 x 116	1.300	3/8	9/16	3/4	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W30 x 124	1.390	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	15/16	1 1/8	W30 x 132	1.470	3/8	9/16	11/16	1	1 3/8
3/8	7/16	11/16	7/8	1 1/16	W30 x 173	1.660	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	5/8	13/16	1	W30 x 191	1.850	3/8	7/16	5/8	7/8	1 1/8
3/8	3/8	9/16	3/4	15/16	W30 x 211	2.010	3/8	7/16	9/16	13/16	1 1/16
3/8	9/16	13/16	1 1/16	1 5/16	W33 x 118	1.210	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	3/4	1	1 1/4	W33 x 130	1.320	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	15/16	1 3/16	W33 x 141	1.430	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W33 x 152	1.530	3/8	1/2	11/16	1	1 5/16
3/8	7/16	5/8	13/16	1 1/16	W33 x 169	1.700	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	13/16	1	W33 x 201	1.790	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	9/16	3/4	15/16	W33 x 221	1.970	3/8	7/16	9/16	13/16	1 1/8
3/8	3/8	9/16	11/16	7/8	W33 x 241	2.130	3/8	7/16	9/16	3/4	1 1/16
3/8	9/16	13/16	1	1 1/4	W36 x 135	1.290	3/8	9/16	13/16	1 1/8	1 1/2
3/8	1/2	3/4	15/16	1 3/16	W36 x 150	1.430	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	15/16	1 1/8	W36 x 160	1.510	3/8	9/16	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/16	W36 x 170	1.600	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	5/8	13/16	1	W36 x 182	1.720	3/8	1/2	5/8	15/16	1 3/16
3/8	7/16	5/8	13/16	1	W36 x 194	1.810	3/8	1/2	5/8	7/8	1 3/16

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G, Z-106/HY, Z-146 and Retro-Guard® RG **Unrestrained Beam**
Flange Protection: Full and Half Flange Thickness **U.L. Design No. D779**
Concrete Weight: NWC or LWC **ICBO 4607 Table 2A**

FULL FLANGE TIP THICKNESS					HALF FLANGE TIP THICKNESS					
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member	1 hr	1.5 hr	2 hr	3 hr	4 hr
					Size x Wt. W/D					
3/8	7/16	9/16	3/4	15/16	W36 x 210 1.960	3/8	7/16	9/16	13/16	1 1/8
3/8	7/16	9/16	3/4	15/16	W36 x 230 1.950	3/8	7/16	9/16	13/16	1 1/8
3/8	3/8	9/16	3/4	7/8	W36 x 245 2.080	3/8	7/16	9/16	13/16	1 1/16
3/8	3/8	1/2	5/8	13/16	W36 x 256 2.370	3/8	3/8	1/2	11/16	15/16
3/8	3/8	9/16	11/16	7/8	W36 x 260 2.180	3/8	7/16	9/16	3/4	1
3/8	3/8	1/2	11/16	13/16	W36 x 280 2.350	3/8	3/8	1/2	3/4	15/16
3/8	3/8	1/2	5/8	3/4	W36 x 300 2.500	3/8	3/8	1/2	11/16	15/16
1/2	1 1/16	1 1/2	1 15/16	2 7/16	Other 0.37	11/16	1 1/8	1 1/2	2 1/8	2 7/8
1/2	1	1 1/2	1 15/16	2 3/8	Other 0.38	11/16	1 1/8	1 1/2	2 1/8	2 13/16
1/2	1	1 7/16	1 7/8	2 3/8	Other 0.39	11/16	1 1/8	1 7/16	2 1/16	2 13/16
1/2	1	1 7/16	1 7/8	2 5/16	Other 0.40	5/8	1 1/16	1 7/16	2 1/16	2 3/4
1/2	1	1 7/16	1 7/8	2 5/16	Other 0.41	5/8	1 1/16	1 7/16	2 1/16	2 3/4
7/16	1	1 7/16	1 7/8	2 5/16	Other 0.42	5/8	1 1/16	1 7/16	2	2 3/4
7/16	1	1 7/16	1 13/16	2 1/4	Other 0.43	5/8	1 1/16	1 7/16	2	2 11/16
7/16	1	1 3/8	1 13/16	2 1/4	Other 0.44	5/8	1 1/16	1 3/8	2	2 11/16
7/16	15/16	1 3/8	1 13/16	2 1/4	Other 0.45	5/8	1 1/16	1 3/8	2	2 5/8
7/16	15/16	1 3/8	1 3/4	2 3/16	Other 0.46	5/8	1	1 3/8	1 15/16	2 5/8
7/16	15/16	1 3/8	1 3/4	2 3/16	Other 0.47	5/8	1	1 3/8	1 15/16	2 5/8
7/16	15/16	1 3/8	1 3/4	2 3/16	Other 0.48	5/8	1	1 3/8	1 15/16	2 9/16
7/16	15/16	1 5/16	1 3/4	2 1/8	Other 0.49	5/8	1	1 5/16	1 7/8	2 9/16
7/16	15/16	1 5/16	1 11/16	2 1/8	Other 0.50	5/8	1	1 5/16	1 7/8	2 1/2
7/16	15/16	1 5/16	1 11/16	2 1/8	Other 0.51	9/16	1	1 5/16	1 7/8	2 1/2
7/16	7/8	1 5/16	1 11/16	2 1/16	Other 0.52	9/16	1	1 5/16	1 7/8	2 1/2
7/16	7/8	1 5/16	1 11/16	2 1/16	Other 0.53	9/16	15/16	1 5/16	1 13/16	2 7/16
7/16	7/8	1 1/4	1 5/8	2 1/16	Other 0.54	9/16	15/16	1 1/4	1 13/16	2 7/16
7/16	7/8	1 1/4	1 5/8	2 1/16	Other 0.55	9/16	15/16	1 1/4	1 13/16	2 7/16
7/16	7/8	1 1/4	1 5/8	2	Other 0.56	9/16	15/16	1 1/4	1 13/16	2 3/8
7/16	7/8	1 1/4	1 5/8	2	Other 0.57	9/16	15/16	1 1/4	1 3/4	2 3/8
7/16	7/8	1 1/4	1 5/8	2	Other 0.58	9/16	15/16	1 1/4	1 3/4	2 3/8
3/8	7/8	1 1/4	1 9/16	2	Other 0.59	9/16	15/16	1 1/4	1 3/4	2 5/16
3/8	7/8	1 3/16	1 9/16	1 15/16	Other 0.60	9/16	15/16	1 3/16	1 3/4	2 5/16
3/8	13/16	1 3/16	1 9/16	1 15/16	Other 0.61	9/16	7/8	1 3/16	1 11/16	2 5/16
3/8	13/16	1 3/16	1 9/16	1 15/16	Other 0.62	9/16	7/8	1 3/16	1 11/16	2 5/16
3/8	13/16	1 3/16	1 9/16	1 7/8	Other 0.63	9/16	7/8	1 3/16	1 11/16	2 1/4
3/8	13/16	1 3/16	1 1/2	1 7/8	Other 0.64	9/16	7/8	1 3/16	1 11/16	2 1/4
3/8	13/16	1 3/16	1 1/2	1 7/8	Other 0.65	1/2	7/8	1 3/16	1 11/16	2 1/4
3/8	13/16	1 3/16	1 1/2	1 7/8	Other 0.66	1/2	7/8	1 3/16	1 5/8	2 3/16
3/8	13/16	1 1/8	1 1/2	1 7/8	Other 0.67	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	13/16	1 1/8	1 1/2	1 13/16	Other 0.68	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	13/16	1 1/8	1 7/16	1 13/16	Other 0.69	1/2	7/8	1 1/8	1 5/8	2 3/16
3/8	13/16	1 1/8	1 7/16	1 13/16	Other 0.70	1/2	7/8	1 1/8	1 5/8	2 1/8
3/8	3/4	1 1/8	1 7/16	1 13/16	Other 0.71	1/2	13/16	1 1/8	1 9/16	2 1/8
3/8	3/4	1 1/8	1 7/16	1 3/4	Other 0.72	1/2	13/16	1 1/8	1 9/16	2 1/8
3/8	3/4	1 1/8	1 7/16	1 3/4	Other 0.73	1/2	13/16	1 1/8	1 9/16	2 1/8
3/8	3/4	1 1/16	1 7/16	1 3/4	Other 0.74	1/2	13/16	1 1/16	1 9/16	2 1/16
3/8	3/4	1 1/16	1 3/8	1 3/4	Other 0.75	1/2	13/16	1 1/16	1 9/16	2 1/16
3/8	3/4	1 1/16	1 3/8	1 3/4	Other 0.76	1/2	13/16	1 1/16	1 1/2	2 1/16
3/8	3/4	1 1/16	1 3/8	1 11/16	Other 0.77	1/2	13/16	1 1/16	1 1/2	2 1/16
3/8	3/4	1 1/16	1 3/8	1 11/16	Other 0.78	1/2	13/16	1 1/16	1 1/2	2
3/8	3/4	1 1/16	1 3/8	1 11/16	Other 0.79	1/2	13/16	1 1/16	1 1/2	2
3/8	3/4	1 1/16	1 3/8	1 11/16	Other 0.80	1/2	13/16	1 1/16	1 1/2	2
3/8	3/4	1 1/16	1 5/16	1 11/16	Other 0.81	1/2	3/4	1 1/16	1 1/2	2
3/8	11/16	1	1 5/16	1 5/8	Other 0.82	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	1	1 5/16	1 5/8	Other 0.83	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	1	1 5/16	1 5/8	Other 0.84	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	1	1 5/16	1 5/8	Other 0.85	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	1	1 5/16	1 5/8	Other 0.86	7/16	3/4	1	1 7/16	1 15/16
3/8	11/16	1	1 5/16	1 5/8	Other 0.87	7/16	3/4	1	1 7/16	1 7/8
3/8	11/16	1	1 1/4	1 9/16	Other 0.88	7/16	3/4	1	1 7/16	1 7/8
3/8	11/16	1	1 1/4	1 9/16	Other 0.89	7/16	3/4	1	1 3/8	1 7/8
3/8	11/16	1	1 1/4	1 9/16	Other 0.90	7/16	3/4	1	1 3/8	1 7/8

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G,
Z-106/HY, Z-146 and Retro-Guard® RG
Flange Protection: Full and Half Flange Thickness
Concrete Weight: NWC or LWC

Unrestrained Beam
U.L. Design No. D779
ICBO 4607 Table 2A

FULL FLANGE TIP THICKNESS					HALF FLANGE TIP THICKNESS					
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member	1 hr	1.5 hr	2 hr	3 hr	4 hr
					Size x Wt.					
					W/D					
3/8	11/16	1	1 1/4	1 9/16	Other 0.91	7/16	3/4	1	1 3/8	1 7/8
3/8	11/16	15/16	1 1/4	1 9/16	Other 0.92	7/16	3/4	15/16	1 3/8	1 13/16
3/8	11/16	15/16	1 1/4	1 9/16	Other 0.93	7/16	3/4	15/16	1 3/8	1 13/16
3/8	11/16	15/16	1 1/4	1 1/2	Other 0.94	7/16	11/16	15/16	1 3/8	1 13/16
3/8	11/16	15/16	1 1/4	1 1/2	Other 0.95	7/16	11/16	15/16	1 3/8	1 13/16
3/8	11/16	15/16	1 3/16	1 1/2	Other 0.96	7/16	11/16	15/16	1 5/16	1 13/16
3/8	5/8	15/16	1 3/16	1 1/2	Other 0.97	7/16	11/16	15/16	1 5/16	1 13/16
3/8	5/8	15/16	1 3/16	1 1/2	Other 0.98	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	15/16	1 3/16	1 1/2	Other 0.99	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	15/16	1 3/16	1 1/2	Other 1.00	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	15/16	1 3/16	1 7/16	Other 1.01	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	15/16	1 3/16	1 7/16	Other 1.02	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	7/8	1 3/16	1 7/16	Other 1.03	7/16	11/16	7/8	1 5/16	1 11/16
3/8	5/8	7/8	1 3/16	1 7/16	Other 1.04	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 7/16	Other 1.05	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 7/16	Other 1.06	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 7/16	Other 1.07	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	Other 1.08	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	Other 1.09	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	Other 1.10	3/8	5/8	7/8	1 1/4	1 5/8
3/8	5/8	7/8	1 1/8	1 3/8	Other 1.11	3/8	5/8	7/8	1 1/4	1 5/8
3/8	5/8	7/8	1 1/8	1 3/8	Other 1.12	3/8	5/8	7/8	1 3/16	1 5/8
3/8	5/8	7/8	1 1/8	1 3/8	Other 1.13	3/8	5/8	7/8	1 3/16	1 5/8
3/8	9/16	7/8	1 1/8	1 3/8	Other 1.14	3/8	5/8	7/8	1 3/16	1 5/8
3/8	9/16	13/16	1 1/16	1 3/8	Other 1.15	3/8	5/8	13/16	1 3/16	1 5/8
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.16	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.17	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.18	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.19	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.20	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.21	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.22	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.23	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	13/16	1 1/16	1 5/16	Other 1.24	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	13/16	1	1 1/4	Other 1.25	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	13/16	1	1 1/4	Other 1.26	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	13/16	1	1 1/4	Other 1.27	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	13/16	1	1 1/4	Other 1.28	3/8	9/16	13/16	1 1/8	1 1/2
3/8	9/16	13/16	1	1 1/4	Other 1.29	3/8	9/16	13/16	1 1/8	1 1/2
3/8	9/16	3/4	1	1 1/4	Other 1.30	3/8	9/16	3/4	1 1/8	1 1/2
3/8	9/16	3/4	1	1 1/4	Other 1.31	3/8	9/16	3/4	1 1/8	1 1/2
3/8	9/16	3/4	1	1 1/4	Other 1.32	3/8	9/16	3/4	1 1/16	1 7/16
3/8	9/16	3/4	1	1 1/4	Other 1.33	3/8	9/16	3/4	1 1/16	1 7/16
3/8	9/16	3/4	1	1 1/4	Other 1.34	3/8	9/16	3/4	1 1/16	1 7/16
3/8	9/16	3/4	1	1 3/16	Other 1.35	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	1	1 3/16	Other 1.36	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	1	1 3/16	Other 1.37	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	15/16	1 3/16	Other 1.38	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	15/16	1 3/16	Other 1.39	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	3/4	15/16	1 3/16	Other 1.40	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	3/4	15/16	1 3/16	Other 1.41	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	3/4	15/16	1 3/16	Other 1.42	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	3/4	15/16	1 3/16	Other 1.43	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	3/4	15/16	1 3/16	Other 1.44	3/8	9/16	3/4	1	1 3/8
3/8	1/2	3/4	15/16	1 1/8	Other 1.45	3/8	9/16	3/4	1	1 3/8
3/8	1/2	3/4	15/16	1 1/8	Other 1.46	3/8	9/16	3/4	1	1 3/8
3/8	1/2	11/16	15/16	1 1/8	Other 1.47	3/8	9/16	11/16	1	1 3/8
3/8	1/2	11/16	15/16	1 1/8	Other 1.48	3/8	9/16	11/16	1	1 3/8
3/8	1/2	11/16	15/16	1 1/8	Other 1.49	3/8	9/16	11/16	1	1 3/8
3/8	1/2	11/16	15/16	1 1/8	Other 1.50	3/8	9/16	11/16	1	1 5/16
3/8	1/2	11/16	15/16	1 1/8	Other 1.51	3/8	9/16	11/16	1	1 5/16

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G, Z-106/HY, Z-146 and Retro-Guard® RG **Unrestrained Beam**
Flange Protection: Full and Half Flange Thickness **U.L. Design No.** D779
Concrete Weight: NWC or LWC **ICBO 4607 Table** 2A

FULL FLANGE TIP THICKNESS					HALF FLANGE TIP THICKNESS					
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member	1 hr	1.5 hr	2 hr	3 hr	4 hr
					Size x Wt. W/D					
3/8	1/2	11/16	7/8	1 1/8	Other 1.52	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/8	Other 1.53	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/8	Other 1.54	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/8	Other 1.55	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/8	Other 1.56	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/8	Other 1.57	3/8	1/2	11/16	1	1 5/16
3/8	1/2	11/16	7/8	1 1/16	Other 1.58	3/8	1/2	11/16	15/16	1 5/16
3/8	1/2	11/16	7/8	1 1/16	Other 1.59	3/8	1/2	11/16	15/16	1 5/16
3/8	1/2	11/16	7/8	1 1/16	Other 1.60	3/8	1/2	11/16	15/16	1 1/4
3/8	1/2	11/16	7/8	1 1/16	Other 1.61	3/8	1/2	11/16	15/16	1 1/4
3/8	1/2	11/16	7/8	1 1/16	Other 1.62	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	11/16	7/8	1 1/16	Other 1.63	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	11/16	7/8	1 1/16	Other 1.64	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	11/16	7/8	1 1/16	Other 1.65	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	11/16	7/8	1 1/16	Other 1.66	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	11/16	7/8	1 1/16	Other 1.67	3/8	1/2	11/16	15/16	1 1/4
3/8	7/16	5/8	13/16	1 1/16	Other 1.68	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	13/16	1 1/16	Other 1.69	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	13/16	1 1/16	Other 1.70	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	13/16	1	Other 1.75	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	5/8	13/16	1	Other 1.80	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	5/8	13/16	1	Other 1.85	3/8	7/16	5/8	7/8	1 1/8
3/8	7/16	5/8	3/4	15/16	Other 1.90	3/8	7/16	5/8	7/8	1 1/8
3/8	7/16	9/16	3/4	15/16	Other 1.95	3/8	7/16	9/16	13/16	1 1/8
3/8	7/16	9/16	3/4	15/16	Other 2.00	3/8	7/16	9/16	13/16	1 1/16
3/8	3/8	1/2	11/16	13/16	Other 2.25	3/8	3/8	1/2	3/4	1
3/8	3/8	1/2	5/8	3/4	Other 2.50	3/8	3/8	1/2	11/16	15/16
3/8	3/8	7/16	9/16	3/4	Other 2.75	3/8	3/8	7/16	5/8	7/8
3/8	3/8	7/16	9/16	11/16	Other 3.00	3/8	3/8	7/16	5/8	13/16
3/8	3/8	3/8	1/2	5/8	Other 3.25	3/8	3/8	3/8	9/16	3/4
3/8	3/8	3/8	1/2	9/16	Other 3.50	3/8	3/8	3/8	1/2	11/16
3/8	3/8	3/8	7/16	9/16	Other 3.75	3/8	3/8	3/8	1/2	11/16
3/8	3/8	3/8	7/16	9/16	Other 4.00	3/8	3/8	3/8	1/2	5/8
3/8	3/8	3/8	7/16	1/2	Other 4.25	3/8	3/8	3/8	7/16	5/8
3/8	3/8	3/8	3/8	1/2	Other 4.50	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	7/16	Other 4.75	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	7/16	Other 5.00	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	7/16	Other 5.25	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	7/16	Other 5.50	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	3/8	Other 5.75	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	Other 6.00	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	Other 6.25	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	Other 6.50	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	Other 6.75	3/8	3/8	3/8	3/8	3/8
3/8	3/8	3/8	3/8	3/8	Other 7.00	3/8	3/8	3/8	3/8	3/8
3/8	3/8	3/8	3/8	3/8	Other 8.00	3/8	3/8	3/8	3/8	3/8



BXUV.X772 Fire Resistance Ratings - ANSI/UL 263

[Page Bottom](#)

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 Listed or Classified 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 as Classified, Listed, or Recognized.

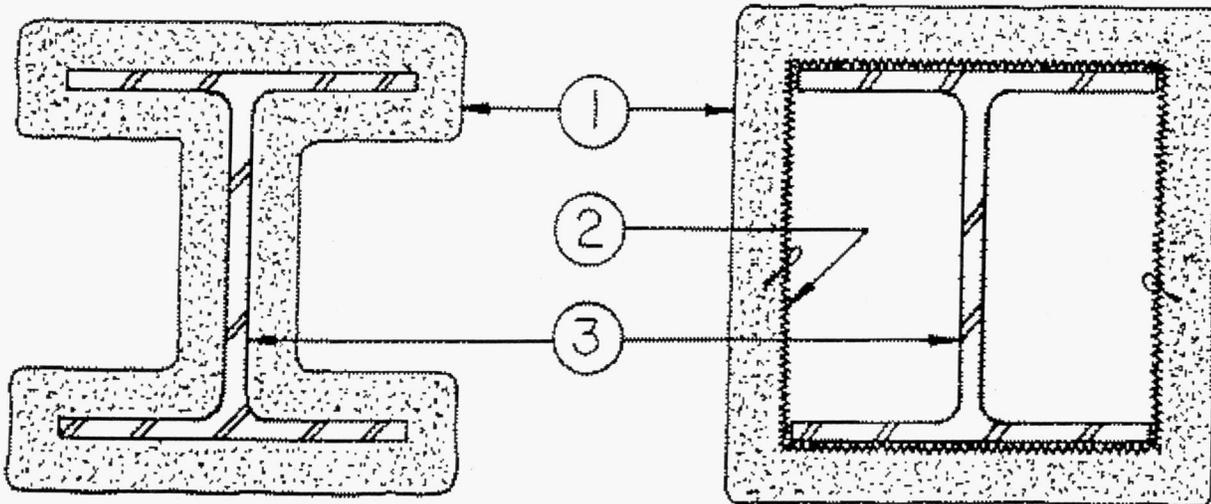
Fire Resistance Ratings - ANSI/UL 263

[See General Information for Fire Resistance Ratings - ANSI/UL 263](#)

Design No. X772

October 22, 2008

Ratings — 1, 1-1/2, 2, 3 and 4 h.



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. Min avg and min ind density of 19/18 pcf respectively for Types 7GP and 7HD. 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:

$$h = R$$

$$1.05 (W/D) + 0.61$$

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 = 0.33 to 6.62

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:

Min Col Size	W/D	Min Thk In.				
		1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W6X9	0.33	1-1/8	1-1/2	2	2-1/2	3-13/16
W6x16	0.57	13/16	1-1/4	1-11/16	2-1/2	3-5/16
W8x28	0.67	3/4	1-3/16	1-3/8	2	2-11/16
W10x49	0.83	11/16	7/8	1-1/8	1-11/16	2-1/2
W14x228	2.49	5/16	1/2	9/16	7/8	1-1/4
W14x730	6.62	5/16	5/16	5/16	3/8	9/16

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

Min Col Size	W/D	Min Thk In.				
		1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W6x9	0.33	1-1/8	1-5/8	2-1/16	2-15/16	3-13/16
W6x16	0.57	7/8	1-5/16	1-3/4	2-9/16	3-3/8
W8x28	0.67	13/16	1-3/16	1-1/2	2-1/4	2-15/16
W10x49	0.83	3/4	1-1/16	1-3/8	2-1/16	2-3/4
W14x233	2.49	5/16	1/2	11/16	1-3/16	1-5/8
W14x730	6.62	5/16	5/16	5/16	9/16	3/4

As an alternate to the equation, the min thickness of Spray-Applied Fire Resistive Materials Types Z-146, Z-146PC, Z-146T, Z-156, Z-156T and Z-156PC required for various fire resistance ratings of contours sprayed or boxed wide flange columns are shown in the table below:

Column Size In.	Min Thkns In.				
	1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W6x9	1-1/16	1-7/16	1-1/2	2-1/4	3
W6x12	1	1-3/8	1-1/2	2-1/4	3
W6x16	13/16	1-1/4	1-1/2	2-1/4	2-15/16
W8x28	3/4	1-3/16	1-3/8	2	2-1/2
W10x49	11/16	7/8	1-1/8	1-9/16	1-15/16
W21x73	11/16	7/8	1-1/8	1-9/16	1-15/16

W12x106	9/16	7/8	1-1/8	1-9/16	1-15/16
W14x233	5/16	1/2	9/16	7/8	1-1/4
W14x730	5/16	5/16	5/16	3/8	9/16

ARABIAN VERMICULITE INDUSTRIES — Types MK-5, MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Sonophone 1, Sonophone 5, Z-106, Z-106/G.

W R GRACE & CO - CONN — Types MK-4, MK-5, MK-6/HY, MK-6/HY Extended Set, MK-6s, RG, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G, 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).

GRACE KOREA INC — Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G.

PYROK INC — Type LD.

SOUTHWEST FIREPROOFING PRODUCTS CO — Types 4, 5, 5EF, 5GP, 5MD, 7GP, 7HD, 8EF, 8GP, 8MD, 9EF, 9GP, 9MD.

VERMICULITE PRODUCTS INC — Type MK-4 or MK-5.

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

3. **Steel Column** — Wide flange steel column, min/max sizes as specified above.

*Bearing the UL Classification Mark

Last Updated on 2008-10-22

[Questions?](#)

[Print this page](#)

[Notice of Disclaimer](#)

[Page Top](#)

[Copyright © 2011 Underwriters Laboratories Inc.®](#)

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 Listed and covered under UL's Follow-Up Service. Always look for the Mark on the product.

UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions: 1. The Guide Information, Designs and/or Listings (files) must be presented in their entirety and in a non-misleading manner, without any manipulation of the data (or drawings). 2. The statement "Reprinted from the Online Certifications Directory with permission from Underwriters Laboratories Inc." must appear adjacent to the extracted material. In addition, the reprinted material must include a copyright notice in the following format: "Copyright © 2011 Underwriters Laboratories Inc.®"

An independent organization working for a safer world with integrity, precision and knowledge.



SECTION III:

GRACE PRODUCT ANNOUNCEMENT

**Grace Product Announcement
Product Name Change**

GRACE

Grace Construction Products

W. R. Grace & Co.
62 Whittemore Avenue
Cambridge, MA 02140

T: 617-498-4347
F: 617-498-4419
M: 978-808-3995
E: paul.e.korenberg@grace.com
W: grace.com

Paul E. Korenberg
Grace Technical Services
Fire Protection Products

Date: 12 September 2008

To our valued customers and friends.

As part of the bidding process and occasionally after our products are installed we are asked to supply letters detailing the specific tests and results regarding the asbestos content of or sprayed fireproofing products. In response to these requests we can confirm as follows:

The Monokote® brand fireproofing products listed below, manufactured by Grace Construction Products were analyzed for fibrous asbestos content by an independent testing laboratory. Production bag samples were randomly selected from each manufacturing plant and shipped to the RJ Lee Group, Inc. for analysis. The RJ Lee Group is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos fiber analysis (PLM) and airborne asbestos fiber analysis (TEM) and by the American Industrial Hygiene Association (AIHA).

The Polarized Light Microscopy (PLM) method, as outlined in EPA /600/ R-23/116, Method for Determination in Bulk Building Materials was utilized to analyze the bulk material samples. There was no asbestos detected in the Monokote fire protection materials.

Transmission Electron Microscopy (TEM) was used to analyze composite samples. TEM is universally recognized as the most state-of-the-art asbestos detection method available today. There was no asbestos detected in the Monokote fire protection materials using this very precise test method. The test results are summarized in Table 1.

Table 1. Monokote Fireproofing Test Results

MONOKOTE PRODUCT	ASBESTOS CONTENT *
MK-6/HY	None detected
MK-6s	None detected
Retroguard	None detected
Z-106/HY	None detected
Z-146	None detected
Z-156PC	None detected

* Detection limit 0.0000002%

Note: EPA asbestos reporting level is 1%.

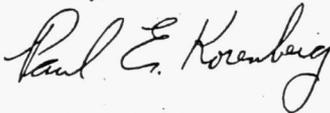
OSHA carcinogen warning and labeling requirement level is 0.1%.

The test reports are available upon request.

Based on the above test methods and results, Grace confirms that the above named products do not contain any asbestos.

If you have any questions concerning this issue, please feel free to contact me.

Sincerely,



Grace Technical Services
Fire Protection Products

SECTION IV:

APPROVED ICBO EVALUATION REPORT ESR 1186

Approved ICBO Evaluation Report ESR-1186

ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5380 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

DIVISION: 07—THERMAL AND MOISTURE PROTECTION
Section: 07810—Applied Fireproofing

REPORT HOLDER:

W. R. GRACE & CO. —CONN.
CONSTRUCTION PRODUCTS DIVISION
62 WHITEMORE AVENUE
CAMBRIDGE, MASSACHUSETTS 02140-1692
(617) 498-4441
www.graceconstruction.com

EVALUATION SUBJECT:

MONOKOTE® MK-6, MK-6/HY, MK-6/HY EXTENDED SET (MK-6/HY ES), MK-6s AND RETRO-GUARD® RG STANDARD-DENSITY CEMENTITIOUS FIREPROOFING MATERIALS; MONOKOTE® Z-106, Z-106/HY AND Z-106/G MEDIUM-DENSITY CEMENTITIOUS FIREPROOFING MATERIALS; AND MONOKOTE® Z-146, Z-146T, Z-156 AND Z-156-T HIGH-DENSITY CEMENTITIOUS FIREPROOFING MATERIALS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Mechanical Code*® (IMC)
- BOCA® *National Building Code*/1999 (BNBC)
- 1999 *Standard Building Code*® (SBC)
- 1997 *Uniform Building Code*™ (UBC)

Properties evaluated:

- Fire resistance
- Physical properties
- Use in plenums

2.0 USES

Monokote MK-6, MK-6/HY, MK-6/HY ES, MK-6s, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T and Retro-Guard RG fireproofing materials are mill-mixed cementitious materials that are machine-applied for fire-resistance-rated protection of structural steel framing members, concrete pan joists and steel floor or roof sections in all types of construction. The fireproofing materials may be used in plenums in accordance with IMC Section 602.2.1.

3.0 DESCRIPTION

3.1 General:

Monokote® MK-6, MK-6/HY, MK-6/HY Extended Set (MK-6/HY ES), MK-6s and Retro-Guard® RG are standard-density

cementitious fireproofing materials; Monokote® Z-106, Z-106/HY and Z-106/G are medium-density cementitious fireproofing materials; and Monokote® Z-146, Z-146T, Z-156 and Z-156T are high-density cementitious fireproofing materials.

MK-6/HY, MK-6/HY ES, MK-6s, Z-106/G and Retro-Guard RG are supplied in bags and mixed with approximately 8 gallons (30.3 L) of water per 48 pounds (21.8 kg) of material. Monokote Z-106 and Z-106/HY, are supplied in bags and mixed with approximately 8.5 gallons (32.2 L) of water per 49 pounds (22.2 kg) of material. Monokote Z-146, Z-146T, Z-156 and Z-156T are supplied in bags and mixed with approximately 4 gallons (15.1 L) of water per 49 pounds (22.2 kg) of material.

MK-6/HY, MK-6/HY ES, MK-6s, Z-106, Z-106/HY, Z-106/G, Z-146 and Z-146T, Z-156 and Z-156T are used for new construction. Retro-Guard RG is used for retrofit spray applications, and turns to light blue when dry. Z-146, Z-146T, Z-156 and Z-156T may be used on surfaces exposed to weather as defined in IBC Section 2502, UBC Section 224, SBC Section 202 or BNBC Section 202.

The fireproofing materials have a Class A (IBC and SBC) or Class I (UBC and BNBC) flame-spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E 84 and UBC Standard 8-1.

3.2 Additives and Bonding Material:

W.R. Grace & Co. Spatterkote SK-3 is a mill-mixed cementitious material applied to galvanized or painted steel floor or roof metal decks, as specified in Tables 2 through 9 of this report.

W.R. Grace & Co. Monokote Accelerator may be added to MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106/HY and Z-106/G to a maximum percentage of 5 percent by weight, as a field-application aid.

Firebond Concentrate is manufactured by Fiberlock Technologies, Inc., and is a bonding agent used when applying Monokote Z-106/HY, injected with Monokote Accelerator, to bare structural steel shapes or when applying fireproofing materials to wide-flange structural steel shapes having an unknown primed or painted surface in accordance with Section 4.5 of this report.

4.0 INSTALLATION

4.1 General:

Installation of cementitious fireproofing materials Monokote® MK-6, MK-6/HY, MK-6/HY Extended Set (MK-6/HY ES), MK-6s, Retro-Guard® RG, Monokote® Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156 and Z-156T must comply with this report and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite during installation. The materials are

mixed in a plaster mixer and then machine-applied through a nozzle, with air pressure and volume adjusted to provide the proper spray pattern. Application is achieved by applying one or more coats, and patching may be done by hand. The required in-place density for the fireproofing materials is shown in Table 1 of this report. In-place density must be verified by the method prescribed in ASTM E 605 (IBC) or BNBC Section 1705.12.4, SBC Section 1709.1.3 or UBC Standard 7-6 (UBC). **The materials must be applied to the thickness specified in Tables 2 through 9 of this report, as applicable.** These materials have setting characteristics and must be applied promptly after mixing. Mixing must use clean equipment.

4.2 Steel Surface Condition:

Steel surfaces that are to be protected must be free from substances that may prevent adhesion. When Firebond Concentrate is used as described in Section 3.2 of this report, the material must be applied at a nominal rate of 500 square feet per gallon (12.2 m²/L) when diluted 1:1 with water, or at a nominal 1000 square feet per gallon (24.4 m²/L) when applied at full strength.

4.3 Application to Galvanized Steel Floor and Roof Units:

MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY and Z-106/G may be sprayed directly onto galvanized steel fluted floor units. When applying MK-6/HY, MK-6/HY ES, MK-6s, RG and Z-106/G, all roof units without concrete topping, all cellular (flat) portions of galvanized metal decks and all bottomless trench headers must first be coated with an application of Spatterkote SK-3. Spatterkote SK-3 must be applied in accordance with the manufacturer's published Installation instructions. The SK-3 application must result in an evenly distributed spattered surface, leaving 10 to 30 percent of all deck surface exposed. Overspray onto other surfaces to be fireproofed is allowed, but is not required. The SK-3 thickness constitutes part of the fireproofing thickness.

When applying Z-106 or Z-106/HY, all cellular (flat) portions of galvanized metal decks must be lathed with 2.5-pound-per-square-yard (1.4 kg/m²), diamond-mesh, $\frac{3}{8}$ -inch (9.5 mm), expanded metal lath, complying with ASTM C 847. When applying Z-146, Z-146T, Z-156 and Z-156T, all cellular and fluted portions of galvanized metal decks must be lathed with 2.5-pound-per-square-yard (1.4 kg/m²), diamond-mesh, $\frac{3}{8}$ -inch (9.5 mm), thick expanded metal lath, complying with ASTM C 847. Electrical trench headers require the use of steel studs and disks when protected with cementitious fireproofing materials.

4.4 Application to Bare Structural Steel Shapes:

MK-6/HY, MK-6/HY ES, MK-6s, Retro Guard RG, Z-106, Z-106/G, Z-146, Z-146T, Z-156 and Z-156T may be sprayed directly onto bare structural steel shapes. Z-106/HY injected with Monokote Accelerator must be applied only after application of Firebond Concentrate.

4.4.1 IBC: In jurisdictions adopting the IBC, structural steel members such as exposed beams, columns and ceilings less than 5 feet (1524 mm) above the floor, landing, or occupied space, and columns or vertical members must be protected with Monokote Z-146, Z-146T, Z-156 or Z-156T at the required thickness, or the exposed material must be protected with corner guards, a substantial jacket of metal or other noncombustible material in accordance with IBC Section 714.4 to a height adequate to provide full protection, but not less than 5 feet (1524 mm).

4.4.2 BNBC, SBC and UBC: In jurisdictions adopting the BNBC, SBC or the UBC, structural steel members such as

exposed beams, columns and ceilings less than 8 feet (2438 mm) above the floor, landing, or occupied space, and columns or vertical members to a height of 8 feet (2438 mm), must be protected with Monokote Z-146, Z-146T, Z-156 or Z-156T at the required thickness, or the exposed material must be protected with either furred wallboard, concrete or cement plaster with lath.

4.5 Application to Primed or Painted Structural Steel Shapes:

Any steel members exceeding the maximum dimensional values in condition 1, 2, or 3 of Section 4.5.1 of this report, require a mechanical break, consisting of one or more minimum 1.7-pound-per-square-yard (0.65 kg/m²) metal lath strips, or No. 20 SWG galvanized hexagonal wire mesh mechanically fastened to the flange or web either by welding, screws or power-actuated fasteners. Fasteners must be spaced a maximum of 12 inches (305 mm) on center, on each longitudinal edge of the strip, so that the clear spans do not exceed the limits established in condition 1, 2 or 3. At least 25 percent of the width of the oversize flange or web element must be covered by the metal lath. Minimum metal lath width must be $3\frac{1}{2}$ inches (89 mm).

4.5.1 Under the following conditions, MK-6/HY, MK-6/HY ES, MK-6s, Retro Guard RG, Z-106, Z-106/HY Z-106/G, Z-146, Z-146T, Z-156 and Z-156T may be applied to wide-flange structural steel shapes having an unknown primed or painted surface:

1. Beam flange width must not exceed 12 inches (305 mm).
2. Column flange width must not exceed 16 inches (406 mm).
3. Beam or column web depth must not exceed 16 inches (406 mm).
4. Bond tests of five specimens in accordance with ASTM E 736 verify the bond strength of the fireproofing material bonded to a painted or primed $\frac{1}{8}$ -inch-thick (3.2 mm) steel substrate.

Firebond Concentrate specified in Section 3.2 of this report must be used for structural steel shapes with unknown primed or painted surfaces.

4.5.2 Monokote MK-6/HY, MK-6/HY ES, MK-6s, Z-106, Z-106/HY, Z-146, Z-146T, Z-156, Z-156T and Retro-Guard RG may be applied directly to painted or primed joists or joist girders without the use of mechanical breaks.

4.6 Thickness:

The thickness tolerances for fireproofing materials must comply with Sections 4.6.1 and 4.6.2 of this report.

4.6.1 Minus Tolerance: The thickness must be corrected by applying additional material where the calculated average thickness is less than that required by the recognized design, or where an individual measured thickness reading has a minus tolerance greater than $\frac{1}{4}$ inch (6.4 mm), or more than 25 percent for a design thickness of less than 1 inch (25.4 mm).

4.6.2 Positive Tolerance: An individual measured thickness that exceeds the thickness specified in a design by $\frac{1}{4}$ inch (6.4 mm) or more must be recorded as the thickness specified in the design plus $\frac{1}{4}$ inch (6.4 mm).

4.7 Special Inspections:

Special inspections shall be provided in accordance with IBC Section 1704.10, BNBC Section 1705.12, SBC Section 1709 and UBC Section 1701.4, as applicable.

5.0 CONDITIONS OF USE

The Monokote® MK-6, MK-6/HY, MK-6/HY Extended Set (MK-6/HY ES), MK-6S and Retro-Guard® RG standard-density cementitious fireproofing materials; Monokote® Z-106, Z-106/HY and Z-106/G medium-density cementitious fireproofing materials; and Monokote® Z-146, Z-146T, Z-156 and Z-156T high-density cementitious fireproofing material described in this report comply with, or are suitable alternates to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation must comply with this report, the manufacturer's published installation instructions and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.
- 5.2 The average bond strength must be a minimum of 20 times the weight of the in-place fireproofing material but not less than 150 psf (732 kg/m²); or, for primed steel, the average bond strength must be a minimum of 80 percent, with a minimum individual bond strength of 50 percent of the bond strength of fireproofing material applied to clean, bare, 1/8-inch-thick (3.2 mm) steel plate, whichever is greater. Where bond strength values are less than these minimums, Firebond Concentrate specified in Section 3.2 of this report must be applied to the primed or painted surfaces, and the bond strength tests must be repeated.

- 5.3 Measuring methods in ASTM E 605, ASTM E 736, IBC Section 1704.10, BNBC Section 1705.12, SBC Section 1709.1 and UBC Standard 7-6 (UBC) must be used to verify thickness, density and bond strength of the fireproofing materials. When thicknesses are averaged and reported as a single measurement, each thickness measurement before averaging must be the thickness listed in this report plus or minus 1/4 inch (6.4 mm), for averaging purposes only.

- 5.4 Special inspection performed by a qualified person approved by the code official is required as set forth in IBC Section 1704.10 or UBC Section 1701.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied and Intumescent Mastic Coating Fire-protection Materials (AC23), dated June 2004, (Editorially revised January 2008).

7.0 IDENTIFICATION

The fireproofing materials described in this report must be identified by a stamp on the bag bearing the manufacturer's name (W.R. Grace & Co.-CONN.), the product type and the evaluation report number (ESR-1186).

TABLE 1—IN-PLACE DRY DENSITY REQUIRED FOR FIREPROOFING MATERIALS

MATERIAL DESIGNATION	IN-PLACE DENSITY (pcf)	
	Minimum Average	Individual Density
MK-6/HY, MK-6/HY ES and RG	15	14
MK-6s	19	18
Z-106, Z-106/HY and Z-106/G	22	19
Z-146 and Z-146T	40	36
Z-156 and Z-156T	50	46

For SI: 1 pcf = 16.018 kg/m³.TABLE 2—MINIMUM AVERAGE THICKNESS OF FIRE PROTECTION MATERIALS APPLIED TO STEEL COLUMNS¹

A. Wide flange steel columns: Minimum thickness (inches) ²				
A1. For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106/G				
MINIMUM W/D RATIO	4 HR.	3 HR.	2 HR.	1 HR.
6.62	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$
2.49	$1\frac{1}{2}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{3}{8}$
0.83	$2\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{8}$	$\frac{3}{4}$
0.67	$2\frac{3}{4}$	2	$1\frac{3}{8}$	$\frac{3}{4}$
0.57	4	$2\frac{1}{2}$	$1\frac{3}{4}$	$\frac{7}{8}$
0.33	$3\frac{1}{8}$	$2\frac{1}{2}$	2	$1\frac{1}{8}$
A2. For fire protection materials: Z-106, Z-106HY				
MINIMUM W/D RATIO	4 HR.	3 HR.	2 HR.	1 HR.
6.62	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$
2.49	$1\frac{1}{4}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{3}{8}$
0.83	$2\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{8}$	$\frac{3}{4}$
0.67	$2\frac{1}{2}$	2	$1\frac{3}{8}$	$\frac{3}{4}$
0.57	3	$2\frac{1}{2}$	$1\frac{5}{8}$	$\frac{7}{8}$
0.33	$3\frac{1}{8}$	$2\frac{1}{2}$	2	$1\frac{1}{8}$
A3. For fire protection materials: Z-146, Z-146T, Z-156, and Z-156T				
MINIMUM W/D RATIO	4 HR.	3 HR.	2 HR.	1 HR.
6.62	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$
2.52	$1\frac{1}{4}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{3}{8}$
0.83	2	$1\frac{5}{8}$	$1\frac{1}{8}$	$\frac{3}{4}$
0.67	$2\frac{1}{2}$	2	$1\frac{3}{8}$	$\frac{3}{4}$
0.57	3	$2\frac{1}{4}$	$1\frac{1}{2}$	$\frac{7}{8}$
0.33	3	$2\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{8}$

For SI: 1 inch = 25.4 mm.

B. Hollow shape steel columns: Minimum thickness (inches) ³					
B1. For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G					
STEEL TUBE: SIZE (inches)	A/P RATIO	4 HR.	3 HR.	2 HR.	1 HR.
3 x 3 x $\frac{3}{16}$	0.18	NR	$3\frac{5}{8}$	$2\frac{3}{8}$	1
8 x 8 x $\frac{5}{8}$	0.58	$1\frac{1}{2}$	$1\frac{1}{8}$	$\frac{3}{4}$	$\frac{3}{8}$
20 x 20 x 1	0.95	1	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$
32 x 32 x 2	1.88	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$
STEEL PIPE SIZE (inches)	A/P RATIO	4 HR.	3 HR.	2 HR.	1 HR.
3 dia. x 0.216 Standard	0.20	NR	$3\frac{1}{8}$	$2\frac{1}{8}$	1
6 dia. x 0.864 Double Extra Strong	0.74	$1\frac{7}{8}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{1}{4}$
8 dia. x 0.322 Standard	0.31	$2\frac{7}{8}$	$2\frac{1}{8}$	2	$\frac{5}{8}$
10 dia. x 0.5 Extra Strong	0.48	$1\frac{7}{8}$	$1\frac{3}{8}$	$\frac{7}{8}$	$\frac{3}{8}$

TABLE 2—(Continued)

B2. Hollow shape steel columns: Minimum thickness (inches) ⁴					
For fire protection materials: Z-146, Z-146T, Z-156, and Z-156T					
STEEL TUBE: SIZE (inches)	A/P RATIO	4 HR.	3 HR.	2 HR.	1 HR.
3 × 3 × 3/16	0.18	4	2 ⁵ / ₈	1 ⁷ / ₈	1
20 × 20 × 3/4	0.72	1 ⁷ / ₈	7/8	5/8	1/4
32 × 32 × 2	1.88	1/2	3/8	1/4	1/4
STEEL PIPE SIZE (inches)	A/P RATIO	4 HR.	3 HR.	2 HR.	1 HR.
4 dia. × 0.237 Standard	0.22	3 ¹ / ₂	2 ⁵ / ₈	1 ⁷ / ₈	7/8
6 dia. × 0.864 Double Extra Strong	0.74	1 ¹ / ₄	7/8	5/8	3/4
8 dia. × 0.322 Standard	0.31	2 ⁷ / ₈	2 ¹ / ₈	1 ³ / ₈	5/8
10 dia. × 0.5 Extra Strong	0.48	1 ⁷ / ₈	1 ³ / ₈	7/8	3/8

For SI: 1 inch = 25.4 mm.

NR = Not recognized

¹Fire-resistive protection is applied directly to exposed column contour or column boxed with metal lath.

²As an alternate to Table 2A, thickness of fireproofing may be determined on the basis of the following equation:

$$h = R/[1.05(W/D) + 0.61]$$

Where:

- R = Fire resistance (hours).
- H = Thickness of fireproofing, ranging from 0.25 to 3.875 inches.
- D = Heated perimeter of steel column (inches).
- W = Weight of steel column (lbs. per lineal foot).

Limitations: W/D ratio ranges from a minimum of 0.33 to a maximum of 6.62.
Minimum thickness is 1/4 inch.

³As an alternate to Table 2B1, thickness of fireproofing, may be determined on the basis of the following equation:

$$T = (R - 12.49)/[265.75(A/P)]$$

Where:

- R = Fire resistance (minutes).
 - A = Cross-sectional area (square inches).
 - P = Heated perimeter (inches).
 - T = Thickness of fireproofing, ranging from 0.375 to 3.875 inches.
- A/P equation for tube columns = $t(A + B - 2t)/(A + B)$.
A/P equation for pipe columns = $t(d - t)/d$.

Where:

- T = Wall thickness of column.
- A = Length of horizontal side (inches).
- B = Length of vertical side (inches).
- D = Diameter of pipe (inches).

Limitations: A/P ratio ranges from a minimum of 0.18 to a maximum of 2. Thickness is between 1/4 inch and 3⁷/₈ inches.

⁴As an alternate to Table 2B2, thickness of fireproofing, may be determined on the basis of the following equation:

$$T = (R - 0.2)/[4.43(A/P)]$$

Where:

- R = Fire resistance (hours).
 - A = Cross-sectional area (square inches).
 - P = Heated perimeter (inches).
 - T = Thickness of fireproofing ranging from 0.375 to 3.875 inches.
- A/P equation for tube columns = $t(A + B - 2t)/(A + B)$.
A/P equation for pipe columns = $t(d - t)/d$.

Where:

- T = Wall thickness of column.
- A = Length of horizontal side (inches).
- B = Length of vertical side (inches).
- D = Diameter of pipe (inches).

Limitations: A/P ratio ranges from a minimum of 0.18 to a maximum of 2. Thickness is between 1/4 inch and 3⁷/₈ inches.

TABLE 3—MINIMUM AVERAGE THICKNESS OF FIRE PROTECTION MATERIALS
APPLIED TO PROTECTED FLOOR ASSEMBLIES

Assembly: Steel beams or joists supporting minimum 1 $\frac{1}{2}$ -inch-deep steel decking with minimum 2 $\frac{1}{2}$ -inch-thick concrete slab over top of flutes.

a. Metal thickness—minimum gage: fluted 22 MSG, cellular 20/20MSG

b. Normal-weight or lightweight concrete¹

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T
Fireproofing Thickness on Metal Deck (inches)

PARAMETER	1 HR	2 HR	3 HR	4 HR	
				Lightweight Concrete	Normal-weight Concrete
Crest	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{4}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Valley	$\frac{3}{8}$	$\frac{3}{8}$	1 $\frac{1}{2}$ ⁺	$\frac{7}{8}$	1 $\frac{1}{8}$
Cellular	$\frac{3}{8}$	$\frac{3}{8}$	1 $\frac{1}{2}$	NR	NR

Assembly: Steel beams or joists supporting minimum 2-inch-deep steel decking with minimum 2-inch-thick concrete slab over top of flute.

a. Metal thickness—minimum gage: fluted 22 MSG, cellular 20/18MSG

b. Normal-weight or lightweight concrete.¹

c. Note: Spatterkote SK-3 is required on cellular decking for MK-6/HY ES, MK-6s, Z-106 and RG. Lath is required on cellular decking for Z-106, Z-106/HY and Z-106/G.

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z156T
Fireproofing Thickness on Metal Deck (inches)

PARAMETER	1 HR	2 HR	3 HR	4 HR
Normal-weight Concrete	$\frac{1}{2}$	$\frac{7}{8}$	1 $\frac{1}{4}$	NR
Lightweight Concrete	$\frac{5}{8}$	1	1 $\frac{1}{2}$	NR

TRENCH HEADERS^{2, 3 and 4}

BOTTOMLESS TRENCH HEADER: MAX. 36 INCHES WIDE	1 HR	2 HR	3 HR	4 HR
Crest	1 $\frac{1}{4}$	1 $\frac{3}{4}$	2 $\frac{1}{4}$	NR
Valley	1	1 $\frac{5}{8}$	2 $\frac{1}{8}$	NR
Cellular	1	1 $\frac{5}{8}$	2 $\frac{1}{8}$	NR
TRENCH HEADER WITH BOTTOM PAN: MAX. 36 INCHES WIDE	1 HR	2 HR	3 HR	4 HR
Crest	1 $\frac{1}{8}$	1 $\frac{1}{8}$	2 $\frac{1}{4}$	NR
Valley	1 $\frac{1}{8}$	1 $\frac{1}{8}$	2 $\frac{1}{8}$	NR
Cellular	1 $\frac{1}{8}$	1 $\frac{1}{8}$	2 $\frac{1}{8}$	NR
TRENCH HEADER WITH INTERMITTENT BOTTOM PAN: MAX. 36 INCHES WIDE	1 HR	2 HR	3 HR	4 HR
Crest	1 $\frac{1}{2}$	2	NR	NR
Valley	1	1 $\frac{3}{4}$	NR	NR
Cellular	1	1 $\frac{3}{4}$	NR	NR

ELECTRICAL INSERTS⁵

Insert where concrete is not removed from deck valleys and insert top ^{6 and 7}	1 HR	2 HR	3 HR	4 HR
Normal-weight concrete slab	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{3}{4}$	NR
Lightweight concrete slab	$\frac{3}{4}$	$\frac{3}{4}$	1 $\frac{1}{8}$	NR
Inserts which penetrate sides of deck cells, and there is no concrete in valleys between cells under insert ⁷	1 HR	2 HR	3 HR	4 HR
Preset: Dual Service				
Normal-weight concrete slab	$\frac{1}{2}$	$\frac{7}{8}$	1 $\frac{1}{4}$	NR
Lightweight concrete slab	$\frac{1}{2}$	$\frac{3}{4}$	1 $\frac{3}{8}$	NR
Preset: Triple Service				
Normal-weight concrete slab	$\frac{1}{2}$	$\frac{5}{8}$	1 $\frac{1}{4}$	NR
Lightweight concrete slab	$\frac{1}{2}$	$\frac{3}{4}$	1 $\frac{1}{2}$	NR
Inserts contain internal modifications and penetrate sides of deck cells where no concrete is in valleys under insert ⁷	1 HR	2 HR	3 HR	4 HR
Preset: Dual Service				
Normal-weight concrete slab	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	NR
Lightweight concrete slab	$\frac{1}{2}$	$\frac{3}{4}$	NR	NR
Preset: Triple Service				
Normal-weight concrete slab	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	NR
Lightweight concrete slab	$\frac{5}{8}$	$\frac{7}{8}$	NR	NR

TABLE 3—(Continued)

Inserts which penetrate top of deck cells, and there is no concrete in valleys between cells under insert ⁸	1 HR	2 HR	3 HR	4 HR
Preset: Triple Service; aluminum plate placed on top of insert				
Normal-weight or lightweight concrete slab	$\frac{5}{8}$	$\frac{7}{8}$	NR	NR
Preset: Triple Service; zinc plate placed on top, sides or bottom of insert				
Normal-weight or lightweight concrete slab	$\frac{3}{8}$	$\frac{5}{8}$	1	NR

For SI: 1 inch = 25.4 mm; 1 psi = 6.89 kPa; 1 ft = 304.8 mm; 1 ft² = 0.092 m²; 1 pcf = 16.02 kg/m³.

NR = Not recognized

Notes:

¹Normal-weight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 148 pcf, and utilizes either carbonate or siliceous aggregates. Lightweight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 110 pcf. Concrete must encapsulate 6 × 6 W1.4 × W1.4 welded wire fabric.

²Fireproofing thickness under bottomless and intermittent trench headers must extend 4 inches beyond each side of trench header. Fireproofing thickness under trench headers with bottom pans must extend 5 inches beyond each side of trench header. Allowable loads must be based on non-composite design.

³The cellular (flat plate) portion of units under trench headers must have welded Nelson steel studs and No. 12 SWG galvanized wire, attached to a $\frac{13}{16}$ -inch-diameter No. 28 MSG galvanized steel disc. Studs must be in rows parallel to the trench. Studs must average at least one stud per 236 sq. in. of cellular floor units beneath the trench, a maximum of 4 inches from edge of trench header with a maximum of 22 inches between rows and 24 inches between studs. For three-hour protection, the stud length must be $2\frac{1}{8}$ inches. For two-hour protection, the stud length must be $1\frac{3}{8}$ inches.

⁴Intermittent bottom trench header consists of a horizontal closure plate (minimum 22 MSG) over the fluted deck section, which is affixed to floor units by welds or screws. Fireproofing thickness for 24-inch-wide intermittent bottom trench headers is $1\frac{1}{8}$ inches for a two-hour rating.

⁵Fireproofing thickness for all inserts must be sprayed to the entire width and length of cellular units between supports and must extend beyond the edges a distance of 12 inches.

⁶Spacing for un-used condition must not be more than one insert for each 6 sq. ft. of floor area, with not less than 30 inches between inserts along the deck unit and 18 inches in the transverse direction. Active inserts cannot exceed more than one in each 12 sq. ft. Un-used inserts must be packed with mineral wool or covered with concrete.

⁷Spacing must not be more than one insert in each $7\frac{1}{2}$ sq. ft. of floor area, with not less than $25\frac{1}{2}$ inches between edges of adjacent inserts or must not be more than one inset in each 8 sq. ft. of floor area, with not less than 2 feet center-to-center of adjacent inserts.

⁸Spacing must not be more than one insert in each 8 sq. ft. of floor area, with not less than 2 feet center-to-center of adjacent inserts.

TABLE 4A—FLOOR BEAMS (W8X28) SUPPORTING A NORMAL-WEIGHT OR LIGHTWEIGHT CONCRETE SLAB OR FLUTED FORM UNITS WITH NORMAL-WEIGHT OR LIGHTWEIGHT CONCRETE TOPPING APPLIED TO UNPROTECTED FLOOR ASSEMBLIES^{1 AND 2}

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T Minimum unrestrained fireproofing thickness (inches)				
Rating (HR)	FLUTED DECK ONLY		FLUTED OR CELLULAR DECK	
	Normal Weight Concrete	Lightweight Concrete	Normal Weight Concrete	Lightweight Concrete
1	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$
1 $\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{8}$
2	$\frac{7}{8}$	1	1 $\frac{1}{8}$	1 $\frac{1}{8}$
3	1 $\frac{1}{2}$	1 $\frac{3}{8}$	1 $\frac{5}{8}$	1 $\frac{5}{8}$
4	2	1 $\frac{5}{8}$	2	2

For SI: 1 inch = 25.4 mm.

TABLE 4B—FLOOR BEAMS (W8X28) SUPPORTING A NORMAL-WEIGHT OR LIGHTWEIGHT CONCRETE SLAB OR FLUTED FORM UNITS WITH NORMAL-WEIGHT OR LIGHTWEIGHT CONCRETE TOPPING APPLIED TO PROTECTED FLOOR ASSEMBLIES^{1 AND 2}

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T Minimum unrestrained fireproofing thickness (inches)				
Rating (HR)	FLUTED DECK ONLY		FLUTED OR CELLULAR DECK	
	Normal Weight Concrete	Lightweight Concrete	Normal Weight Concrete	Lightweight Concrete
1	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$
1 $\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{7}{8}$
2	$\frac{7}{8}$	1	$\frac{7}{8}$	1
3	1 $\frac{1}{4}$	1 $\frac{3}{8}$	1 $\frac{1}{4}$	1 $\frac{5}{8}$
4	1 $\frac{5}{8}$	1 $\frac{5}{8}$	2	2

For SI: 1 inch = 25.4 mm; 1 psi = 6.89 kPa; 1 pcf = 16.02 kg/m³.

Notes:

¹Normal-weight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 148 pcf, and utilizes either carbonate or siliceous aggregates. Lightweight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 110 pcf. Concrete must encapsulate 6 × 6 W1.4 × W1.4 welded wire fabric.

²As an alternate to beam thicknesses in Tables 4A and 4B, thickness for unrestrained beams may be determined on the basis of the following equation:

$$T_1 = \frac{[(W/2 / D_2) + 0.6]T_2}{[(W/1 / D_1) + 0.6]}$$

Where:

- T = Thickness of fireproofing (inches).
- W = Weight of steel beam (pounds per lineal foot).
- D = Heated perimeter of steel beam (inches).
- 1 = Refers to desired beam size and required material thickness.
- 2 = Refers to W8×28 beam size and appropriate material thickness in Tables 4A and 4B.

Limitations: Minimum thickness must not be less than $\frac{3}{8}$ inch. W/D ratios must not be less than 0.37.

TABLE 5—FLOOR JOISTS SUPPORTING MIXED CELLULAR/FLUTED DECKING WITH NORMAL-WEIGHT CONCRETE SLAB OR WITH SOLID CONCRETE SLAB APPLIED TO PROTECTED OR UNPROTECTED FLOOR ASSEMBLIES

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T					
Minimum unrestrained fireproofing thickness (inches)					
Joist and bridging with or without lath, scrim or net ^{1,2,3,4 and 5}	Spacing	1 HR	2 HR	3 HR	4 HR
10K1 @ 30 ksi	More than 4 ft. O.C.	7/8	2 1/4	3 1/2	NR
10K1 @ 30 ksi	Equal to or less than 4 ft. O.C.	7/8	1 7/8	2 7/8	NR
Top and bottom chords consist of two angles with a minimum total area of 0.96 and 0.77 sq. in., respectively. Web members are either round bars or angles. Minimum area for the end diagonal web is 0.444 sq. in. Minimum area for the first six interior diagonal webs is 0.406 sq. in. All other interior webs have a minimum area of 0.196 sq. in.	NA	1 1/8	2 1/4	2 3/4	2 7/8
Top and bottom chords consist of two angles with a minimum total area of 1.74 sq. in. First five web members are round bars or angles, 0.886 sq. in. All other interior webs have a minimum area of 0.441 sq. in.	NA	1 1/8	2 1/4	2 3/4	2 7/8

For Sl: 1 inch = 25.4 mm; 1 in² = 645 mm²; 1 psi = 6.89 kPa; 1 ft = 304.8 mm; 1 psi = 6.89 kPa; 1 lb/sq. yd. = 0.38 kg/m²; 1 pcf = 16.02 kg/m³; 1 ksi = 6.894.8 kPa.

NA = Not applicable
NR = Not recognized

Notes:

¹Normal-weight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 148 pcf, and utilizes either carbonate or siliceous aggregates. Lightweight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 110 pcf. Concrete must encapsulate 6 x 6 W1.4 x W1.4 welded wire fabric.

²Fire-resistive protection is applied directly to exposed beam contour or boxed with expanded metal lath.

³Fireproofing must be applied to joist following joist contour. 1.7 to 3.4-lb./sq. yd. diamond mesh 3/8 inch expanded steel lath or 3/16 inch fiberglass scrim fabric or 20 mil strand 3/16 inch plastic net secured to one side of each steel joist is optional. If metal lath is used, lath is to be fully covered, with no minimum thickness requirement. If fiberglass mesh is used, mesh is not required to be fully covered.

⁴Thickness of fireproofing must be 1 1/2 inches up to 2 hour rating for minimum 16K2 joists with minimum 3/4-inch-diameter web members or for LH joists.

⁵Minimum 5 pcf or less density polystyrene can be used over the deck without affecting the deck or beam protection thicknesses. When other rigid thermal insulations or more than 5 pcf polystyrene is used over the deck, the deck and beam protection thickness must be increased to the next 1/2 hourly rating using interpolation. As an alternative for floor beam thickness, roof beam thickness can be substituted using the thickness for the same hourly rating.

TABLE 6—CONCRETE PAN JOISTS, POURED-IN-PLACE WITH NORMAL-WEIGHT CONCRETE SLAB AT A MINIMUM TOTAL 2 1/2 INCH THICKNESS, A MAXIMUM 30 INCH SPAN BETWEEN JOISTS AND A MINIMUM 3/4 INCH CONCRETE COVER FOR JOIST REINFORCEMENT¹

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T				
Minimum unrestrained fireproofing thickness (inches)				
Parameter	1 HR	2 HR	3 HR	4 HR
Slab Soffit	7/8	7/8	NR	NR

For Sl: 1 inch = 25.4 mm; 1 psi = 6.89 kPa; 1 pcf = 16.02 kg/m³.

NR = Not recognized

Note:

¹Normal-weight concrete has a minimum compressive strength of 3,000 psi and a minimum unit weight of 148 pcf, and utilizes either carbonate or siliceous aggregates.

TABLE 7—MINIMUM AVERAGE THICKNESS OF FIRE PROTECTION MATERIALS APPLIED TO STEEL TRUSSES FOR FIRE PROTECTION MATERIALS MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-157, Z-156T (inches)^{1, 2, 3, 4 AND 5}

The thickness of fire protection materials applied to structural steel trusses is determined in accordance with UBC Standard 7-7, Part I, as follows:

Step 1: Determine the W/D ratio for each individual element of the truss. W/D ratios are defined as the weight per lineal foot (W) of the element in pounds divided by the heated perimeter (D) of the element (sides directly exposed to heat in a fire) in lineal inches. The weight-to-heated perimeter (W/D ratio) of truss elements which directly support floor or roof constructions, i.e., top chords, must be determined on the same basis as for beams and girders. The method to calculate the heated perimeter (D) of the top chord is illustrated in the left hand figure below. The weight-to-heated perimeter ratio (W/D ratio) of truss elements which can be simultaneously exposed to fire on all sides, i.e., webs and bottom chords must be determined on the same basis as columns. The method to calculate the heated perimeter of the web and bottom chord is illustrated in the right hand figure below. For different shapes not illustrated in the figures below, the same general methodology applies.

Step 2: Substitute the W/D ratio for each individual element of the truss into the formula below to determine the thickness of protection required (inches):

$$t = R/[63(W/D) + 37]$$

Where:

- t = Thickness of fireproofing protection (inches).
- R = Fire resistance (minutes).
- W = Weight of steel, lbs./lin. ft.
- D = Heated perimeter of each truss element (inches)³

Notes:

¹Where truss construction includes tube or pipe steel elements, the thickness of protection for the tube or pipe steel must be taken from Table 2, of this report.

²Methodology presented in this table is limited to unrestrained conditions.

³As an alternate to the formula, thickness may be taken from Table 2 columns using the appropriate minimum W/D ratio.

⁴Minimum chord or web member size has W/D ratio = 0.33. Other steel shapes with W/D ratios greater than 0.33 may be used.

⁵Top flange of the top chord supports concrete slab or steel deck units.

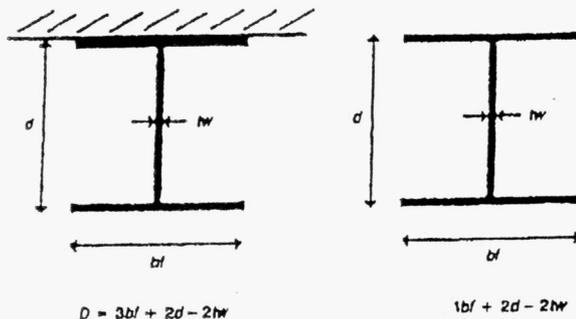


TABLE 8—MINIMUM AVERAGE THICKNESS OF FIRE PROTECTION MATERIALS APPLIED TO PROTECTED ROOF ASSEMBLIES FOR FIRE PROTECTION MATERIALS MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146 (inches)^{1, 2}

- A. Roof assembly with polyisocyanurate insulation board or mineral and fiber and fiberglass insulation boards.
 1. **Structural support:** Steel beams or joists supporting minimum 1½ inch fluted steel decking, minimum No. 22 MSG gage.
 2. **Gypsum board:** Five-eighths-inch-thick gypsum board fastened or adhered to metal roof deck under insulation board.
 3. **Insulation type:**
 - a. Polyisocyanurate insulation boards: Minimum 2 inches thick with gypsum board, minimum 3 inches thick without gypsum board; or
 - b. Mineral and fiber board: Minimum thickness 1 inch. Minimum thickness 2 inches when Item 4b or Item 4c is used; or
 - c. Fiberglass insulation board: Minimum thickness ¾ inch for one hour and 1¾ inches for two hours. Minimum 1¾ inches when Item 4b or Item 4c is used.
 - d. Polystyrene foamed plastic insulation boards: Minimum thickness 1 inch, maximum thickness 8 inches, and maximum density 2.5 pcf. Insulation boards must be used with ⅝-inch-thick gypsum board fastened or adhered to metal roof deck under insulation board.
 4. **Roof covering:**
 - a. Hot-mopped or cold-applied Class A, B, or C roof covering.
 - b. Ballasted, adhered or mechanically attached single-ply roof covering.
 - c. Metal roof deck panels in addition to or in lieu of Items 4a and 4b.

TABLE 8—(Continued)

FIRE PROTECTION MATERIAL THICKNESS FOR UNRESTRAINED RATINGS (inches)			
PARAMETER	3 HR.	2 HR.	1 HR.
Deck without gypsum board	$2\frac{3}{8}$	$1\frac{3}{4}$	1
Deck with gypsum board	$1\frac{5}{8}$	$1\frac{1}{8}$	$\frac{5}{8}$

For SI: 1 inch = 25.4 mm; 1 pcf = 16.02 kg/m³.

B. Assembly: Extruded polystyrene foamed plastic roof insulation boards.

- Structural support:** Steel beams or joists supporting minimum $1\frac{1}{2}$ inch fluted steel decking, minimum No. 22 MSG gage.
- Gypsum board:** Five-eighths-inch-thick gypsum board fastened or adhered to metal roof deck under insulation board.
- Insulation:** Extruded polystyrene, minimum thickness 1 inch, maximum thickness 8 inches, and maximum density 2.5 pcf insulation boards.
- Roof covering:**
 - Hot-mopped or cold-applied Class A, B or C roof covering.
 - Ballasted, adhered or mechanically attached single-ply roof covering.

FIRE PROTECTION MATERIAL THICKNESS FOR UNRESTRAINED RATINGS (inches)			
PARAMETER	3 HR.	2 HR.	1 HR.
Deck with gypsum board	NR	$1\frac{5}{8}$	$\frac{3}{4}$

For SI: 1 inch = 25.4 mm.

C. Roof assembly with polyurethane foam plastic roof insulation:

- Structural support:** Steel beams or joists supporting minimum $1\frac{1}{2}$ -inch-deep fluted steel decking, minimum No. 22 MSG gage.
- Gypsum board:** Five-eighths-inch-thick gypsum board fastened or adhered to metal deck under insulation.
- Insulation type:** Polyurethane foamed plastic formed by the simultaneous spraying of two liquid components applied over the gypsum board at a nominal thickness of 1 to 5 inches.

FIRE PROTECTION MATERIAL THICKNESS FOR UNRESTRAINED RATINGS (inches)			
PARAMETER	3 HR.	2 HR.	1 HR.
Deck with gypsum board	$2\frac{1}{2}$	$2\frac{1}{8}$	$1\frac{1}{2}$

For SI: 1 inch = 25.4 mm.

D. Roof assembly with no minimum insulation thickness:

- Structural support:** Steel beams or joists supporting minimum $1\frac{1}{2}$ inch fluted steel decking, minimum No. 22 MSG gage.
- Gypsum board:** Five-eighths-inch-thick gypsum board fastened or adhered to metal roof deck under insulation board.
- Insulation:** No minimum insulation thicknesses with or without gypsum board.
- Roof covering:**
 - Hot-mopped or cold-applied Class A, B, or C roof covering.
 - Ballasted, adhered or mechanically attached single-ply roof covering.
 - Metal roof deck panels in addition to or in lieu of Items 4a and 4b.

FIRE PROTECTION MATERIAL THICKNESS FOR UNRESTRAINED RATINGS (inches)			
For fire protection materials: MK-6/HY, MK-6s, MK-6/HY, ES, RG, Z-106, Z-106/HY, Z-106/G			
PARAMETER	3 HR.	2 HR.	1 HR.
Deck without gypsum board	$2\frac{3}{8}$	$1\frac{3}{4}$	1
Deck with gypsum board	$1\frac{5}{8}$	$1\frac{1}{2}$	$\frac{5}{8}$

For SI: 1 inch = 25.4 mm.

E. Roof assembly with no minimum insulation thickness:

- Structural support:** Steel beams or joists supporting minimum $1\frac{1}{2}$ inch fluted steel decking, minimum No. 22 MSG gage.
- Gypsum board:** Five-eighths-inch-thick gypsum board fastened or adhered to metal roof deck under insulation board.
- Insulation:** No minimum insulation thicknesses with or without gypsum board.
- Roof covering:**
 - Hot-mopped or cold-applied Class A, B, or C roof covering.
 - Ballasted, adhered or mechanically attached single-ply roof covering.
 - Metal roof deck panels in addition to or in lieu of Items 4a and 4b.

FIRE PROTECTION MATERIAL THICKNESS FOR UNRESTRAINED RATINGS (inches)			
For fire protection material: Z-146			
PARAMETER	3 HR.	2 HR.	1 HR.
Deck without gypsum board	$3\frac{3}{4}$	$2\frac{5}{8}$	$1\frac{5}{8}$
Deck with gypsum board	$3\frac{3}{4}$	2	1

For SI: 1 inch = 25.4 mm.

TABLE 8—(Continued)

(F) FIRE PROTECTION MATERIAL THICKNESS FOR WIDE FLANGE MEMBER PROTECTION (inches) ² AND ⁵				
BEAMS	MINIMUM W/D RATIO	3 HR.	2 HR.	1 HR.
Min. W8 x 28	0.8	$\frac{3}{8}$ [$\frac{5}{8}$]	$\frac{7}{8}$ [$1\frac{1}{8}$]	$\frac{1}{2}$ + [$\frac{5}{8}$]
Min. W6 x 16	0.66	$1\frac{1}{2}$ [$1\frac{7}{8}$]	1 [$1\frac{1}{4}$]	$\frac{5}{8}$ [$1\frac{1}{2}$]
Min. W8 x 10	0.37	2 [$2\frac{3}{8}$]	$1\frac{3}{8}$ [$1\frac{5}{8}$]	$\frac{3}{4}$ [$\frac{3}{4}$]

For SI: 1 inch = 25.4 mm.

(G) FIRE PROTECTION MATERIAL THICKNESS FOR STEEL JOIST PROTECTION (inches) ⁴			
SIZE AND SPACING OF STEEL JOISTS	3 HR.	2 HR.	1 HR.
10K1 with or without scrim or lath spaced > 4 ft. o.c.	$3\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{1}{8}$
10K1 with or without scrim or lath spaced, 4 ft. o.c.	$2\frac{7}{8}$	$1\frac{7}{8}$	1
12K3 24 ksi max or 16K2 30 ksi max. joists with or without scrim > 4 ft o.c.	$2\frac{1}{4}$	$1\frac{5}{8}$	1
12K3 24 ksi max or 16K2 30 ksi max. joists with or without scrim 4 ft. o.c.	$2\frac{1}{8}$	$1\frac{1}{2}$	1

For SI: 1 inch = 25.4 mm; 1 lb/sq. yd. = 0.38 kg/m².

*Spatterkote SK3 required on roof decking for MK-6/HY, MK-6/HY ES, MK-6s, Z-106/G, and RG. Firebond Concentrate is required on roof decking for Z-106/HY. Lath is required on roof decking with Z-146.

+Increase thickness by $\frac{1}{16}$ inch for Z-106/HY to the nearest $\frac{1}{8}$ inch.

¹Insulation and roof covering and method of securement must be classified by Underwriters Laboratories Inc. and be recognized in a current ICC-ES evaluation report. Where foam plastic insulation is used, it must be recognized in the roof covering ICC-ES evaluation report.

NR = Not recognized.

²As an alternate to the roof beam thickness provided in Table 8-F, thicknesses for unrestrained beams may be determined by the following equation:

$$T1 = \frac{[(W2 / D2) + 0.6] / 2}{[(W1 / D1) + 0.6]}$$

Where:

- T = Thickness of fireproofing.
- W = Weight of steel beam (pounds per lineal foot).
- D = Heated perimeter of steel beam (inches).
- 1 = Refers to desired beam size and required material thickness.
- 2 = Refers to given beam size and material thickness in table.

Limitations: Minimum thickness must not be less than $\frac{3}{8}$ inch.
W/D ratios must not be less than 0.37.

³1.7 to 3.4 lb./sq. yd. diamond mesh, $\frac{3}{8}$ inch metal lath, $\frac{3}{32}$ to $\frac{3}{16}$ inch fiberglass scrim fabric, or 20 mil strand $\frac{3}{16}$ inch plastic net, secured to one side of each steel joist, is optimal.

⁴Bridging bars or angles must be protected with the coating material thickness required for a minimum distance of 12 inches beyond the joist.

⁵The number in brackets [] refer to the thickness required when the $\frac{1}{2}$ flange tip thicknesses are used.

TABLE 9—MINIMUM AVERAGE THICKNESS OF FIRE PROTECTION MATERIALS
APPLIED TO UNPROTECTED ROOF ASSEMBLIES (inches)^{1, 2, 3, 4 AND 5}

For fire protection materials: MK-6/HY, MK-6/HY ES, MK-6s, RG, Z-106, Z-106/HY, Z-106/G, Z-146, Z-146T, Z-156, Z-156T				
Structural Member	W/D Ratio	1 HR	2 HR	3 HR
W6x16 Beam – Full flange lip thickness	0.66	$\frac{5}{8}$	$1\frac{1}{2}$	$2\frac{1}{4}$
W6x16 Beam – Half flange lip thickness	0.66	$\frac{3}{4}$	$1\frac{7}{8}$	3
10K1 Joist @ 30 ksi > 4 ft. o.c. ^{4,5}	NA	$1\frac{1}{8}$	$2\frac{1}{4}$	$3\frac{1}{2}$
10K1 Joist @ 30 ksi ≤ 4 ft. o.c. ^{4,5}	NA	1	$1\frac{7}{8}$	$2\frac{7}{8}$

For SI: 1 inch = 25.4 mm; 1 lb/sq. yd. = 0.38 kg/m².

NA = Not applicable

¹Insulation and roof covering method of securement must be classified by Underwriters Laboratories Inc. and be recognized in a current ICC-ES evaluation report. Where foam plastic insulation is used, it must be recognized in the roof covering manufacturer's ICC-ES evaluation report.

²Design stress of the steel deck units must not exceed 75 percent of their allowable bending stress.

³Insulating concrete manufacturer's specific application instructions, wire mesh requirements, minimum dry density requirements of concrete and insulation board requirements as specified in individual manufacturer's ICC-ES evaluation reports.

⁴Use of 1.7 to 3.4 lb./sq. yd. diamond mesh 3/8 inch expanded steel lath, $\frac{3}{32}$ to $\frac{3}{16}$ inch fiberglass scrim fabric, or 20 mil strand $\frac{3}{16}$ inch plastic net secured to one side of each steel joist is optional.

⁵Bridging bars or angles must be protected with the coating material thickness required for a minimum distance of 12 inches beyond the joist.

As an alternate to beam thicknesses in Tables 9, thickness for unrestrained beams may be determined on the basis of the following equation:

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

Where:

- T = Thickness of fireproofing (inches).
- W = Weight of steel beam (pounds per lineal foot).
- D = Heated perimeter of steel beam (inches).
- 1 = Refers to desired beam size and required material thickness.
- 2 = Refers to W6x16 beam size and appropriate material thickness in table.

Limitations: Minimum thickness must not be less than $\frac{3}{8}$ inch. W/D ratios must not be less than 0.37.

SECTION V:

LETTER FROM MANUFACTURER THAT EQUIPMENT IS APPROVED TO
PUMP MATERIAL.

**Manufacturer's Letter that Equipment is
Approved to Pump Material**

GRACE

W. R. Grace & Co. - Conn
2500 S. Goinway St.
Santo Ana, CA 92707

June 24, 1998

(206) 675-0012

(206) 675-0013 Fax

Fred S. Shearer & Sons Inc.
7000 S.W. Varns Rd.
Tigard, OR 97223

RE: Grace Fireproofing

To Whom It Concern :

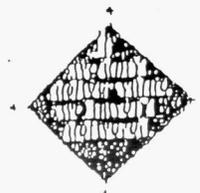
This letter is to verify that Fred S. Shearer & Sons Inc. has the proper equipment and is experienced in the application of our fireproofing products.

If I can be of any further assistance concerning this matter please give me a call.

Sincerely,



Ken L. Dzioba
Architectural Representative



Monokote, Toplax, Retro-Guard, Zambite and Rapid Flow are registered trademarks and Spatterkote and Suretex are trademarks of Grace Construction Products, W.R. Grace & Co.-Conn. We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the user's consideration, investigation and verification, but we do not warrant the results to be obtained. We read all statements, recommendations or suggestions in connection with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W.R. Grace & Co.-Conn., 67 Whittemore Avenue, Cambridge, MA 02140. In Canada, W.R. Grace & Co. of Canada Ltd., 294 Clement Rd. W., Ajax, Ontario, Canada L1R 3C6.

SECTION VI:

FIREPROOFING MANUFACTURER PRODUCT DATA SHEET

**Fireproofing Manufacturers Product
Data Sheet**

RETRO-GUARD® RG Replacement fireproofing

Product Description

Retro-Guard® RG replacement fireproofing is a single component, mill-mixed gypsum plaster based product which requires only the addition of water on the job site to form a consistent, pumpable slurry. RG can be used on structural steel columns, beams, joists, trusses, flat plate cellular and fluted decking.

Features & Benefits

Retro-Guard Cementitious Fireproofing has been specifically developed by Grace Construction Products to meet the needs of the fireproofing respray contractor. Retro-Guard offers the following advantages:

- **Quick set**—in 7 to 10 minutes with the use of Monokote® Accelerator and Injection System
- **Low water ratio**—reduced drying time
- **Less overspray**—work close to steel, less cleanup
- **No noxious fumes** or irritating particulates released during or after application
- **Hard durable surface**
- **Extra-strength bags** for handling and storage ease
- **Fully UL fire tested** and classified for use with the most post-removal lock downs in the industry
- **Dries to a light blue color**—easily identified and differentiated

Materials

- a. Material shall be Retro-Guard RG replacement fireproofing as manufactured by Grace Construction Products.
- b. Mixing water shall be clean, fresh and suitable for domestic consumption, and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material.

- c. Lock down agents shall be UL Classified for use with Retro-Guard RG. Refer to the ULI Fire Resistance Directory current edition for products listed with Retro-Guard under Classification Category CBUI.

Delivery & Storage

- a. All material to be used for fireproofing shall be delivered in original unopened packages bearing the name of the manufacturer, the brand and the proper Underwriters Laboratories Inc. identification.

Mixing

- a. Retro-Guard shall be mixed by machine in a conventional plaster type mixer or a continuous mixer specifically modified for cementitious fireproofing. The mixer shall be kept clean and free of all previously mixed material. The mixer speed in a conventional mixer shall be adjusted to the lowest speed which gives adequate blending of the material and a mixer density of 40–45 pcf (640–720 kg/m³) of material.
- b. Using a suitable metering device and a conventional mixer, all water shall be first added to the mixer as the blades turn. Where possible, the mixer blades shall then be stopped and all the Retro-Guard fireproofing added. The mixer blades shall then be restarted. If the mixer blades are left running, Retro-Guard should be added to the mixer as quickly as possible. Mixing shall continue only until all material is thoroughly wet and no lumps remain. Target density of 43 ± 1 pcf (688 ± 16 kg/m³) is most desirable. Overmixing Retro-Guard will reduce pumping rate and will adversely affect final in-place density and hangability. Undermixing Retro-Guard will negatively affect in-place density and yield.

Steel Surfaces

- a. Prior to the application of Retro-Guard an inspection shall be made to determine that all steel surfaces are acceptable to receive fireproofing. The steel to be

Performance Characteristics

Physical Properties	Recommended Specification	Typical Values	Test Method
Dry density, minimum average	15 pcf (240 kg/m ³)	15 pcf (240 kg/m ³)	ASTM E605
Bond strength	200 psf (9.6 KPa)	339 psf (16.2 KPa)	ASTM E736
Compression, 10% deformation	1,200 psf (51 KPa)	1,440 psf (68.9 KPa)	ASTM E761
Air erosion	Max 0.000 g/ft ² (0.00 g/m ²)	0.000 g/ft ² (0.00 g/m ²)	ASTM E859
High velocity air erosion	No continued erosion after 4 hours	No continued erosion after 4 hours	ASTM E859
Corrosion	Does not contribute to corrosion	Does not contribute to corrosion	ASTM E937
Bond impact	No cracking, spalling or delamination	No cracking, spalling or delamination	ASTM E760
Deflection	No cracking, spalling or delamination	No cracking, spalling or delamination	ASTM E759
Resistance to mold growth	No growth after 28 days	No growth after 28 days	ASTM G21
Surface burning characteristics	Flame spread = 0 Smoke developed = 0	Flame spread = 0 Smoke developed = 0	ASTM E84
Combustibility	Less than 5 MJ/m ² total, 20 kw/m ² peak heat release	Less than 5 MJ/m ² total, 20 kw/m ² peak heat release	ASTM E1354
Impact penetration	Max 6 cm ³ abraded	3.3 cm ³	City of San Francisco
Abrasion resistance	Max 15 cm ³ abraded	8.3 cm ³	City of San Francisco

fireproofed shall be free of oil, grease, excess rolling compounds or lubricants, loose mill scale, rust or any other substance that will impair proper adhesion. Where necessary, the cleaning of steel surfaces to receive fireproofing shall be the responsibility of the abatement contractor, or general contractor.

- b. The project architect shall determine if the painted/primed steel or lock down agent on the steel to receive fireproofing have been tested in accordance with ASTM E119, to provide the required fire resistance rating.
- c. Many Fire Resistance Designs allow the use of painted metal floor or roof deck in place of galvanized decking. Painted decking must be UL listed in the specific fire resistance designs and must carry the UL classification marking. Consult your local Grace sales representative for details.
- d. Prior to application of Retro-Guard, a bonding agent, approved by the fireproofing manufacturer, shall be applied to all concrete substrates to receive Retro-Guard.
- e. In advance of the application of the fireproofing, a bond test shall be conducted on all painted/primed steel surfaces or steel that has been covered with a lock down agent to determine if the paint or lock down agent will impair the ambient bond of the fireproofing.
- f. Where cellular steel decking is present, both cellular and fluted decking requires the application of Spatterkote® SK-3 before application of Retro-Guard RG. The thickness of SK-3 is incorporated into the total fireproofing thickness.
- g. Fireproofing to the underside of steel roof deck assemblies shall be done only after roofing application is complete and roof traffic has ceased.

Application

- a. Application of Retro-Guard Fireproofing can be made in the following sequence:
 1. For thicknesses of approximately 1/2 in. (13 mm) or less, apply in one pass.
 2. For thicknesses of 3/8 in. (16 mm) or greater, apply second passes after the first coat has set.

The use of the Monokote Accelerator Injection System is required to obtain optimal job site application performance. The use of the Monokote Accelerator Injection System will provide quick set material (usually seven to ten minutes after application), greater in-place yield, and the ability to spray an area in essentially one continuous operation. Second coat can be applied as soon as first material applied has set.
- b. Prior to application of Retro-Guard, a bonding agent, approved by the fireproofing manufacturer, shall be applied to all concrete substrates to receive Retro-Guard.
- c. Spatterkote SK-3 shall be applied to all deck areas when flat plate cellular steel decking is present, and as specified in some roof deck designs. Consult current UL Directory for specific use. Spatterkote shall be applied in accordance with manufacturer's application instructions.

- d. Retro-Guard Fireproofing material shall not be used if it contains partially set, frozen or caked material.
- e. Retro-Guard shall have a minimum average dry in-place density of 15 lbs/ft³ (240 kg/m³).
- f. Retro-Guard shall be mixed with water at the job site.
- g. Monokote Accelerator when used shall be mixed and used according to the manufacturers recommendations.
- h. Retro-Guard is applied directly to the steel, at various rates of application which will be job dependent, using standard plastering type equipment or continuous mixer/pump units. A spray gun, with a properly sized orifice and spray shield and air pressure at the nozzle of approximately 20 psi (38 KPa), will provide the correct hangability, density and appearance.

NOTE: If freshly sprayed Retro-Guard does not adhere properly, it is probably due to a too wet mix, poor thickness control, or an improperly cleaned substrate.

Temperature & Ventilation

- a. An air and substrate temperature of 40°F (4.5°C) minimum shall be maintained for 24 hours prior to application, during application and for a minimum of 24 hours after application of Retro-Guard.
- b. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided to achieve a minimum total fresh air exchange rate of 4 times per hour until the material is dry.

Field Tests

- a. The architect will select an independent testing laboratory (for which the owner will pay) to sample and verify the thickness and density of the fireproofing in accordance with the provisions of ASTM E605-93, *Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members* or Uniform Building Code Standard No. 7-6, *Thickness and Density Determination for Spray Applied Fireproofing*.
- b. The architect will select an independent testing laboratory (for which the owner will pay) to randomly sample and verify the bond strength of the fireproofing in accordance with the provisions of ASTM E736.
- c. Results of the above tests will be made available to all parties at the completion of pre-designated areas which shall have been determined at a pre-job conference.

Safety

- a. Retro-Guard is SLIPPERY WHEN WET. The General Contractor and Applicator shall be responsible for posting appropriate cautionary "SLIPPERY WHEN WET" signs.
- b. A Material Safety Data Sheet for Retro-Guard is available on our web site at www.graceconstruction.com or call toll free at 866-333-3SBM.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

Retro-Guard, Monokote and Spatterkote are registered trademarks of W. R. Grace & Co.-Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co.-Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, Grace Canada, Inc., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

This product may be covered by patents or patents pending.
RG-121K Printed in U.S.A. 12/07

Copyright 2007. W. R. Grace & Co.-Conn.
FA/LI/1M

GRACE

MONOKOTE® SPATTERKOTE® SK-3

Product Information

Description

Monokote® Spatterkote® SK-3 is a mill-mixed Portland cement based cementitious spray applied fireproofing accessory product. It is designed to be used with Monokote MK-6®, Z-106/G and Retro-Guard® RG Replacement Fireproofing on cellular steel decking with flat plate on the bottom and some roof-ceiling designs. Cement based Spatterkote bonds tenaciously to flexible galvanized flat plate steel surfaces used in many of today's most advanced structural steel deck designs. When used in conjunction with Monokote MK-6, Z-106/G and/or Retro-Guard Fireproofing, Spatterkote provides the most reliable fireproofing systems available to the spray fireproofing industry.

Uses

Spatterkote SK-3 shall be applied to all cellular steel floor units with flat plate on the bottom before the application of Monokote MK-6, Z106/G or Retro-Guard Replacement Fireproofing. Spatterkote is also required in some roof-ceiling and concrete floor-ceiling designs and is optional on other steel surfaces. The thickness of Spatterkote is included in the total final fireproofing thickness.

Materials

- a. Material shall be Spatterkote, Underwriters Laboratories designation "Type SK-3", as manufactured by Grace Construction Products, W. R. Grace & Co.—Conn. or its processing distributors.
- b. Mixing water shall be clean, fresh and suitable for domestic consumption and free from such amounts of minerals or organic substances as would affect the set of the fireproofing.
- c. Retarder material shall be Red Top Plaster Retarder as manufactured by United States Gypsum or approved equal.

Application

Application procedure shall conform to the material manufacturer's application instructions. Spatterkote shall be spray applied at the approximate rate of 1 lb/20 ft² (1 kg/4.9 m²) [nominal 960 ft²/46 lbs (100 m²/21 kg) bag]. Spatterkote

should be sprayed as its name suggests. After application, the deck areas should look lightly textured and when viewed directly from below, 10–30% of the galvanized surface should remain exposed. A continuous coverage with no deck showing through is NOT acceptable.

Surface Preparation

All surfaces to receive Spatterkote shall be free of oil, grease, paints/primers, loose mill scale, dirt or other foreign substances which may impair proper adhesion of the fireproofing to the substrate. Spatterkote is not intended for application over alkali sensitive primers.

Job Set-Up, Equipment & Spray Instructions

General

Spatterkote can be pumped through the main system directly from the main pump to a smaller pump on the floor or can be applied using a separate mixer/pump set up on the floor. The use of only a main system is considered most cost effective.

For simplest application, start with Spatterkote first thing in the morning before application of Monokote has begun. Pumping will begin with Spatterkote and be immediately followed with retarded Monokote (see caution for "sandwich" Monokote-Spatterkote-Monokote alternate). Predetermine the number of bags of Spatterkote needed to spray the entire floor and place near the mixer. UL requires a minimum waiting period of 30 minutes after Spatterkote application before overspraying with Monokote or Retro-Guard. A single floor or several floors may be sprayed with Spatterkote at one time.

Job Set-Up

Set-up detailed below is based on pumping through the main Monokote system to an FM-9 (2L4 Rotor Stator) pump on the floor.

A large plaster pump, TM-30, A-3.75 or other (presently being used for Monokote application) is used to pump Spatterkote through main system to the hopper of a small pump (FM-9 or other 2L4 Rotor Stator Pump) placed on spray floor. FM-9 is fitted with 100 ft (30.5 m) max of 1¼ in. (31 mm)

plaster hose with 6 ft (1.8 m) pole gun. Pole gun to be 1 or 1 1/4 in. by 5 ft (25 or 31 mm by 1.5 m) aluminum pipe with hose swivel and nozzle fitted with 3/8 in. (10 mm) "tough boy" orifice. The 3/8 in. (10 mm) "tough boy" orifice is essential to obtain best pattern and throw to the steel surface, FM-9 to be fitted with front wheel to increase floor mobility. Monokote floor (main system) hose to be fitted with 2 in. (50 mm) KamLoc Brass (quick fit) fitting at the 2 in. x 1 1/2 in. (50 mm x 38 mm) reducer. 2 in. (50 mm) hose to be disconnected and placed near hopper of FM-9. Large pump must be able to be shut off from spray floor, 10 gal (38 L) of water should be brought to the spray floor to allow for cleanout of the floor pump.

Mixing Procedures

Spattekote is formulated to be mixed with water in a mechanical plaster mixer to form a cohesive, uniform slurry of 44–55 lb/ft³ (700–880 kg/m³). Water nominal 8 1/4–8 3/4 gal (31.2–33.1 L) per bag should be added to the mixer followed by addition of Spatterkote. Mixing should continue and water adjusted to create a wet, creamy mix with the consistency of medium thick tomato/rice soup. Mixing a wet mix at 35 rpm for a period of 1 1/2–3 minutes will produce proper consistency. Mix will be significantly wetter than Monokote.

Pumping

- a. Large plaster pump (TM-30, A3.75 or equal) and hoses should be primed with a small amount of water. Pump should be placed in a low gear and when the hopper is empty the mixer can be dumped and Spatterkote pumping begun. When all the Spatterkote has been mixed and dumped into the pump hopper, the mixer must be dumped and allowed to empty completely. The first 3 bag batch of Monokote MK-6 can then be mixed with the addition of 2.5 oz (74 mL) [one half of a 5 oz (148 mL) dixie cup] of plaster retarder. Retarder must be added or fast setting will occur. When all the Spatterkote has been pumped and the hopper is empty, the retarded Monokote can be dumped and regular Monokote mixing/pumping can continue.
- b. On the spray floor the 2 in. (50 mm) hose (open mouth with quick fit) should be held in the hopper of the FM-9 and the Spatterkote

allowed to flow into the hopper. The FM-9 (soap the night before, see section c, which follows) should be placed in third gear. When the hopper of the FM-9 is approximately 1/2 full, start the pump and immediately begin Spatterkote application. Experience will dictate the proper speed of the large main pump to match the output of the FM-9 floor pump.

- c. When Monokote appears at the mouth of the 2 in. (50 mm) hose, the main pump can be shut off and the 1 1/2 in. (38 mm) Monokote floor hose attached with the quick fit and laid aside until completion of Spatterkote application. When all the Spatterkote has been pumped, 5 gal (19 L) of water can be used to wash down the pump and clean the hoses. When this is complete, an additional 5 gal (19 L) of water pumped through the system will complete the cleanout. When the system is clean, a small amount of liquid dish soap can be "dribbled" over the end of the turning stator tube in hopper. This will lubricate the stator and prevent sticking of the tube and rotor during start up at a later date.

Cautions

1. If Spatterkote is sandwiched between Monokote MK-6, Z-106/G or Retro-Guard (i.e., Monokote pumping-change to Spatterkote-change back to Monokote) the Monokote batches in front of and following Spatterkote **MUST BE RETARDED**. One half of a 5 oz (148 mL) dixie cup of plaster retarder added to the mixing water of a 3 bag batch of Monokote MK-6 or Retro-Guard is sufficient.
2. Whenever changing products, the pump hopper should be allowed to completely empty and the sides scraped clean. Where mixing blades do not clean the mixer, a small amount of water should be added to the mixer and dumped into the full pump hopper to help empty the mixer completely.
3. Caution: Spatterkote is cement-based. It will stain aluminum curtain walls, car finishes, and other surfaces which are attacked by alkali (lime).
4. Always review the information on the bag and in the MSDS before using the product. This product is manufactured for professional use only.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

Monokote, MK-6, Retro-Guard and Spatterkote are registered trademarks of W. R. Grace & Co.—Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co.—Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, Grace Canada, Inc., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

This product may be covered by patents or patents pending.
MK-513G Printed in U.S.A. 12/07

Copyright 2007. W. R. Grace & Co.—Conn.
FA/LL/11M

GRACE

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: MK-6 HY
MSDS Number: Z-01745
Cancelled MSDS Number: Z-01721
MSDS Date: 07/11/2008
Chemical Family Name: Lightweight Gypsum Aggregate Plaster
Product Use: Fireproofing Product.
Chemical Formula: Mixture-NA
CAS # (Chemical Abstracts Service Number): Mixture-NA

Manufactured by:

W.R.Grace & Co.-Conn.
62 Whittemore Avenue
Cambridge, MA 02140

Grace Canada, Inc.
294 Clements Road West
Ajax, Ontario L1S 3C6

In Case of Emergency Call:

In USA: (617) 876-1400 In Canada: (905) 683-8561

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS#	Percent (max)
Calcium Carbonate.	1317-65-3	1-10
Calcium sulfate	007778-18-9	50-100
Cellulose.	65996-61-4	1-10
Polystyrene	009003-53-6	1-10
Quartz	014808-60-7	1-10

SECTION 3 - HAZARDS IDENTIFICATION

Emergency Overview:

Caution!

Causes eye irritation.

Causes skin irritation.

Causes respiratory irritation

Prolonged exposure may cause risk of lung disease (i.e. silicosis and/or lung cancer).

HMIS Rating:

Health: 1*
Flammability: 0
Reactivity: 0
Personal Protective Equipment: B (See Section 8)

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

Potential Health Effects:

Inhalation: May be irritating if inhaled resulting in coughing and sneezing.
May aggravate chronic respiratory conditions such as asthma or bronchitis.
Long term inhalation of dust may increase risk of contracting pneumoconiosis ("dusty lungs") and decrease lung function.
Prolonged inhalation of respirable crystalline silica dust can result in lung disease (i.e. silicosis and/or lung cancer). Symptoms include coughing, shortness of breath, wheezing and reduced pulmonary function.

Eye Contact: Eye contact causes irritation.

Skin Contact: Skin contact causes irritation.
May dry skin.
During hardening (rehydration) this product may slowly develop sufficient heat to cause severe burns possibly resulting in permanent injury. Do not allow product to harden around any body part or while in continuous, prolonged contact with the skin.

Skin Absorption: Not expected to be harmful if absorbed through the skin.

Ingestion: Ingestion not expected to be harmful.

SECTION 4 - FIRST AID MEASURES:

Skin Contact: Wash with soap and water.
If discomfort or irritation persists, consult a physician.
Remove contaminated clothing and wash before reuse.

Eye Contact: Flush eyes with water for at least 15 minutes while holding eyelids open.
If discomfort or irritation persists, consult a physician.

Ingestion: Do not induce vomiting.
Never give anything by mouth to an unconscious person.
If discomfort or irritation persists, consult a physician.

Inhalation: If symptoms develop, get fresh air. If symptoms persist, consult a physician.
If breathing has stopped, give artificial respiration then oxygen if needed.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point:	Not Applicable
Flash Point Method:	Not Applicable
Lower Explosion Limit:	Not Available
Upper Explosion Limit:	Not Available
Auto-Ignition Temperature:	Not Available

NFPA Rating:

Health:	1
Flammability:	0
Reactivity:	0

Extinguishing Media: Not Applicable. Product will not burn.

Special Fire Fighting Procedures: None
No special procedures specific to this product.

Unusual Fire and Explosion Hazards: None unless noted below.

SECTION 6 - ACCIDENTAL RELEASE MEASURES:

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

Spills/Leaks: Use proper personal protective equipment. Do not flush to sewer or allow to enter waterways. Keep unnecessary people away.

If spilled, prevent material from entering water systems. Observing the listed Precautionary Measures found in Section 7 of this document. Dry spills should be immediately swept up and placed in a suitable container to prevent further release of material. Slurry spills should be immediately contained (to minimize the extent of the spill) and absorbed with an inert, non-combustible material. Place material in a suitable container to prevent further release.

SECTION 7 - HANDLING AND STORAGE

- Precautionary Measures:** Avoid contact with eyes, skin and clothing.
Avoid creating and inhaling airborne dust or particulates.
Practice good personal hygiene to avoid ingestion.
Use only with adequate ventilation.
Wash clothing before reuse.
Equip mixers with dust covers.
Provide respiratory protection if needed.
Wear skin and eye protection to avoid contact with dust or spray.
Post "Slippery When Wet" signs where appropriate.
Use anti-slip surfaces on working platforms.
FOR PROFESSIONAL USE ONLY. KEEP OUT OF CHILDREN'S REACH.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT

EXPOSURE GUIDELINES (US)

Ingredient	ACGIH TLV			OSHA PEL			Other
	TWA	STEL	Ceiling	TWA	STEL	Ceiling	
Calcium Carbonate.	10 mg/m ³ TWA (particulate matter containing no asbestos and <1% crystalline silica)	-	-	-	-	-	-
Calcium sulfate	10 mg/m ³ TWA (particulate matter containing no asbestos and < 1% crystalline silica)	-	-	15 mg/m ³ TWA; 5 mg/m ³ TWA (respirable fraction)	-	-	-
Cellulose.	-	-	-	-	-	-	-
Polystyrene	-	-	-	-	-	-	-
Quartz	0.025 mg/m ³ TWA (respirable fraction)	-	-	((250)/(%SiO ₂ + 5) mppcf TWA (respirable)); ((10)/(%SiO ₂ + 2) mg/m ³ TWA (respirable)); ((30)/(%SiO ₂ + 2) mg/m ³ TWA (total dust))	-	-	-

In addition to the exposure limits referenced above, the following non-specific limits for dust apply to this product; OSHA, 15 mg/m³-TWA or Total Dust and 5 mg/m³-TWA as Respirable Dust, ACGIH, 10 mg/m³-TWA as Total Dust and 3 mg/m³-TWA as Respirable Dust.

EXPOSURE GUIDELINES (CANADA)

Employers should consult local Provincial regulatory limits for exposure guidelines which may vary locally.

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

Engineering Controls: Exhaust fans may be necessary when mixing in enclosed areas.

Personal Protective Equipment:

Respiratory Protection: Wear approved respiratory protection (generally a N-95 dust mask is appropriate) to prevent employee exposure from exceeding the limits specified.

Skin Protection: Work gloves or hand creams are recommended to prevent drying of skin.

Eye Protection: At minimum, safety glasses with side shields should be worn where exposure to excessive dust or spray is likely.

Work/Hygienic Practices: Use good personal hygiene practices.

Use bag opening and disposal procedures which minimize dust release. Equip mixers with dust covers to minimize dust released during mixing cycle. After each work shift, workers should shower with soap and water. Work clothing should be changed daily.

Prior to welding or cutting, product must be removed from steel surfaces in those immediate areas where exposure to excessive heat, applied either directly or through conduction, from cutting or welding operations is possible.

All trades should minimize the release of dust during removal of materials by:

Wetting using water, prior to its removal.

Removing small areas of fireproofing at one time.

Maintaining a clean worksite.

Quartz (Crystalline silica) is a naturally-occurring mineral that is commonly contained in materials that are mined from the earth's surface such as sand, limestone, clay and gypsum (Calcium sulfate). Total quartz is a value usually representing the combined fractions of large, non-respirable sized particles and of respirable sized particles (less than ten microns in aerodynamic diameter). It is only the respirable fraction of total quartz that is recognized as hazardous by professionals in the field of Occupational Health and by most regulatory agencies.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Appearance/Odor:	Coarse, free flowing white to black powder, no odor.
Odor Threshold: (ppm)	Not Determined
pH:	Not Available
Vapor Pressure: (Mm Hg)	Unknown
Vapor Density: (Air = 1)	Unknown
Solubility In Water:	Unknown
Specific Gravity: (Water = 1)	Not Available
Evaporation Rate: (Butyl Acetate = 1)	Unknown
Boiling Point:	Not Applicable
Viscosity:	Unknown
Bulk Density: (Pounds/Cubic Foot)(Pcf)	12-16 PCF
% Volatiles (gr/L): (70°F) (21°C)	Not Available

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

SECTION 10 - STABILITY AND REACTIVITY

Chemical Stability: Stable
Conditions To Avoid: None known for this product.
Hazardous Polymerization: Will not polymerize.
Hazardous Decomposition Products: Carbon dioxide, Carbon monoxide and Monomers (C₈H₈) and various polymers (C₈H₈). Temperatures in excess of 4000°F from cutting or welding operations may generate Sulfur dioxide. Upon complete combustion, Carbon monoxide and Carbon dioxide are released.

SECTION 11 - TOXICOLOGICAL INFORMATION

<u>Ingredient(No data unless listed.)</u>	<u>CAS Number</u>	<u>LD50 and LC50</u>
Calcium Carbonate.	1317-65-3	Oral LD50 Rat: 6450 mg/kg
Cellulose.	65996-61-4	Inhalation LC50 Rat: >5800 mg/m ³ /4H; Oral LD50 Rat: >5 g/kg; Dermal LD50 Rabbit: >2 g/kg

Carcinogenicity:

Ingredient	IARC Group 1	IARC Group 2A	IARC Group 2B	NTP Known	NTP Suspect	OSHA
Calcium Carbonate.	No	No	No	No	No	No
Calcium sulfate	No	No	No	No	No	No
Cellulose.	No	No	No	No	No	No
Polystyrene	No	No	No	No	No	No
Quartz	Yes	No	No	Yes	No	Yes

Mutagenicity: Not applicable.
Teratogenicity: Not applicable.
Reproductive Toxicity: Not applicable.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Fate: No data available for product.
Ecotoxicity: No data available for product.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Procedures: Consult all regulations (federal, state, provincial, local) or a qualified waste disposal firm when characterizing waste for disposal. According to EPA (40 CFR § 261), waste of this product is not defined as hazardous. Dispose of waste in accordance with all applicable regulations.

Wastes of this product such as empty bags and excess material are typically not defined as hazardous.

SECTION 14 - TRANSPORTATION INFORMATION

Proper Shipping Name: Not Applicable
UN/NA Number: Not Applicable
Domestic Hazard Class: Nonhazardous
Surface Freight Classification: Wall Plaster
Label/Placard Required: Not Applicable

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

SECTION 15 - REGULATORY INFORMATION

REGULATORY CHEMICAL LISTS:

CERCLA (Comprehensive Response Compensation and Liability Act):
(None present unless listed below)

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>	<u>CERCLA RQ</u>
----------------------	--------------	-------------	------------------

SARA Title III (Superfund Amendments and Reauthorization Act)

SARA Section 312/Tier I & II Hazard Categories:

Health Immediate (acute)	Yes
Health Delayed (chronic)	Yes
Flammable	No
Reactive	No
Pressure	No

302 Reportable Ingredients (Identification Threshold 1%):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>	<u>SARA 302 TPQ</u>
----------------------	--------------	-------------	---------------------

313 Reportable Ingredients (Chemicals present below reporting threshold are exempt):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

National Volatile Organic Compound Emission Standards For Architectural Coatings:

 Volatile Organic Content: (gr/L) 0

WHMIS Classification(s): D2 A

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR). This MSDS contains all the information required by the CPR.

State Regulatory Information:

California Proposition 65: WARNING! This product contains substances known to the state of California to cause cancer, birth defects or other reproductive harm.

Massachusetts Hazardous Substance List(Identification threshold 0.001%(1ppm)):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
Quartz	014808-60-7	4.3924

New Jersey Hazardous Substance List(Identification threshold (0.1%)):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
Pentane	000109-66-0	.1179

Pennsylvania Hazardous Substance List(Identification threshold 0.01%):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

CHEMICAL INVENTORY STATUS:

All chemicals in this product are listed or exempt from listing in the following countries:

US	CANADA		EUROPE	AUSTRALIA	JAPAN	KOREA	PHILIPPINES
TSCA	DSL	NDSL	EINECS/ELINCS	AICS	ENCS	ECL	PICCS
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes

SECTION 16 - OTHER INFORMATION

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: MK-6 HY
MSDS ID Number: Z-01745

MSDS Date: 07/11/2008

Non-Hazardous Ingredient Disclosure:

Chemical Name

CAS Number

Prepared by:	EH&S Department
Approved by:	EH&S Department
Approved Date:	07/11/2008

Disclaimer:

"The data included herein are presented in accordance with various environment, health and safety regulations. It is the responsibility of a recipient of the data to remain currently informed on chemical hazard information, to design and update its own program and to comply with all national, federal, state and local laws and regulations applicable to safety, occupational health, right-to-know and environmental protection."

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote® Accelerator
MSDS ID Number: Z-01766

MSDS Date: 03/25/2009

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Monokote® Accelerator
MSDS Number: Z-01766
Cancelled MSDS Number: Z-01650
MSDS Date: 03/25/2009
Chemical Family Name: Aluminum Sulfate Hydrate
Product Use: Plaster Set-time Accelerator
Chemical Formula: $Al_2(SO_4)_3 \cdot 18 H_2O$ approx.
CAS # (Chemical Abstracts Service Number): 10043-01-3

Manufactured by:

W.R.Grace & Co.-Conn.	Grace Canada, Inc.
62 Whittemore Avenue	294 Clements Road West
Cambridge, MA 02140	Ajax, Ontario L1S 3C6

In Case of Emergency Call:

In USA: (617) 876-1400 In Canada: (905) 683-8561

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS#	Percent (max)
Aluminum sulfate	010043-01-3	50-100

SECTION 3 - HAZARDS IDENTIFICATION

Emergency Overview:

Warning !
Causes eye burns.
Causes skin irritation.
May be harmful if ingested.
Causes digestive tract burns if ingested.

HMIS Rating:

Health:	2
Flammability:	0
Reactivity:	0
Personal Protective Equipment:	E (See Section 8)

Potential Health Effects:

Inhalation: Causes respiratory tract irritation. If prolonged exposure to vapor or mist occurs, effects may be more severe resulting in coughing and breathing difficulties.

Effects include: Coughing, shortness of breath, difficulty breathing, chest tightness and sore throat.

Eye Contact: Eye contact causes severe chemical irritation and burns.

Prolonged eye contact can result in redness and itching.

Skin Contact: Skin contact causes irritation.

Prolonged skin contact may cause skin rash and can result in burns.

Skin Absorption: Not expected to be harmful if absorbed through the skin.

Ingestion: Harmful if ingested.

If ingested, causes burns to the linings of the mouth, esophagus and stomach.

Effects include: Nausea, vomiting and diarrhea.

SECTION 4 - FIRST AID MEASURES:

Skin Contact: Wash with soap and water.

If discomfort or irritation persists, consult a physician.

Remove contaminated clothing and wash before reuse.

Eye Contact: Flush eyes with water for at least 15 minutes while holding eyelids open.

Get immediate medical attention.

Ingestion: Do not induce vomiting.

Never give anything by mouth to an unconscious person.

If discomfort or irritation persists, consult a physician.

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote® Accelerator

MSDS ID Number: Z-01766

MSDS Date: 03/25/2009

Inhalation: If symptoms develop, get fresh air. If symptoms persist, consult a physician.
If breathing has stopped, give artificial respiration then oxygen if needed.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flash Point Method: Not Applicable
Lower Explosion Limit: Not Available
Upper Explosion Limit: Not Available
Auto-Ignition Temperature: Not Available

NFPA Rating:

Health: 0
Flammability: 0
Reactivity: 0

Extinguishing Media: Dry chemical, carbon dioxide, water spray, or chemical foam.

Special Fire Fighting Procedures: Wear self contained breathing apparatus and complete personal and protective equipment when potential exposure to vapor or products of combustion exist. Prevent run off from fire control or dilution from entering streams or drinking water supplies.

No special procedures specific to this product.

Unusual Fire and Explosion Hazards: None unless noted below.

SECTION 6 - ACCIDENTAL RELEASE MEASURES:

Spills/Leaks: Use proper personal protective equipment. Keep unnecessary people away.

If spilled, prevent material from entering water systems, observing the listed Precautionary Measures found in Section 7 of the MSDS.

Dry spills should be immediately swept up and placed in a suitable container to prevent further release of material. Slurry spills should be immediately contained (to minimize the extent of the spill) and absorbed with an inert, non-combustible material. Place material in a suitable container to prevent further release.

SECTION 7 - HANDLING AND STORAGE

Precautionary Measures: Avoid contact with eyes, skin and clothing.

Do not take internally.

Practice good personal hygiene to avoid ingestion.

Use only with adequate ventilation.

Keep bags closed when not in use.

Wash clothing before reuse.

Equip mixers with dust covers.

Provide respiratory protection if needed.

Wear skin and eye protection to avoid contact with dust or spray.

FOR PROFESSIONAL USE ONLY. KEEP OUT OF CHILDREN'S REACH.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT

EXPOSURE GUIDELINES (US)

Ingredient	ACGIH TLV			OSHA PEL			Other
	TWA	STEL	Ceiling	TWA	STEL	Ceiling	
Aluminum sulfate	-	-	-	-	-	-	-

In addition to the exposure limits referenced above, the following non-specific limits for dust apply to this product; OSHA, 15 mg/m³-TWA or Total Dust and 5 mg/m³-TWA as Respirable Dust, ACGIH, 10 mg/m³-TWA as Total Dust and 3 mg/m³-TWA as Respirable Dust.

EXPOSURE GUIDELINES (CANADA)

Employers should consult local Provincial regulatory limits for exposure guidelines which may vary locally.

Engineering Controls: Exhaust fans may be necessary when mixing in enclosed areas.

Personal Protective Equipment:

Respiratory Protection: Wear approved Dust/Mist respiratory (N-95) protection to prevent employee exposure from exceeding the limits specified in this section.

Skin Protection: Work gloves or hand creams are recommended to prevent drying of skin.

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote® Accelerator

MSDS ID Number: Z-01766

MSDS Date: 03/25/2009

Eye Protection: At minimum, safety glasses with side shields should be worn. Where exposure to excessive dust or spray is likely, splash goggles should be worn.

Work/Hygienic Practices: Use good personal hygiene practices.

Use bag opening and disposal procedures which minimize dust release. Equip mixers with dust covers to minimize dust released during mixing cycle.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Solid
Appearance/Odor: White odorless powder.
Odor Threshold: (ppm) Not Applicable
pH: 1% solution-3.5
Vapor Pressure: (Mm Hg) Not Applicable
Vapor Density: (Air = 1) Not Applicable
Solubility In Water: 50% @ 0°C
Specific Gravity: (Water = 1) 1.61
Evaporation Rate: (Butyl Acetate = 1) Not Applicable
Boiling Point: >212°F/100°C
Viscosity: Unknown
Bulk Density: (Pounds/Cubic Foot)(Pcf) Not Applicable
% Volatiles (gr/L): (70°F) (21°C) Not Applicable

SECTION 10 - STABILITY AND REACTIVITY

Chemical Stability: Stable
Conditions To Avoid: None known for this product.
Hazardous Polymerization: Will not polymerize.
Hazardous Decomposition Products: None known for this product.

SECTION 11 - TOXICOLOGICAL INFORMATION

Ingredient(No data unless listed.) **CAS Number** **LD50 and LC50**
Aluminum sulfate 010043-01-3 Oral LD50 Mouse : 6207 mg/kg

Carcinogenicity:

Ingredient	IARC Group 1	IARC Group 2A	IARC Group 2B	NTP Known	NTP Suspect	OSHA
Aluminum sulfate	No	No	No	No	No	No

Mutagenicity: Not applicable.
Teratogenicity: Not applicable.
Reproductive Toxicity: Not applicable.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Fate: No data available for product.
Ecotoxicity: No data available for product.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Procedures: Consult all regulations (federal, state, provincial, local) or a qualified waste disposal firm when characterizing waste for disposal. According to EPA (40 CFR § 261), waste of this product is not defined as hazardous. Dispose of waste in accordance with all applicable regulations. Wastes of this product such as empty bags and excess material are typically not defined as hazardous.

SECTION 14 - TRANSPORTATION INFORMATION

Proper Shipping Name: Not Applicable
UN/NA Number: Not Applicable
Domestic Hazard Class: Nonhazardous
Surface Freight Classification: Aluminum Sulfate, Solid
Label/Placard Required: Not Applicable

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote® Accelerator
MSDS ID Number: Z-01766

MSDS Date: 03/25/2009

SECTION 15 - REGULATORY INFORMATION

REGULATORY CHEMICAL LISTS:

CERCLA (Comprehensive Response Compensation and Liability Act):

(None present unless listed below)

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>	<u>CERCLA RQ</u>
Aluminum sulfate	010043-01-3	100	final RQ = 5000 pounds (2270 kg)

SARA Title III (Superfund Amendments and Reauthorization Act)

SARA Section 312/Tier I & II Hazard Categories:

Health Immediate (acute)	Yes
Health Delayed (chronic)	No
Flammable	No
Reactive	No
Pressure	No

302 Reportable Ingredients (Identification Threshold 1%.):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>	<u>SARA 302 TPQ</u>
----------------------	--------------	-------------	---------------------

313 Reportable Ingredients (Chemicals present below reporting threshold are exempt):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

National Volatile Organic Compound Emission Standards For Architectural Coatings:

Volatile Organic Content: (gr/L) Not Applicable

WHMIS Classification(s): D2 B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR). This MSDS contains all the information required by the CPR.

State Regulatory Information:

California Proposition 65: This product does not contain substances known to the state of California to cause cancer, birth defects or other reproductive harm.

Massachusetts Hazardous Substance List(Identification threshold 0.001%(1ppm)):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

New Jersey Hazardous Substance List(Identification threshold (0.1%)):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

Pennsylvania Hazardous Substance List(Identification threshold 0.01%):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

CHEMICAL INVENTORY STATUS:

All chemicals in this product are listed or exempt from listing in the following countries:

US	CANADA		EUROPE	AUSTRALIA	JAPAN	KOREA	PHILIPPINES
TSCA	DSL	NDSL	EINECS/ELINCS	AICS	ENCS	ECL	PICCS
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes

SECTION 16 - OTHER INFORMATION

Non-Hazardous Ingredient Disclosure:

Chemical Name

CAS Number

Prepared by: EH&S Department

Approved by: EH&S Department

Approved Date: 03/25/2009

Disclaimer:

"The data included herein are presented in accordance with various environment, health and safety regulations. It is the responsibility of a recipient of the data to remain currently informed on chemical hazard information, to design and update its own program and to comply with all national, federal, state and local laws and regulations applicable to safety, occupational health, right-to-know and environmental protection."

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote Spatterkote SK-3
MSDS ID Number: Z-01755

MSDS Date: 07/11/2008

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Monokote Spatterkote SK-3
MSDS Number: Z-01755
Cancelled MSDS Number: Z-01714
MSDS Date: 07/11/2008
Chemical Family Name: Cementitious Mixture
Product Use: Fireproofing Product.
Chemical Formula: Mixture-NA
CAS # (Chemical Abstracts Service Number): Mixture-NA

Manufactured by:

W.R.Grace & Co.-Conn. 62 Whittemore Avenue Cambridge, MA 02140	Grace Canada, Inc. 294 Clements Road West Ajax, Ontario L1S 3C6
--	---

In Case of Emergency Call:

In USA: (617) 876-1400 In Canada: (905) 683-8561

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS#	Percent (max)
Chopped continuous glass filament	065997-17-3	1-10
Polystyrene	009003-53-6	1-10
Portland cement	065997-15-1	50-100
Pulp, cellulose	065996-61-4	1-10
Quartz	014808-60-7	< 1

SECTION 3 - HAZARDS IDENTIFICATION

Emergency Overview:

Warning!

Irritating to eyes, skin and respiratory system.
Prolonged exposure may cause alkali burns resulting in damage to skin and eyes.
Prolonged exposure may cause risk of lung disease (i.e. silicosis and/or lung cancer)

HMIS Rating:

Health:	2*
Flammability:	0
Reactivity:	0
Personal Protective Equipment:	E

Potential Health Effects:

Inhalation: Causes respiratory tract irritation.

Exposure may aggravate chronic respiratory conditions such as asthma or bronchitis. Long-term inhalation of dust may increase risk of contracting pneumoconiosis ("dusty lungs") and reduced pulmonary function.

Prolonged inhalation of respirable crystalline silica dust can result in lung disease (i.e. silicosis and/or lung cancer). Symptoms include coughing, shortness of breath, wheezing and reduced pulmonary function.

Eye Contact: Eye contact causes irritation.

Prolonged contact may cause burns due to the alkaline nature of cement.

Direct contact with Monokote spray may cause physical injury.

Skin Contact: Skin contact causes irritation.

Prolonged skin contact causes burns especially if skin or product is wet. This may occur without warning since little heat is sensed.

Prolonged skin contact can result in permanent damage.

May cause sensitization due to Hexavalent chromium contained in Portland Cement.

Exposure to skin may produce "cement" dermatitis which is due to the alkaline and abrasive properties of cement dust.

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote Spatterkote SK-3
MSDS ID Number: Z-01755

MSDS Date: 07/11/2008

Skin Absorption: Not expected to be harmful if absorbed through the skin.

Ingestion: If ingested, causes irritation or burns to the linings of the mouth, esophagus and stomach.

SECTION 4 - FIRST AID MEASURES:

Skin Contact: Wash with soap and water.

If discomfort or irritation persists, consult a physician.

Remove contaminated clothing and wash before reuse.

Eye Contact: Flush eyes with water for at least 15 minutes while holding eyelids open.

Get immediate medical attention.

Ingestion: Do not induce vomiting.

Never give anything by mouth to an unconscious person.

If discomfort or irritation persists, consult a physician.

Inhalation: If symptoms develop, get fresh air. If symptoms persist, consult a physician.

If breathing has stopped, give artificial respiration then oxygen if needed.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable

Flash Point Method: Not Applicable

Lower Explosion Limit: Not Available

Upper Explosion Limit: Not Available

Auto-Ignition Temperature: Not Available

NFPA Rating:

Health: 2

Flammability: 0

Reactivity: 0

Extinguishing Media: Not Applicable. Product will not burn.

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None unless noted below.

SECTION 6 - ACCIDENTAL RELEASE MEASURES:

Spills/Leaks: If spilled, prevent material from entering water systems. Observing the listed Precautionary Measures found in Section 7 of this document. Dry spills should be immediately swept up and placed in a suitable container to prevent further release of material. Slurry spills should be immediately contained (to minimize the extent of the spill) and absorbed with an inert, non-combustible material. Place material in a suitable container to prevent further release.

Use proper personal protective equipment. Do not flush to sewer or allow to enter waterways.

SECTION 7 - HANDLING AND STORAGE

Precautionary Measures: Avoid contact with eyes, skin and clothing.

Wear skin and eye protection to avoid contact with dust or spray.

Do not take internally.

Practice good personal hygiene to avoid ingestion.

Use only with adequate ventilation.

Wash clothing before reuse.

Equip mixers with dust covers.

Provide respiratory protection if needed.

Wear skin and eye protection to avoid contact with dust or spray.

Post "Slippery When Wet" signs where appropriate.

Use anti-slip surfaces on working platforms.

FOR PROFESSIONAL USE ONLY. KEEP OUT OF CHILDREN'S REACH.

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote Spatterkote SK-3
 MSDS ID Number: Z-01755

MSDS Date: 07/11/2008

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT

EXPOSURE GUIDELINES (US)

Ingredient	ACGIH TLV			OSHA PEL			Other
	TWA	STEL	Ceiling	TWA	STEL	Ceiling	
Chopped continuous glass filament	-	-	-	-	-	-	-
Polystyrene	-	-	-	-	-	-	-
Portland cement	10 mg/m3 TWA (particulate matter containing no asbestos and < 1% crystalline silica)	-	-	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)	-	-	-
Pulp, cellulose	-	-	-	-	-	-	-
Quartz	0.025 mg/m3 TWA (respirable fraction)	-	-	((250)/(%SiO ₂ + 5) mppcf TWA (respirable)); ((10)/(%SiO ₂ + 2) mg/m3 TWA (respirable)); ((30)/(%SiO ₂ + 2) mg/m3 TWA (total dust))	-	-	-

In addition to the exposure limits referenced above, the following non-specific limits for dust apply to this product; OSHA, 15 mg/m3-TWA or Total Dust and 5 mg/m3-TWA as Respirable Dust, ACGIH, 10 mg/m3-TWA as Total Dust and 3 mg/m3-TWA as Respirable Dust.

EXPOSURE GUIDELINES (CANADA)

Employers should consult local Provincial regulatory limits for exposure guidelines which may vary locally.

Engineering Controls: Exhaust fans may be necessary when mixing in enclosed areas.

Personal Protective Equipment:

Respiratory Protection: Wear approved respiratory protection (generally a N-95 dust mask) to prevent employee exposure from exceeding the limits specified.

Skin Protection: Work gloves or hand creams are recommended to prevent drying of skin.

Eye Protection: At minimum, safety glasses with side shields should be worn where exposure to excessive dust or spray is likely.

Work/Hygienic Practices: Use good personal hygiene practices.

Use bag opening and disposal procedures which minimize dust release. Equip mixers with dust covers to minimize dust released during mixing cycle. After each work shift, workers should shower with soap and water. Work clothing should be changed daily.

Prior to welding or cutting, product must be removed from steel surfaces in those immediate areas where exposure to excessive heat, applied either directly or through conduction, from cutting or welding operations is possible.

Remove material in a manner so as to minimize the creation of dust. All trades should minimize the release of dust during removal of materials by:

Applying a spray mist of water to wet product, prior to its removal.

- Removing small areas of fireproofing at one time.
- Maintaining a clean worksite.

Quartz (Crystalline silica) is a naturally-occurring mineral that is commonly contained in materials that are mined from the earth's surface such as sand, limestone, clay and gypsum (Calcium sulfate). Total quartz is a value usually representing the combined fractions of large, nonrespirable sized particles and of respirable sized particles (less than ten microns in aerodynamic diameter). It is only the respirable fraction of total quartz that is recognized as hazardous by professionals in the field of Occupational Health and by most regulatory agencies. Portland Cement may contain trace amounts of heavy metals recognized as carcinogens by NTP, OSHA or IARC.

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote Spatterkote SK-3
MSDS ID Number: Z-01755

MSDS Date: 07/11/2008

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Appearance/Odor:	Coarse, free flowing grey powder, no odor.
Odor Threshold: (ppm)	Not Applicable
pH:	11-13 for Portland Cement
Vapor Pressure: (Mm Hg)	Not Applicable
Vapor Density: (Air = 1)	Not Applicable
Solubility In Water:	Slight
Specific Gravity: (Water = 1)	Not Applicable
Evaporation Rate: (Butyl Acetate = 1)	Not Applicable
Boiling Point:	Not Applicable
Viscosity:	Unknown
Bulk Density: (Pounds/Cubic Foot)(Pcf)	17 - 25
% Volatiles (gr/L): (70°F)(21°C)	Not Applicable

SECTION 10 - STABILITY AND REACTIVITY

Chemical Stability:	Stable
Conditions To Avoid:	None known for this product.
Hazardous Polymerization:	Will not polymerize.
Hazardous Decomposition Products:	Carbon dioxide, Carbon monoxide, Monomers (C8H8) and various polymers (C8H8). Temperatures in excess of 4000°F from cutting or welding operations may generate Sulfur dioxide. Upon complete combustion, Carbon monoxide and Carbon dioxide are released and trace amounts of nitrogen and asphyxiants.

SECTION 11 - TOXICOLOGICAL INFORMATION

Ingredient(No data unless listed.) CAS Number LD50 and LC50

Carcinogenicity:

Ingredient	IARC Group 1	IARC Group 2A	IARC Group 2B	NTP Known	NTP Suspect	OSHA
Chopped continuous glass filament	No	No	No	No	No	No
Polystyrene	No	No	No	No	No	No
Portland cement	No	No	No	No	No	No
Pulp, cellulose	No	No	No	No	No	No
Quartz	Yes	No	No	Yes	No	Yes

Mutagenicity:	Not applicable.
Teratogenicity:	Not applicable.
Reproductive Toxicity:	Not applicable.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Fate:	No data available for product.
Ecotoxicity:	No data available for product.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Procedures: Consult all regulations (federal, state, provincial, local) or a qualified waste disposal firm when characterizing waste for disposal. According to EPA (40 CFR § 261), waste of this product is not defined as hazardous. Dispose of waste in accordance with all applicable regulations. Wastes of this product such as empty bags and excess material are typically not defined as hazardous.

SECTION 14 - TRANSPORTATION INFORMATION

Proper Shipping Name:	Not Applicable
UN/NA Number:	Not Applicable
Domestic Hazard Class:	Nonhazardous
Surface Freight Classification:	Wall plaster
Label/Placard Required:	Not Applicable

W. R. GRACE
MATERIAL SAFETY DATA SHEET

Product Name: Monokote Spatterkote SK-3
MSDS ID Number: Z-01755

MSDS Date: 07/11/2008

SECTION 15 - REGULATORY INFORMATION

REGULATORY CHEMICAL LISTS:

CERCLA (Comprehensive Response Compensation and Liability Act):
(None present unless listed below)

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>	<u>CERCLA RQ</u>
----------------------	--------------	-------------	------------------

SARA Title III (Superfund Amendments and Reauthorization Act)

SARA Section 312/Tier I & II Hazard Categories:

Health Immediate (acute)	Yes
Health Delayed (chronic)	Yes
Flammable	No
Reactive	No
Pressure	No

302 Reportable Ingredients (Identification Threshold 1%.):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>	<u>SARA 302 TPQ</u>
----------------------	--------------	-------------	---------------------

313 Reportable Ingredients (Chemicals present below reporting threshold are exempt):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

National Volatile Organic Compound Emission Standards For Architectural Coatings:

Volatile Organic Content: (gr/L) 0

WHMIS Classification(s): D2 A

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR). This MSDS contains all the information required by the CPR.

State Regulatory Information:

California Proposition 65: WARNING! This product contains substances known to the state of California to cause cancer, birth defects or other reproductive harm.

Massachusetts Hazardous Substance List(Identification threshold 0.001%(1ppm)):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
Quartz	014808-60-7	.9031

New Jersey Hazardous Substance List(Identification threshold (0.1%)):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

Pennsylvania Hazardous Substance List(Identification threshold 0.01%):

<u>Chemical Name</u>	<u>CAS #</u>	<u>Wt %</u>
----------------------	--------------	-------------

CHEMICAL INVENTORY STATUS:

All chemicals in this product are listed or exempt from listing in the following countries:

US	CANADA		EUROPE	AUSTRALIA	JAPAN	KOREA	PHILIPPINES
TSCA	DSL	NDSL	EINECS/ELINCS	AICS	ENCS	ECL	PICCS
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes

SECTION 16 - OTHER INFORMATION

Non-Hazardous Ingredient Disclosure:

<u>Chemical Name</u>	<u>CAS Number</u>
----------------------	-------------------

Prepared by: EH&S Department
Approved by: EH&S Department
Approved Date: 07/11/2008

Disclaimer:

"The data included herein are presented in accordance with various environment, health and safety regulations. It is the responsibility of a recipient of the data to remain currently informed on chemical hazard information, to design and update its own program and to comply with all national, federal, state and local laws and regulations applicable to safety, occupational health, right-to-know and environmental protection."

SECTION VII:

MANUFACTURER WINTER OR COLD WEATHER CONDITIONS
PROCEDURES.

**Manufacturers Cold Weather Conditions
Procedures**

Cold Weather Application

The industry and Grace standard specified minimum application temperature for water containing, setting products is 40 F. (4.4 C.). This minimum temperature includes a safety factor which allows some but not all point to point temperature variation within a building exposed to the environment. There may be temperature variations at various building elevations of high structures, windy conditions may create significant wind chill factors, and measuring devices may not be completely accurate. These factors should always be considered before spraying is begun.

There are cases where applicators have requested supplemental information regarding the performance of our plaster based products applied at temperatures below our standard recommended minimum temperatures. While maintain our recommended minimum temperature specification of 40 F.(4.4 C.) we can advise that injecting MK-6/HY, thereby reducing the set time to below 15 minutes, increases the safety factor. Under controlled laboratory conditions, injected MK-6/HY attained adequate bond when applied to galvanized and bare structural steel substrates when the following conditions were met:

- 1) Substrate temperatures were maintained at a minimum of 35 F. (1.5 C.)
- 2) Ambient air temperatures were maintained at a minimum of 35 F. (1.5 C.)
- 3) Spatterkote is applied to all galvanized deck
- 4) Both air and substrate temperatures are maintained above 35 F. (1.5 C.) for a minimum of 4 hours after application.

It should be understood that due to variable jobsite temperature conditions, Grace assumes no liability for problems due to application of our products at temperatures outside our standard published recommended specifications

Bulletin #169 which follows, further addresses application in marginal conditions.

SECTION VIII:

INSPECTION OF SPRAYED APPLIED FIREPROOFING.

Inspection of Sprayed Applied Fireproofing

MonoQuote

Published by W. R. Grace and Co.-Conn., manufacturers of Monokote® and Retro-Guard® Fireproofing

Special Edition -

Inspection of Spray-applied Fireproofing

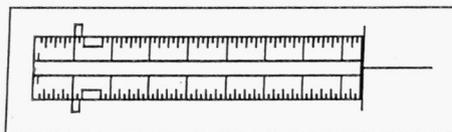
Why Inspect Fireproofing? Fireproofing Inspection Procedures

Field inspection of cementitious and Sprayed-mineral Fiber fire resistive materials is the last step to ensure quality fire protection for a building. Fireproofing must be installed properly. In addition to satisfactory thickness and dry density, sprayed fireproofing should meet or exceed specified in-place performance standards, such as bond strength, damage-ability and air erosion resistance. Architects generally specify in place performance standards to ensure the satisfactory performance of fireproofing materials over the life of a building. It is the roll of inspectors to confirm that the contractor has complied with building code and architectural requirements. Inspection is mandated in the IBC 1707.11, NBC 1705 (1705.12), SBC Section 1709 and UBC Section 1701.5, Item 10. This Section states that the building owner must employ a special inspector during new or retro-fit construction to inspect spray-applied fireproofing. The test methods employed by inspectors are outlined in the IBC, NBC, SBC and the Uniform Building Code Standards 7-6.

These following is an outline of the requirements for cementitious and Sprayed Fiber spray-applied fire Resistive Materials. The inspection includes :

- *Substrate examination*
- *Thickness testing*
- *In-place density testing*
- *Bond Testing*

If the substrate is unsatisfactory, it is generally the responsibility of the general contractor to correct the unsatisfactory condition. If the applied thickness is inadequate, the fireproofing contractor must add additional thickness. In some cases, other trades damage in-place fireproofing. When this occurs, the fireproofing contractor should be employed by the trade(s) which damaged the fireproofing to make repairs. Inadequate in-place density must also be corrected by the fireproofing contractor. Field dry density should satisfy fire-test and in place performance specifications.



Thickness Inspection Gauge Illustrated

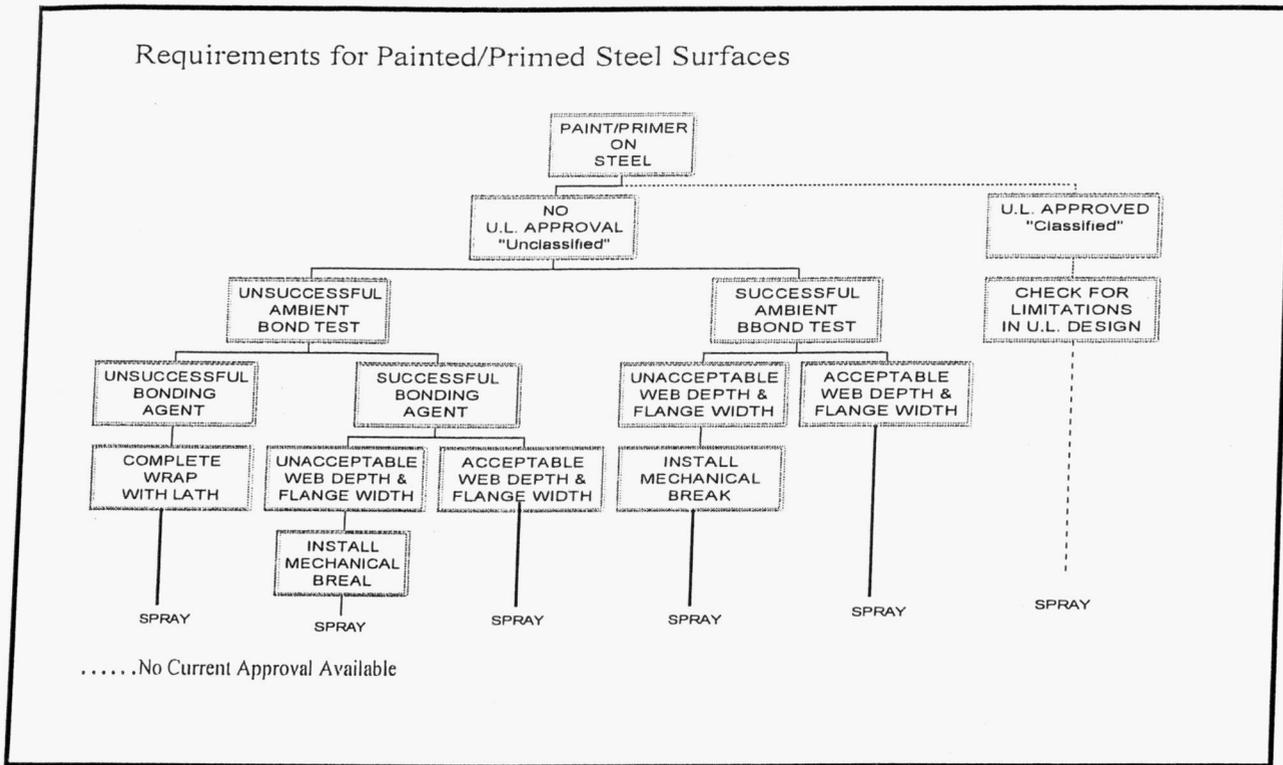
Substrate Examination

As a general rule, a satisfactory substrate for application of fireproofing is free of oil, grease, *paints/primers*, loose mill scale, dirt or other foreign substances which may impair proper adhesion of the fireproofing to the steel or concrete substrate.

Special attention is required when encountering painted or primed structural steel or steel decking. While some decking manufacturers have obtained approval for painted deck in fire-rated assemblies, the inspector should review submittals to be certain an Underwriters Laboratories, Inc. (U.L.) tested and approved painted deck is installed. If the deck is not approved or classified by UL, it may be necessary to apply metal lath to the deck prior to application of fireproofing. Painted or primed structural steel should be avoided. If painted/primed steel is present and the paint/primer is not U.L. approved, then bonding agents and/or mechanical breaks may be required. A flow chart on page 2 illustrates U.L.'s requirements for fireproofing painted/primed steel. The flow chart illustrates when bonding agents and/or mechanical breaks are needed. As an alternative, the paint/primer may be removed from the steel by sandblasting or other methods.

Steel substrates do not have to be perfect however. Rust, because it provides a rough surface, is desirable. Minor substrate imperfections, such as an occasional blot of oil or light flakes of mill scale, can generally be overlooked.

Requirements for Painted/Primed Steel Surfaces



The flow chart above illustrates the steps which are required by U.L. before painted/primed steel can be fireproofed. "Classified" painted/primed steel substrates are tested, in accordance with A.S.T.M. E-119 (full scale fire test), and approved by U.L. for use with a sprayed fireproofing product. Mechanical breaks include metal lath strips or welded pin studs. See the introduction to "Sprayed Material" in the U.L. Fire Resistance Directory for more information. Steel joists may be painted or primed mechanical breaks are not needed.

Thickness Test Methods

For Thickness measurement, a steel rule or thickness depth gauge (as illustrated on page 1) graduated in 1/16 inch increments is used to inspect applied thickness. (See UBC Standard 7.6, ASTM E-605 or AWCI manual 12-A for thickness procedures using fixed probe gauge). Thickness inspection shall be on a *random sample* basis. The codes do not require every square foot of fireproofed surface to be inspected.

The thickness shall be determined by inserting the penetrating pin of the thickness depth gauge perpendicular to and through the fireproofing material to the substrate. When the point of the pin touches the substrate, the disc on the depth gauge shall be moved against the fireproofing with sufficient force on the disc to register the *average plane of the surface*. According to the IBC

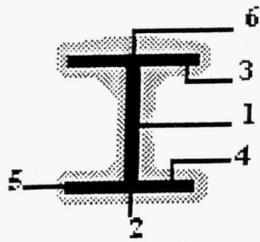
Section 1704.11.3 and UBC 7-6 section 7.603.3: "The acceptance of measurements with a minus tolerance greater than 1/4 inch (6.4mm) shall not be permitted. If design thickness is less than 1 inch (25.4mm), no more than 25 percent less thickness shall be permitted. Measurements greater than 1/4 (6.4mm) for thickness over 1 inch (25.4mm), or 25 percent for thickness less than 1 inch (25.4mm) above the required thickness, shall not be used to determine the thickness average." NBC does not list a thickness tolerance. SBC Section 1709.1.2 allows a thickness tolerance of +/- 1/8.

Thickness testing requirements in IBC section 1704.11.3.2. refer to ASTM E605 requirements. This section requires thickness measurements to be performed on 25% of structural framing members on each floor. ASTM requires 18 thickness measurements for beams, 14 thickness measurements of joists

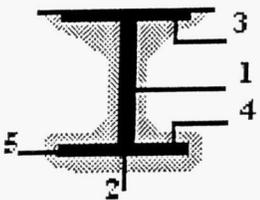
and trusses and 24 thickness measurements on columns measured on a 300mm representative length of each preselected element.

Thickness testing requirements for columns and structural framing members is outlined in NBC section 1705.12.3.2. This section requires thickness measurements to be performed on 25% of each type of structural framing members (on each floor). Columns shall be measured cross-sectionally at twelve locations and beams and girders shall be measured cross-sectionally at seven locations.

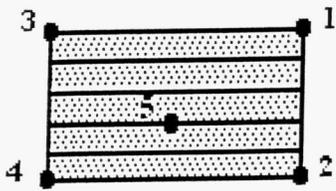
Thickness testing requirements for columns and structural framing members is outlined in SBC Section 1709.1.2. This section requires thickness measurements to be performed on 25% of each type of structural frame members and on 10% of beams that are not part of



Column Probes



Beam Probes



Deck Probes, 144 sq. in.

the structural frame on each floor using ASTM E605 sampling.

Thickness testing requirements differ for columns, primary supports, secondary supports and deck. U.B.C. Section 601.4 defines the *structural frame* as columns and beams connecting to columns and other members essential to the stability of the building as a whole. *Secondary supports* do not frame into columns and support floor or roof panels only. According to U.B.C. Standard Section 7.603.4, 25% of the structural frame on each floor shall be randomly inspected for proper thickness. Section 7.603.5 states that 10% of the secondary supports shall be randomly inspected.

Columns shall be measured cross-sectionally at six locations and beams shall be measured cross-sectionally at five locations as illustrated on the right. The measurements shall be averaged to determine if satisfactory thickness has been applied.

Applied material thickness is also required to be inspected on floor and roof decks also.

IBC Section 1704.11.3.1 requires the thickness to be measured based the average of 4 measurements of 1 thickness measurement for each 1,000 sq.ft. of each floor area in accordance with ASTM E-605.

NBC Section 1705.1.2.3.1 requires 1 thickness measurement for each 1,000 sq.ft. Sample area shall be a minimum of 144 sq. in. with a minimum width of not less than 6 inches. Four measurements shall be averaged and reported as one thickness for each inspected area on each story.

SBC Section 109.1.2. requires thickness measurement for each 10,000 sq.ft. area on each floor.

UBC 7-6 Section 7.603.6 requires Ten floor thickness measurements for each prescribed thickness shall be made for each 10,000 sq. ft. of area. Sample area shall be a minimum of 144 sq. in. with a minimum width of not less than 6 inches. Five measurements (center and four corners) shall be averaged and reported as one thickness for each inspected area.

Half-Flange Tip. Sometimes Wide flange beams and columns flange tips are allowed to have 1/2" the required thickness on the rest of the member. In this case Thickness averaging should be done separately for the flange tips (AWCI manual 12A 5.3.3. 5)

Fireproofing Product Types

All model codes refer to two types of Sprayed Fire resistive Materials: Cementitious and Sprayed Fiber (Sprayed Fiber is also referred to as Sprayed Fibreous materials.) UL, ASTM and AWCI define two types of spray applied fireproofing materials : Cementitious SFRMs and Sprayed Fiber SFRMs series (ASTM E1513-93, AWCI manual 12A and UL listing in 1998 Fire Resistance Directory and current listings in UL Building Materials Directory.)

All 700 series designs in the U.L. Fire Resistance Directory are cementitious materials. Monokote® is a gypsum based cementitious fireproofing material. Cementitious materials can be identified on job sites as materials which are mixed with water and pumped wet. Because cementitious materials are wet mixed, in-place density problems are rare. Sprayed fiber is the second type of fireproofing material. Sprayed fiber materials are pumped dry. Water is added to the dry material at the nozzle. The higher the water pressure, the greater the density of sprayed fiber materials. All 800 series U.L. designs are for sprayed fiber materials. 900 series designs are generally for unprotected assemblies (no spray on the underside of the deck) where cementitious or sprayed fiber is applied to beams only. It is important to remember that a designated thickness for cementitious materials in a 700 series U.L. design is not applicable for a sprayed fiber product, and visa versa.

Fireproofing Density
Inspection Procedures

In-Place Density Testing

UBC 7-6 Section 7.604 and ASTM E605 describe procedures for testing the in-place density of spray-applied fireproofing materials. Density sampling is critical because it measures the ability of a fireproofing material to perform in real world conditions. When performance criteria for fireproofing, such as abrasion resistance or compression strength, are considered, it is important to select a minimum dry density which satisfies the specified performance criteria. Care should be taken to make certain that the minimum dry density you inspect is sufficient to satisfy not only the fire-test criteria (as is reported in a U.L. design), but also the in-place performance criteria outlined in the specification. It is important to provide timely and accurate density test results.

The IBC section 1704.11.4 requires the density in accordance to ASTM E605 (based on a column, beam and deck for each 10,000 square feet of floor area.)

NBC Section 1705.12.4 requires a minimum density of 15pcf and requires sampling rates to be same as the ones for thickness measurements.

SBC Section 1709.1.3 requires density measurements for a column, beam and deck for each 10,000 square feet of floor area or fraction thereof. Density testing is required in accordance with ASTM E605 and density measurement tolerance of not less than 5% of the specified density.

The U.B.C. Standard requires one density test for a column, beam and deck, for each 10,000 square feet of floor area or fraction thereof. Density test procedures are outlined in section 7.604.3. ICBO AC # 23 requires a minimum 15pcf density for both cementitious and sprayed fiber fire resistive material.

Procedure: Basically, a rectangular template (one square foot for example) is used to mark off an area on the surface of the fireproofing. Five thickness measurements (averaged) are taken within the template area. These thickness measurements are used to determine the thickness of the sample to be tested. The test specimen is cut along the perimeter of the template. All the in-place material within the template is carefully removed from the substrate. Density testing errors occur most often when the thickness measurements for the specimen are incorrect or when material removed is incomplete.

The specimen is oven dried at 120°F at a specified relative humidity until a constant weight is obtained.

The constant weight of the dry material is measured. Density is calculated in accordance with the following formula:

Dry density
(pcf) = $W * 1728 \div l * w * t$
where:
l=length of specimen (in)
w=width of specimen (in)
t=thickness of specimen
W=dried weight (lbs)

No dry density sample shall have a density less than 5 percent below the specified minimum density. Where the dry density is unsatisfactory, it must be corrected by replacing the low density material or applying additional thickness over the low density material.

See page 6 for an alternative density determination method when density sampling is difficult.

ALTERNATIVE DENSITY DETERMINATION PROCEDURES

Because fireproofing specimens have irregular surfaces, determining dimensions and thicknesses prior to removing the density sample may pose a problem under U.B.C. 7-6 or E-605 test methods. An alternative method of determining the volume of a specimen for use in calculating density has been included in U.B.C. Standard 7-6. Briefly, this method utilized the concept of displacement. The volume of the fireproofing specimen is precisely determined by measuring the volume of lead shot or polystyrene beads which are displaced when the specimen is placed in a container which previously contained a known volume of shot or beads.

BOND STRENGTH TESTING

All Codes require Bond Strength testing to meet to the specified Cohesive/adhesive performance criteria. All Model codes require a minimum 150 pounds per square foot bond strength. Most Cementitious and Sprayed Fiber Sprayed Fire Resistive Product manufacturers list their products at minimum 200 psf.

IBC Section 1704.11.5 and NBC section 1705.12.5 require at least one test conducted on a column, beam, girder, joist, truss and deck for every 10,000 square feet or fraction thereof of each sprayed area on each story (IBC references ASTM E 736 for testing requirement.)

SBC Section 1709.1.4 and UBC Standard 7-6 Section 7.605 requires

at least one test conducted on a column, beam, and deck for every 10,000 square feet or fraction thereof. They both describe the testing procedure similar to ASTM E 736.

OTHER INSPECTION PROCEDURES

Thickness requirements. It is generally the responsibility of the project architect or engineer to (1) specify appropriate fire-resistive assemblies in the bid documents or (2) provide approved submittals which contain material thickness requirements and proof sources. Material thickness requirements can be determined from U.L. or other approved fire-resistive tests.

A.S.T.M. E-605 is an alternative field testing procedure for sprayed fireproofing. E-605 is similar to U.B.C. Standard No. 7-6. E-605 requires the inspector to check for proper thickness and density in predetermined repetitive manner. The primary difference between E-605 and code requirements is the quantity of thickness probes.

PATCHING

According to Underwriters Laboratories, fireproofing products can not be *re-used* after initial spray application.

Applicators can not patch sprayed fiber fireproofing with cementitious fireproofing according to U.L. Likewise, sprayed fiber materials

must be used to patch sprayed fiber. Special patching kits are available for sprayed fiber materials.

Hand patching. Approvals vary by manufacturer, however, hand patching is generally permitted as long as the density and thickness requirements are maintained. UL limits hand patching to no more than 144 sq. inches for each individual patch area.

SPECIAL REQUIREMENTS

Exposed Fireproofing

High-density SFRMs with high bond and compressive strengths are recommended where the fireproofing is exposed to moving vehicles or other traffic. ICBO ES AC # 23 requires that SFRMs used in these areas to have a minimum density of 35 pcf, minimum bond strength of 7,000 psf and minimum compressive strength of 50,000 psf on any part of the structure less than 8ft above the floor or occupied space below. Otherwise, the exposed element is to be protected with furred wallboard, concrete or cement plaster.

Column Protection

Columns shall be fully protected for their full length according to the four model codes. (IBC Section 713.1, NBC Section 716.2, SBC Section 701.4, UBC Section 704.)

Special Rules for Respray

Lockdown Agents

In retro-fit application (such as asbestos abatement respray work), it is the responsibility of the inspector to determine if the respray fireproofing material has been approved for use by Underwriters Laboratories over the lockdown agent used by the abatement contractor. Abatement contractors use lockdown agents on abated substrates to bond residue asbestos fibers in place. Unlike new construction where fireproofing bonds to bare steel, in retrofit applications the fireproofing bonds to the lockdown agent. Mechanical breaks (such as metal late strips) must be applied to the substrate before application of fireproofing if the lockdown agent has no U.L. approval with the fireproofing. The rules for painted/primed steel apply to unclassified lockdowns also.

Beam and Joist Protection

In certain UL designs and with restrained assembly ratings, beams and joists have lower rating than the assembly rating. All codes require that all structural elements supporting a rated assembly or construction (exterior wall, floor, roof) to have a fire resistance rating equal to or greater the assembly they support. (IBC Section 713.2.2, NBC Section 716.1, SBC Section 601.3.2, UBC Section 601.4 and Table 6-A.)

The IBC default to unrestrained assembly ratings. In this condition, the beams and joists have to have at least equal unrestrained hourly rating to that of unrestrained assembly rating. (IBC Section 703.2.3, ASTM E119)

Fireproofing by Formula

The thickness of fireproofing material can be adjusted using a mathematical formula to determine material thickness requirements for both vertical and horizontal supports. These formulas use W/D ratios and these formulas are based on results from successful fire tests. W/D ratios compare the weight per foot of a steel element to its heated perimeter (the area of the element directly exposed to fire).

Beam Protection Thickness Adjustment

This formula applies to Wide Flange structural elements exposed to fire only on three sides. UL designs list min beam sizes e.g. W8x28, however UL allows that other beam sizes (smaller or larger) in the same design with thicknesses developed by this formula for unrestrained ratings only. This is a generic formula and is applicable only to Unrestrained Beam Ratings. (UL front of the Book, SBC 709.5.2.2.1)

$$T1 = [(W2/D2) + 0.6]T2 / [(W1/D1) + .6]$$

Where :

- T= Thickness of Fireproofing (inches)
- W= Weight of steel beam (lbs. per lineal foot)
- D= Heated perimeter of steel beam (inches)
- 1= Refers to desired beam size and required material thickness
- 2= Refers to given beam size and material thickness

Limitations :

- Minimum thickness $\geq 3/8$ inch
- W/D Ratio ≥ 0.37

Column Protection Thickness Adjustment

This Formula is developed for individual Cementitious and Sprayed Fiber products. It is used to calculate the thickness of structural steel exposed on all four sides. It does not apply to tube or pipe columns. (UBC Standard 7-7, IBC 720.5.1.3, SBC 709.5.1.3, UL designs)

$$h = R/[C1(W/D) + C2]$$

Where :

- R= Fire resistance (hours)
- h= Thickness of fireproofing ranging from 0.375 to 3.875 inches
- D= Heated perimeter of steel column (inches)
- W= Weight of steel column (lbs. per lineal foot)
- C1 and C2 material dependent constants

Limitations:

- W/D ratio ranges from min. 0.33 to max. 6.62
- Minimum thickness is 3/8 inch

Joists and Trusses

Metal lath, scrim and plastic netting may be used to aid in the application of fireproofing to *steel*

joists. Some fire-rated designs permit thickness reductions when such lath, scrim or netting is used, in such case lath or mesh are required.

The amount of Spray protection for joists is dependent on the size of the joist and the maximum tensile stresses it will be support. The following information needs to be evaluated :

- Min depth and weight in lbs. per lineal foot of joist ?
- In some cases and when no joist designation is used, check min. dimensions of top chord, bottom chord and web member sizes?
- mesh or lath required?
- Spacing of joists?
- maximum tensile stress (psi) ?

Truss Elements

Since the web and bottom chord of truss elements are exposed to heat from a fire on all sides, the code requires such elements to receive column-like protection when no testing is available. Therefore, UL and three model codes allow to select column fire-resistive designs to protect truss elements assuming the individual elements of the truss have a sufficient W/D ratio.

Flute Cavities above beams are to be plugged with fireproofing material unless otherwise specified in the listed design (UL guidelines when beams are perpendicular to the flutes.)

Floors. In order to determine if the underside of a floor deck requires spray-applied fireproofing protection, the following information must be evaluated:

- Type, depth and span of deck?
- Thickness of concrete topping over the top of the flutes of metal deck?
- Type and density of concrete topping?

Electrified (cellular) floors generally have special requirements. Trench headers and raceways may require additional thickness, bonding agents and/or welded pin studs. Additional thickness at inserts must extend along the full length of the raceway and onto adjacent deck units.

Roof Protection

Roof assemblies use significantly more fireproofing than floor assemblies. In fire-resistive assemblies, roof materials are limited to specific types (and thicknesses) of roof insulation and roof covering.

Do not assume that all roof coverings and/or roof insulations are approved for use in fire-resistive construction. If a roofing product has an Underwriters Laboratories, Inc. Class A or B roof covering listing, it does not necessarily mean it provides a one or two-hour fire-resistive roof assembly.

The amount of spray protection to the underside of the roof deck will vary for each type of roof insulation. For example, if you specify a phenolic roof insulation and it is changed to fiber board during construction, the thickness of fireproofing to the underside of the roof deck must be changed as well.

Some roof assemblies require gypsum board over the metal deck prior to the installation of roof insulation. All current listings for rated roof construction with Polystyrene insulation require the

use of gypsum wallboard on the deck prior to the installation of the polystyrene.

In order to determine if the underside of the roof deck requires spray-applied fire resistive material protection, the following information must be evaluated:

- Type and depth of deck ?
- Type and thickness of insulation material? (polyisocyanurate, mineral and fiber board, polystyrene or insulating concrete)
- Use of gypsum wallboard and thickness of wallboard
- Maximum Spacing of steel joists and maximum span of steel deck

High Roofs. All codes have provisions to reduce the ratings of roofs above a certain height (BOCA 18ft and 15 ft Table 602 item 11 and Section 715.3 - UBC 25 and 18ft, SBC 20ft Table 600 footnote p.) Generally, the full roof construction needs to be above the required height in order for this exception to be applied. Should any part of the roof be under the required height limit, this exception does not apply and fireproofing has to be applied to all rated roof members.

Future Floors

Sometimes roof decks are built as floor assemblies with concrete poured over the deck and roof insulation installed over the concrete. This type of roof deck could be used as a floor assembly in future renovations for adding new stories.

UL recommends for unprotected floor assemblies, when roof insulation other than polystyrene (≤ 5 pcf) is used over the concrete, that beam ratings be increased to the next ½ hourly rating for unrestrained assembly ratings. For restrained ratings, the beam protection thickness is based on the unrestrained beam rating equal to the restrained assembly rating.

Polystyrene Insulation

There are no fire rated roof assemblies based on ASTM E119 (UL 263) test with only Polystyrene insulation directly over the deck

All rated polystyrene roof assemblies require the use of gypsum wallboard to the deck prior to the installation of polystyrene

Where can I purchase inspection depth gauges? Contact: Hydra-Cone® Inc., Gauge No. 050-62, 3445 Board Rd., York, PA 17402

Please contact us if you need additional information at :
(800) 778-2880

Or, visit us at our Web site :

www.graceconstruction.com