

**Design No. D985**

July 23, 2015

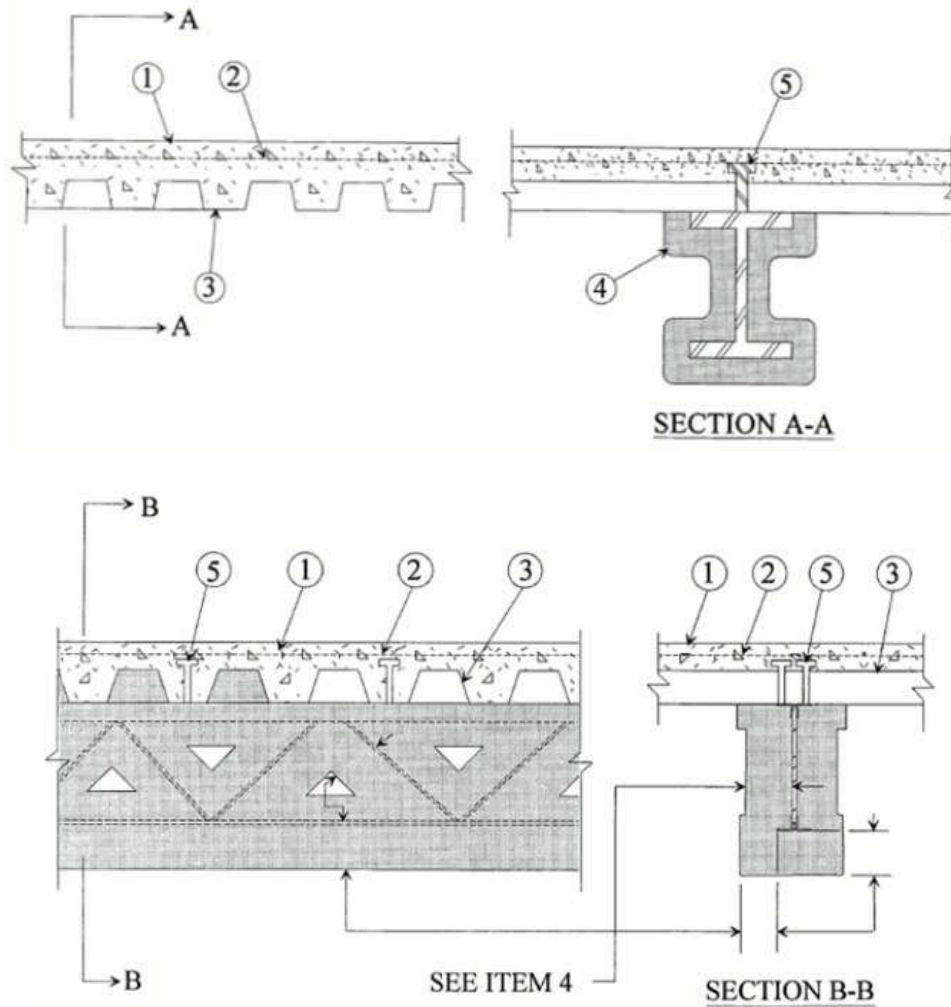
Restrained Assembly Ratings — 3/4, 1, 1-1/2, 2 or 3 Hr (See Items 1, 6 and 10)

Unrestrained Assembly Rating — 0 Hr (See Items 3, 4, 4A and 10)

Unrestrained Beam Ratings — 1, 1-1/2, 2, 3 and 4 Hr (See Items 4, 4A and 10)

Loading Determined by Allowable Stress Design Method or Load and Resistance Factor Design Method published by the American Institute of Steel Construction, or in accordance with the relevant Limit State Design provisions of Part 4 of the National Building Code of Canada.

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



1. **Supports** — W8 x 28 or alternate (per Section IV.6 in the front of the Fire Resistance Directory) steel beam or min 10K1 steel joists when joist substitution applied.

# FIRE RESISTANCE DIRECTORY W R GRACE – NON-LOAD RESTRICTED DESIGNS

## Fire-resistance Ratings - ANSI/UL 263

**1A. Normal Weight or Lightweight Concrete** — Normal weight concrete carbonate or siliceous aggregate, 3500 psi compressive strength, vibrated. Lightweight concrete, expanded shale, or slate aggregate by rotary-kiln method, or expanded clay aggregate by rotary-kiln or sintered-grate method, 3000 psi compressive strength, vibrated, 4 to 7 percent entrained air.

Restrained Assembly Rating Hr	Concrete (Type)	Concrete Unit Weight pcf	Concrete Thkns In
1	Normal Weight	147-153	3-1/2
1-1/2	Normal Weight	147-153	4
2	Normal Weight	147-153	4-1/2
3	Normal Weight	147-153	5-1/4
3/4 or 1	Lightweight	107-113	2-1/2
1	Lightweight	107-120	2-5/8
1-1/2	Lightweight	107-113	3
2	Lightweight	107-113	3-1/4
2	Lightweight	107-116	3-1/4*
2	Lightweight	114-120	3-1/2
3	Lightweight	107-113	4-3/16
3	Lightweight	114-120	4-7/16

\* For use with 2 or 3 in. steel floor and form units only.

**2. Welded Wire Fabric** — 6 x 6, 10 x 10 SWG.

**2A. Negative Reinforcement** — (Not Shown) — Optional — For 3/4, 1, 1-1/2 and 2 Hr Restrained Assembly Rating Only. Used in lieu of Item 2 and with Item 2B. For floor spans with concrete cast continuous over the supporting beams. Deformed bars designed to resist the support moments of the concrete slab in accordance with the latest ACI Building Code Specifications.

**2B. Fiber Reinforcement** — (Not Shown) — For 3/4, 1, 1-1/2 and 2 Hr Restrained Assembly Rating Only. Required with Item 2A. Engineered synthetic fibers added to concrete mix to control shrinkage cracks in concrete. Fibers added to concrete mix at rate of 5 lbs of fiber for each cubic yard of concrete.

**W R GRACE & CO - CONN** — Type Strux 90/40

**3. Steel Floor or Form Units\*** — Composite, fluted, 1-1/2, 2, or 3 in. deep galv units welded to beam or joist. Min gauge is 22 MSG.

**ASC STEEL DECK, DIV OF ASC PROFILES L L C** — 32 in. wide Types NH-32, NHN-32, NHF-32; 36 in. wide Types BH-36, BHN-36, BHN-35-1/4, BHF-36, 2WH-36, 2WHS-36, 3WH-36, 3W-36, DG3W-36. All units may be galvanized or Prime Shield. May be vented designated with a "V" suffix to the product name

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

**CANAM STEEL CORP** — 24 in. wide, Types 1-1/2, 2 or 3 in. LOK-Floor; 36 in. wide, Types 2 or 3 in. LOK-Floor; 24 in. wide, Type N-LOK; 24, 30 or 36 in. wide, Type 1-1/2 in. B-LOK

**CONSOLIDATED SYSTEMS INC** — 24 in. wide Types CFD-2, CFD-3; 24, 30 or 36 in. wide Type CFD-1.5; 24 or 36 in. wide Types Mac-Lok 2, Mac-Lok 3; 24 in. wide, Types B2C, B2FC, NC, NFC; 30 in. wide Type B3C; 24 in. wide Type Versa-Dek

**DECK WEST INC** — 36 in. wide Types B-DW, 2-DW or 3-DW. Side joints of 2-DW and 3-DW may be fastened together with min 1 in. long No. 12 x 14 self-drilling, self-tapping steel screw 36 in. OC

**DESIGN ASSISTANCE CONSTRUCTION SYSTEMS INC** — 36 in. wide Type DACS1.5CD, or 24 in. wide Types DACS2.0CD or DACS3.0CD

**EPI C METALS CORP** — 24 in. wide Types EC150, EC300, EC366, EC150, EC300 inverted; 30 in. wide Types ECB150, ECBR150; 36 in. wide Types EC266

**MARLYN STEEL DECKS INC** — Types 1.5 CF, 2.0 CF or 3.0 CF

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

**VALLEY JOIST** — 24 or 36 in. wide Types WVC 1-1/2 or WVC 2

**VERCO DECKING INC - A NUCOR CO** — 24, 30 or 36 in. wide Types PLB, B, BR; 24 or 36 in. wide Types PLW2, W2, PLW3, W3, 24 in. wide Types PLN, N; 12 in. wide PLW2, W2, PLW3 or W3 units may be blended with 24 or 36 in. wide PLW2, W2, PLW3 or W3 units, respectively; or Type N3. May be phos/ptd

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**VULCRAFT, DIV OF NUCOR CORP** — 24, 30 or 36 in. wide, Type 1.5 VL, 1.5 VLI, 1.5PLVLI; 24 or 36 in. wide. Types 2VLI, 2.0PLVLI, 3VLI, 3.0PLVLI; 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

**The Unrestrained Assembly Rating is equal to the Unrestrained Beam Rating for a max of 3 Hr and is limited to the following floor units and spans:**

- (a) 1-1/2, 2 and 3 in. deep, 24 in. wide, 22 MSG or thicker fluted with clear spans not more than 7 ft, 8 in.
- (b) 1-1/2, 2 and 3 in. deep, 24 in. wide, 20 MSG or thicker fluted with clear spans not more than 8 ft, 8 in.
- (c) 1-1/2 and 2 in. deep, 24 in. wide, 16 MSG or thicker fluted with clear spans not more than 9 ft, 11 in.
- (d) 3 in. deep, 36 in. wide, 18 MSG or thicker fluted and 24 in. wide with clear spans not more than 13 ft, 2 in.

For assemblies utilizing 3-1/4 in. lightweight concrete topping with a max Restrained Assembly Rating of 2 Hr, the Unrestrained Assembly Rating is equal to the Unrestrained Beam Rating and is limited to the following floor units and spans:

- (a) 1-1/2, 2, and 3 in. deep, 24 or 36 in. wide, 22 MSG fluted with clear spans not more than 9 ft, 6 in.
- (b) 2 and 3 in. deep, 24 or 36 in. wide 20 MSG fluted with clear spans not more than 10 ft, 0 in.
- (c) 3 in. deep, 24 in. wide, 20 MSG fluted with clear spans not more than 13 ft, 2 in.

**4. Spray-Applied Fire Resistive Materials** — Applied by mixing with water and spraying in one or more coats to a final thickness as shown in the tables below, to steel beam surfaces which must be clean and free of dirt, loose scale and oil. Min avg and min ind density of 15/14 pcf, respectively for Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, RG. Min avg and min ind density of 22/19, respectively for Types Z-106, Z-106/G and Z-106/HY. Min avg and min ind density of 40/36 pcf respectively for Types AV-650, Z-146, Z-146PC and Z-146T cementitious mixture. Min avg and min ind density of 50/45 pcf respectively for Types AV800, Z-156, Z-156T and Z-156PC. For method of density determination, refer to Design Information Section.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	W8x28 Beam (see Note #1)	
			Fluted Floor Units w/Light Weight Concrete	Fluted Floor Units w/Normal Weight Concrete
1	1	1	3/8	5/16
			5/8#	
1-1/2	1	1	3/8	5/16
			5/8#	
1-1/2	1-1/2	1-1/2	5/8	9/16
			15/16#	
2	1	1	3/8	5/16
			5/8#	
2	2	2	15/16	13/16
			1-1/4#	
3	1-1/2	1-1/2	5/8	9/16
3	3	3	1-9/16	1-5/16
3	3	4	2-1/8	1-7/8

**Note #1: Joists from the N series designs may be substituted for the listed beam. 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.**

# This thickness applies when optional Item 10 is used over 3-1/4 in. light weight concrete topping.

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Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Joist Thickness	
			Joist Spacing More than 4 ft OC	Joist Spacing 4 ft OC or less
1	1	1	7/8	3/4
1-1/2	1	1	7/8	3/4
1-1/2	1-1/2	1-1/2	1-5/16	1-1/8
2	1	1	7/8	3/4
2	2	2	1-3/4	1-1/2
3	1-1/2	1-1/2	1-7/16	1-7/16
3	3	3	2-9/16	2-5/16

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when normal weight concrete is used and the thickness applied to the beams' lower flange edges is reduced to one-half that shown in the table.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	W8x28 Beam and NW Concrete
1	1	1	3/8
1-1/2	1	1	3/8
1-1/2	1-1/2	1-1/2	5/8
2	1	1	3/8
2	2	2	7/8
3	1-1/2	1-1/2	5/8
3	3	3	1-7/16
3	3	4	1-15/16

+ Thickness applied to beams' lower flange edges shall be a minimum of 1/4 in.

**ARABIAN VERMICULITE INDUSTRIES** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, Z-106, Z-106/G, Z-106HY, Z-146, AV-650, AV-800

**GRACE KOREA INC** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, Z-106/G, Z-106, Z-106HY, Z-146

**W R GRACE & CO - CONN** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, RG, Z-106/G, Z-106, Z106HY, Z-146, Z-146T, Z-146PC, Z-156, Z-156T, Z-156PC

5. **Shear-Connector-Studs-Optional** — Studs 3/4 in. diam by 3 in. long, for 1-1/2 in. deep form units to 5-1/4 in. long for 3 in. deep form units, headed type or equivalent per AISC specifications. Welded to the top flange of the beam through the steel form units.

6. **Electrical Inserts** — (Not Shown) — Classified as "Outlet Boxes and Fittings Classified for Fire Resistance".

**WIREMOLD CO** — After set Inserts. Single-service after set inserts installed per accompanying installation instructions in 2-1/2 in. diam hole core-drilled through min 3-1/4 in. thick concrete topping to top of cell of any min 3 in. deep cellular steel floor unit specified under Item 3. Spacing shall be no more than one insert in each 10 sq ft of floor area in each span with a min center to center spacing of 16 in. If the high potential and low potential raceways of the cellular steel floor unit are separated by a valley filled with concrete, the center to center spacing of the high potential and low potential single-service after set inserts may be reduced to a min of 7-1/2 in. Restrained Assembly Rating is 2 hr or less with internally protected Type 436 after set insert with Types M4-, M6- or M8- Series single-service activation fitting

**WIREMOLD CO** — Internally protected Type 436 after set insert with Type M4-, M6- or M8- Series single-service activation fitting

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## Fire-resistance Ratings - ANSI/UL 263

7. **Roof Covering Materials\*** — (Optional, not shown) — Consisting of materials compatible with insulations described herein which provide Class A, B or C coverings. See Roofing Materials and Systems Directory - Roof Covering Materials (TEVT).

8. **Insulating Concrete** — (Not Shown) — Optional. Various types of insulating concrete prepared and applied in the thickness indicated:

A. **Vermiculite Concrete** — (Not Shown) — Optional.

1. Blend 6 to 8 cu ft of Vermiculite Aggregate\* to 94 lb Portland Cement and air entraining agent. Min thickness of 2 in. as measured to the top surface of the structural concrete or foamed plastic (Item 9) when it is used.

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2. Blend 3.5 cu ft. of Type NVC Concrete Aggregate\* or Type NVS Vermiculite Aggregate\* to 94 lb Portland Cement. Slurry coat, 1/8 in. thickness beneath foamed plastic (Item 9) when used, 1 in. min topping thickness.

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Vermiculite concrete may be covered with Roof Covering Materials (Item 7).

B. **Cellular Concrete-Roof Topping Mixture\*** — Concentrate mixed with water and Portland Cement per manufacturers specifications. Min. thickness of 2-in. as measured to the top surface of the structural concrete or foamed plastic (Item 9) when used. 28-day min compressive strength of 190 psi as determined with ASTM C495-66.

**AERIX INDUSTRIES** — Cast dry density of 37 (+ or -) 3.0 pcf

**CELCORE INC** — Type Celcore with cast dry density of 31 (+ or - 3.0) pcf or Type Celcore MF with cast dry density of 29 (+ or - 3.0) pcf

**ELASTIZELL CORP OF AMERICA** — Type II. Mix #1 of cast dry density 39 (+ or -) 3.0 pcf, Mix #2 of cast dry density 40 (+ or -) 3.0 pcf, Mix #3 of cast dry density 47 (+ or -) 3.0 pcf

**LITE-CRETE INC** — Cast dry density of 29 (+ or -) 3.0 pcf

**SIPLAST INC** — Mix No. 1 or 2. Cast dry density of 32+3 (Mix No. 1) or 36+3 (mix No. 2) pcf

C. **Perlite Concrete** — Mix consists of 6.2 cu ft Perlite Aggregate\* to 94 lbs of Portland cement and 1-1/2 pt air entraining agent. Compressive strength 80 psi min.

See Perlite Aggregate (CFFX) category for names of Classified companies.

D. **Cellular Concrete-Roof Topping Mixture\*** — Foam Concentrate mixed with water, Portland Cement and UL Classified Vermiculite Aggregate per manufacturer's application instructions. Cast dry density of 33 (+ or -) 3.0 pcf and 28-day compressive strength of min 250 psi as determined in accordance with ASTM C495-86.

**AERIX INDUSTRIES** — Mix No. 3

**SIPLAST INC** — Mix No. 3

E. **Floor Topping Mixture\*** — (Optional, not shown) — Approx 4.5 gal of water to 41 lbs of NVS Premix floor topping mixture. Slurry coat 1/8 in. thickness beneath foamed plastic (Item 9) when used, 1 in. min topping thickness.

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Floor Topping Mixture may be covered with Built-Up or Single Membrane Roof Covering.

9. **Foamed Plastic\*** — (Optional, not shown) — For use only with vermiculate or cellular concretes or Floor Topping mixture (Item 8E) -Rigid polystyrene foamed plastic insulation having slots and/or holes sandwiched between vermiculite concrete slurry which is applied to the normal or lightweight concrete surface and concrete topping.

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**VERMICULITE PRODUCTS INC**

10. **Roof Insulation-Mineral and Fiber Boards\* or Foamed Plastic\*** — (Optional, not shown) — Mineral and fiber boards or polyisocyanurate roof insulation applied over concrete floor with no restriction on board thickness. When mineral and fiber boards or polyisocyanurate roof insulation are used the unrestrained beam rating shall be increased by a min of 1/2 hr. See Mineral and Fiber Boards (CERZ) or Foamed Plastic (CCVW) category for names of Manufacturers.

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