

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

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

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

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

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

Design No. D949

January 18, 2019

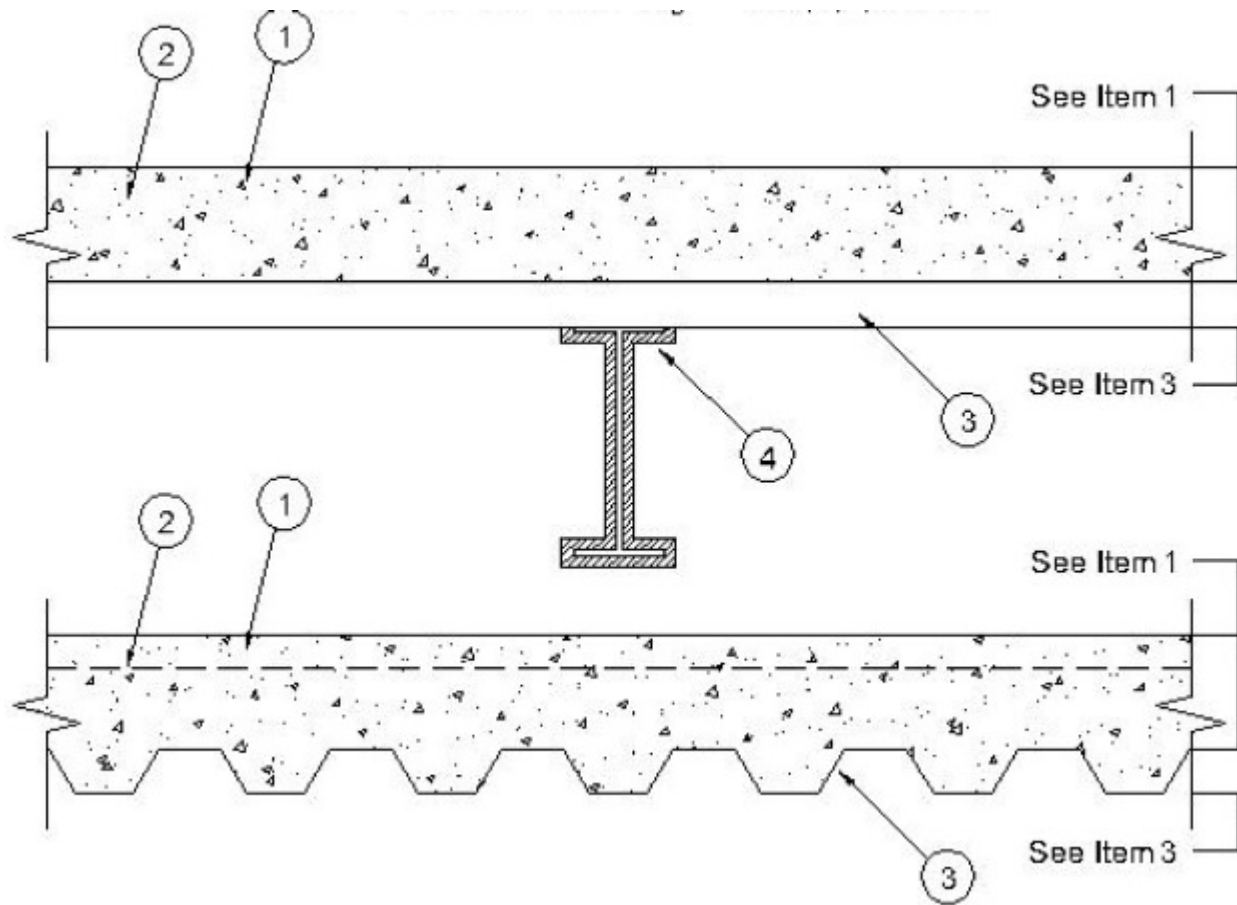
Restrained Assembly Ratings — 3/4, 1, 1-1/2, 2, or 3 Hr. (See Item 1, 4 and 6)

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

Unrestrained Beam Ratings — 1, 1-1/2, 2, 3, or 4 Hr. (See Item 4)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide **BXUV or **BXUV7****

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



Supports — W8x28 min size steel beam or min.10K1 steel joists.

1. 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 (See Item 6) | 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.

3. **Steel Floor and Form Units*** — Composite 1-1/2, 1-5/8, 2 or 3 in. deep galv units or 4-1/2 in. deep noncomposite galvanized units. Fluted units may be uncoated or phosphatized/painted. Min gauges are 22 MSG for fluted and 20/20 MSG for cellular units.

(1) all 18, 24, 26, 28 or 36 in. wide cellular.

(2) all fluted.

(3) one or two 3 in. deep, 12 in. wide, 18/18 MSG min cellular units, alternating with 3 in. deep fluted or other cellular.

(4) any blend of fluted and 18, 24, 26, 28, or 36 in. wide cellular.

(5) 3 in. deep, 30 in. wide cellular with 8-1/8 in. wide valley along side joints may be used when 3/8 in. diam reinforcing bars are placed 1-1/2 in. to each side of side joints and 1 in. above bottom of unit.

(6) Corrugated, 1-5/16 in. deep, 30 in. wide, 24 MSG min galv units with shear wires factory welded to deck corrugations. Welded to supports 12 in. OC. through welding washers. For shear wire spacing of 8 in. or less the steel deck stress shall not exceed 20 KSI. For shear wire spacing greater than 8 in. OC. but less than or equal to 12 in. OC., steel deck stress shall not exceed 12 KSI.

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, BHF-36A, 2WH-36, 2WHS-36, 2WHF-36, 2WHF-36A, 3WxH-36, 3WxHF-36, 3WxHF-36A, 3WH-36, 3WHF-36, 3WHF-36A, 3W-36, 3WF-36, DG3W-36, DG3WF-36. All units may be galvanized or Prime Shield. Non-cellular decks may be vented designated with a "V" suffix to the product name. Cellular deck top and bottom sections may be riveted together (designated with "Fr") vs. arc spot welded, "F".

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

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

NEW MILLENNIUM BUILDING SYSTEMS L L C — 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; 12 in. wide Mac-Way cellular 45 MOW, 2-633 MTWA, 3-633 MTWA, 2-633MTWV, 3-633MTWV+, 24 in. wide Type Versa-Dek.

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

EPIC METALS CORP — 24 in. wide Types EC150, ECP150, EC300, ECP300, EC366, ECP366, EC150, EC300 inverted, Epicore A; 2.0 ECA, 30 in. wide Types ECB150, ECBR150; 36 in. wide Type EC266.

GENS METALS INC — 24 or 36 in. wide Types LF2, LF3.

MARLYN STEEL DECKS INC — Type 1.5 CF, 2.0 CF or 3.0 CF.

CHIA TEH CONSTRUCTION MATERIAL CO LTD — 24 or 36 in. wide Mac-Lok 3; 24 in. wide CFD-3.

HAMBRO STRUCTURAL SYSTEMS, DIV OF CANAM STEEL CORP — 36 in. wide, 1-1/2 in. Type P3615HB. The max superimposed loadings for Type P3615HB units shall not exceed 250 PSF. For single spans, the use of the units shall be limited to 5 ft 6 in., 6 ft 0 in. and 6 ft 6 in. max spans for the 22, 20 and 18 gauge units, respectively. For multiple spans, 18 gauge units may be used on a max 7 ft 6 in. spans with a max total superimposed loading of 240 PSF.

H H ROBERTSON — QL Types, 24 in. wide 3 or 3 inverted, UKX, UKX-3, 2 in. 99, AKX, 21 or 21 inverted, 121, NKX, TKX; 24 or 30 in. wide GKX, GKXH, GKX-A; 36 in. wide 99, AKX, WKX; 24, 26, or 36 in. wide NKX; 1.5NKC, NKC, AKX, 2 or 3 in. TKC; 12 in. wide noncomposite Sec. 12; 17 in. wide 21; 26 or 28 in. wide UKX, 87.5 cm wide. Side joints of QL, 99, 121, WKX, TKX, TKC, and Metric units - QL-77-900; QLC-78-900 may be welded together 60 in. OC. Side joints of 99, AKX, WKX, GKX, GKX-A, TKX and Metric units - QL-77-900 and QLC-78-900 may be fastened together with min 1 in. long No. 12x14 self-drilling, self-tapping steel screws 36 in. OC.

NEW MILLENNIUM BUILDING SYSTEMS L L C — 24 or 36 in. wide Types 2.0CD, 3.0CD, 2.0CFD, 3.0CFD, 3.0CFDES; 24, 30 or 36 in. wide Types 1.5CD, 1.5CDI, 1.5CDR, 1. Fluted units may be phos/painted or galvanized.

ROOF DECK INC — 36 in. wide Types LOK 1 1/2, LOK 1 1/2 R; 24 in. wide Types LOK-2, LOK-3.

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

VERCO DECKING INC - A NUCOR CO — FORMLOK™ deck types PLB, B, BR, PLN3, N3, PLN, N, PLW2, W2, PLW3, W3. Units may be galvanized, phos./ptd., or mill finish. Units may be cellular or acoustical cellular, with the suffix "CD" or "CD-AC" added to the product name, respectively. All non-cellular deck may be vented or non-vented. 12 in. wide PLW2, W2, PLW3 or W3 units may be blended with 24 or in. wide PLW2, W2, PLW3 or W3 units, respectively.

VULCRAFT, DIV OF NUCOR CORP — 24, 30 or 36 in. wide, Types 1.5VL, 1.5VLI, 1.5VLP, 1.5VLR; 24 or 36 in. wide, Types 2VLI, 3VLI, 2VLP, 3VLP. Side joints of Type 1.5VL may be fastened together with min 1 in. long No. 12x14 self-drilling, self-tapping steel screws 36 in. OC max.

WIREMOLD CO — 24 in. wide, Types 2 or 3 in. WDR.

Spacing of welds attaching units to supports shall be 12 in. OC for 12, 24, and 36 in. wide units, four welds per sheet for 30 in. wide units, 6 in. OC for 18 in. wide and Sec. 12 units. Unless noted otherwise, adjacent units button-punched or welded together 36 in. OC along side joints. Adjacent 18 in. wide units welded together 30 in. OC along side joints. For **3 Hr. Rating**, units with overlapping type side joints welded together 24 in. OC max.

When a superimposed load of 250 PSF is desired the spacing of welds or button-punches shall not exceed 24 in. OC along side joints.

+12 in. wide, 1-1/2 in. deep Mac-Way units may be blended with 24 in. wide B2C or 30 in. wide B3C units in a blend of one cell to one or more fluted units. 12 in. wide, 2 in. deep Mac-Way units may be blended with 36 in. wide Mac-Lock 2 units in a blend of one cell to one or more fluted units. 12 in. wide, 3 in. deep Mac-Way units may

be blended with 36 in. wide Mac-Lock3 units in a blend of one cell to one or more fluted units. The side edge of the fluted unit is placed on the top of the side edge of the Mac-Way unit and the two are welded together with welding washers spaced a max. of 32 in. OC for Mac-Lock 2 or 3 units and a max. of 24 in. OC for the B2C or B3C units.

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

(a) 1-1/2 in. deep, 24 in. wide, 22 MSG or thicker fluted with clear spans not more than 7 ft 8 in.

(b) 1-1/2 in. deep, 24 in. wide, 20 MSG or thicker fluted with clear spans not more than 8 ft 8 in.

(c) 1-1/2 in. deep, 24 in. wide, 16 MSG or thicker fluted and 18/18 MSG or thicker cellular 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, 20/18 MSG or thicker cellular with clear spans not more than 13 ft 2 in.

3A. Steel Floor and Form Units* — As an alternate to Item 3, 2 in. deep, 20 MSG composite units.

VULCRAFT, DIV OF NUCOR CORP — 36 in. wide. Types 2VLI

4. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to the beam to the final thicknesses shown below. Deck crest areas shall be filled with Spray-Applied Fire Resistive Materials above the beam. Beam surfaces must be 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 19/18 pcf respectively for Types 7GP and 7HD. For method of density determination, see Design Information Section.

When Joists are utilized:

| Joist Thickness | | | | |
|---------------------|-----------------------|-------------------|----------------|--|
| Restrained Assembly | Unrestrained Assembly | Unrestrained Beam | SFRM Thickness | SFRM Thickness Joist spacing 4 ft. OC spacing or less |
| 1 | 1 | 1 | 3/4 | 3/4 |
| 1-1/2 | 1 | 1 | 1-3/8 | 1-3/8 |
| 1-1/2 | 1-1/2 | 1-1/2 | 1-7/16 | 1-3/8 |

| | | | | |
|---|-------|-------|---------|--------|
| 2 | 1 | 1 | 2-1/16 | 2-1/16 |
| 2 | 2 | 2 | 2-1/8 | 2-1/16 |
| 3 | 1-1/2 | 1-1/2 | 3-11/16 | 3-3/8 |
| 3 | 3 | 3 | 3-11/16 | 3-3/8 |

| W8x28 Beam Thickness | | | | |
|-----------------------------|------------------------------|--------------------------|-----------------|-----------------------|
| Restrained Assembly | Unrestrained Assembly | Unrestrained Beam | Concrete | SFRM Thickness |
| 1 | 1 | 1 | LW or NW | 3/8 |
| 1-1/2 | 1 | 1 | LW or NW | 3/8 |
| 1-1/2 | 1-1/2 | 1-1/2 | LW or NW | 9/16 |
| 2 | 1 | 1 | LW or NW | 3/8 |
| 2-1/2** | 1 | 1 | LW or NW | 1 |
| 2 | 2 | 2 | LW or NW | 13/16 |
| 3 | 3 | 3 | LW or NW | 1-1/4 |
| 3-1/2** | 3 | 3 | LW or NW | 1-1/2 |
| 4 | 4 | 4 | LW or NW | 1-5/8 |

** The 2-1/2 and 3-1/2 hour ratings are for use when mineral fiber boards, polystyrene insulation exceeding 5 pcf, or polyisocyanurate insulation are used over the concrete in D900 series designs as stated in the front of the Fire Resistance Directory - III. FLOOR-CEILINGS AND ROOF-CEILINGS, Item 21. Roof Insulation.

The thickness of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the thickness applied to the beams lower flange edges is reduced by one-half and the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units.

| W8x28 Half Flange Beam Thickness | | | | |
|---|------------------------------|--------------------------|-----------------|-----------------------|
| Restrained Assembly | Unrestrained Assembly | Unrestrained Beam | Concrete | SFRM Thickness |
| 1 | 1 | 1 | LW or NW | 3/8+ |
| 1-1/2 | 1 | 1 | LW or NW | 3/8+ |
| 1-1/2 | 1-1/2 | 1-1/2 | LW or NW | 9/16 |
| 2 | 1 | 1 | LW or NW | 3/8+ |
| 2-1/2** | 2 | 2 | LW or NW | 1-1/16 |
| 2 | 2 | 2 | LW or NW | 13/16 |

| | | | | |
|---------|-------|-------|----------|---------|
| 3 | 1-1/2 | 1-1/2 | LW or NW | 9/16 |
| 3 | 3 | 3 | LW or NW | 1-3/8 |
| 3-1/2** | 3 | 3 | LW or NW | 1-3/4 |
| 4 | 4 | 4 | LW or NW | 1-15/16 |

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

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

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.**"

H H ROBERTSON — Preset Inserts

For use with 2-1/2 in. lightweight concrete topping over QL-WKX steel floor units. Installed over factory-punched holes in floor units per accompanying installation instructions.

Spacing shall not be more than one insert in each 14 sq ft. of floor area with spacing along floor units not less than 48 in. OC. The holes cut in insert cover for passage of wires shall be no more than 1/8 in. larger diam. than wire. Restrained Assembly Rating is 3/4 hr with Tapmate II-FS-1 and 1 hr with Tapmate II-FS-2 inserts.

H H ROBERTSON — Tapmate II-FS-1, II-FS-2; Series KEB.

(2)**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 Type 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.

7. Mineral and Fiber Boards* — (Optional, not shown). Applied over concrete floor with no restriction on board thickness. When mineral and fiber boards are used, the unrestrained beam rating shall be increased by a minimum of 1/2 hr.

See Mineral and Fiber Board (CERZ) category for names of manufacturers.

8. Roof Covering Materials* — (Optional, not shown) Consisting of materials compatible with insulations described herein which provide Class A, B or C coverings. See Built-Up Roof Covering Materials in Building Materials Directory.

9. 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 10) when it is used.

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2. Blend 3.5 cu. ft. of Type NVC Concrete Aggregate* or Type NVS Vermiculite Aggregate* coat, 1/8 in. thickness beneath foamed plastic (Item 10) when used, 1 in. min topping thickness.

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Vermiculite concrete may be covered with Roof Covering Materials (Item 8).

B. Cellular Concrete — Roof Topping Mixture* — concentrate mixed with water and Portland cement per manufacturers specifications. Cast dry density and 28— day min. compressive strength of 190 psi as determined with ASTM C495— 66.

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.

CELLULAR CONCRETE SOLUTIONS L L C — Cast dry density of 37 (+ 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.

C. Cellular Concrete-Roof Topping Mixture* — Concentrate mixed with water and Portland cement per manufacturers specifications. 28-day min. compressive strength of 190 psi as determined with ASTM C495-66.

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D. Perlite Concrete — 6 cu ft. of Perlite Aggregate* to 94 lb of Portland Cement and 1-1/2 pt air entraining agent. Min. thickness 2 in. as measured to the top surface of structural concrete or foamed plastic (Item 10A) when it is used.

See Perlite Aggregate (CFFX) in Fire Resistance Directory for names of manufacturers.

E. 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.

CELLULAR CONCRETE SOLUTIONS L L C — Mix No. 3.

SIPLAST INC — Mix No. 3.

F. 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 10) 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.

10. Foamed Plastic* — (optional — Not Shown) For use only with vermiculite (Item 9A) or cellular (Item 9C) concretes — 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 vermiculite concrete topping (Item 9A). Max. Thickness to be 8 in.

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10A. Foamed Plastic* — For use only with cellular concrete. Nominal 24 by 48 by max. 8 in. thick polystyrene foamed plastic insulation boards having a density of 1.0 + 0.1 pcf encapsulated within cellular concrete topping (Item 98). Each insulation board shall contain six nominal 3 in. diameter holes oriented in two rows of three holes each with the holes spaced 12 in. OC, transversely and 16 in. OC longitudinally.

See Foamed Plastic* (BRYX) category in Building Materials Directory or Foamed Plastic* (CCVW) category in Fire Resistance Directory for list of manufacturers.

11. Foamed Plastic* — (Optional, not shown). Polyisocyanurate roof insulation, applied over concrete floor with no restriction on insulation thickness. When polyisocyanurate insulation is used, the unrestrained beam rating shall be increased by a minimum of 1/2 hr.

See Foamed Plastic (CCVW) category for list 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.**

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Design/System/Construction/Assembly Usage Disclaimer

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

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