

# BXUV.P936

## 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.

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. P936

October 07, 2019

**Restrained Assembly Ratings — 1, 1-1/2 or 2 Hr (See Items 3, 5, 6 and 8)**

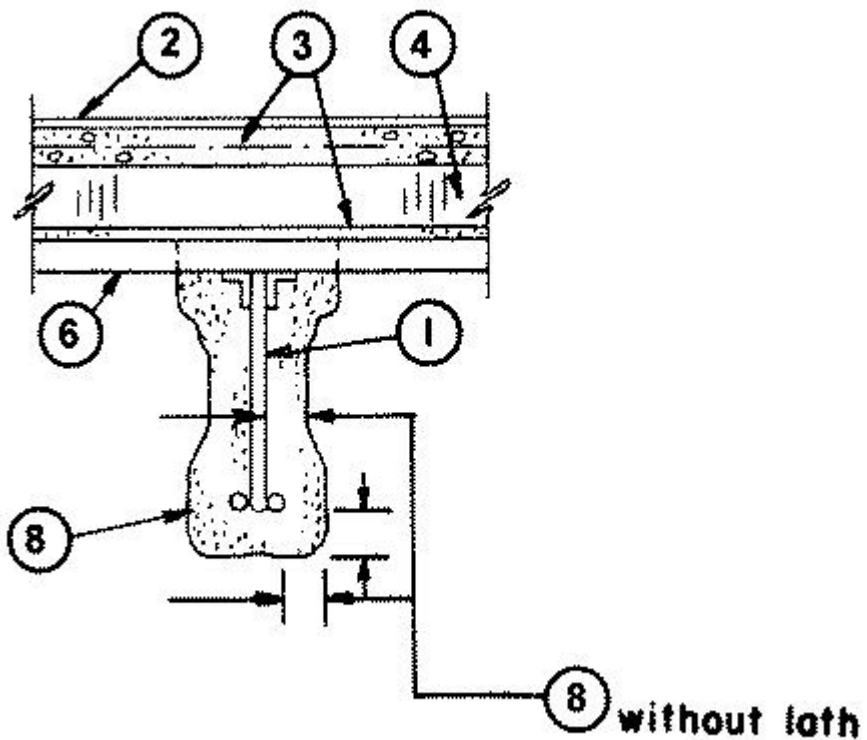
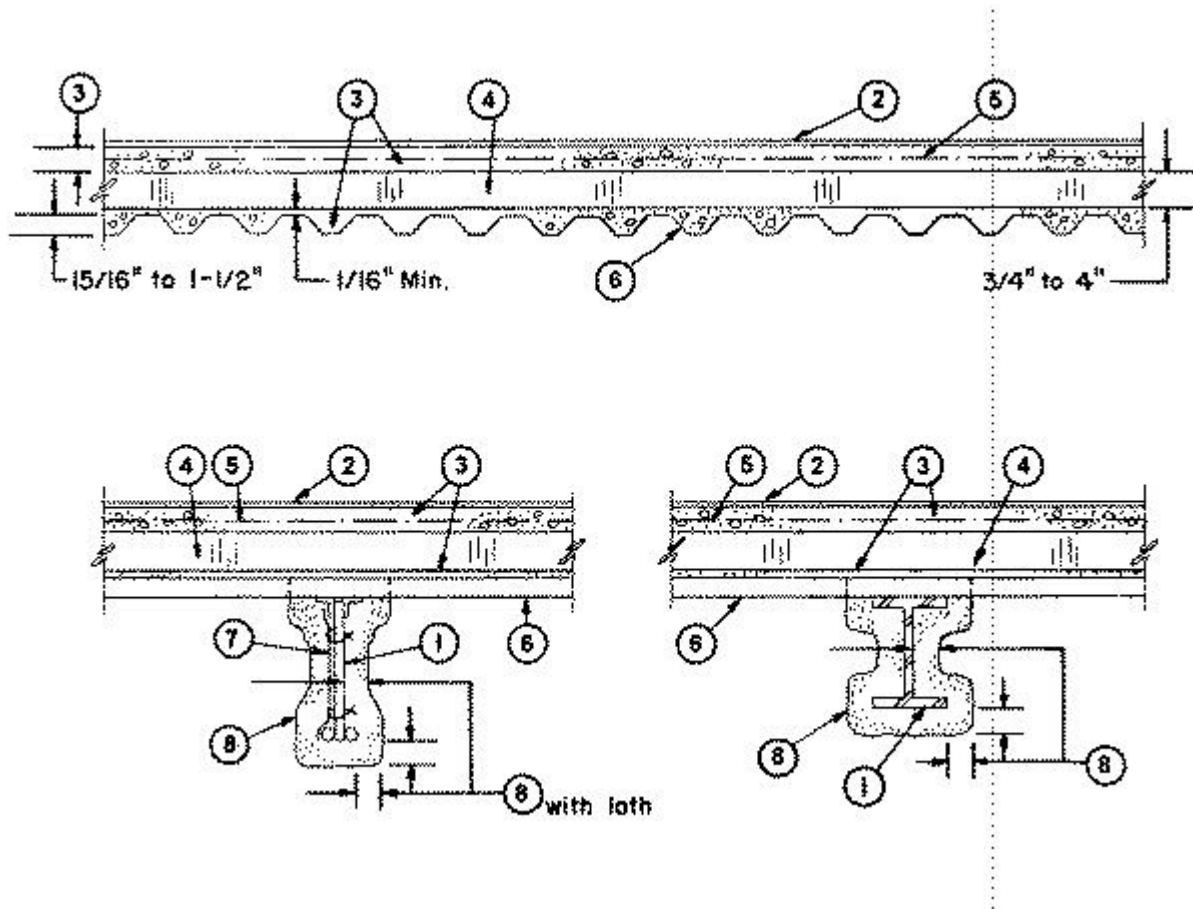
**Unrestrained Assembly Rating — 0 Hr (See Item 6)**

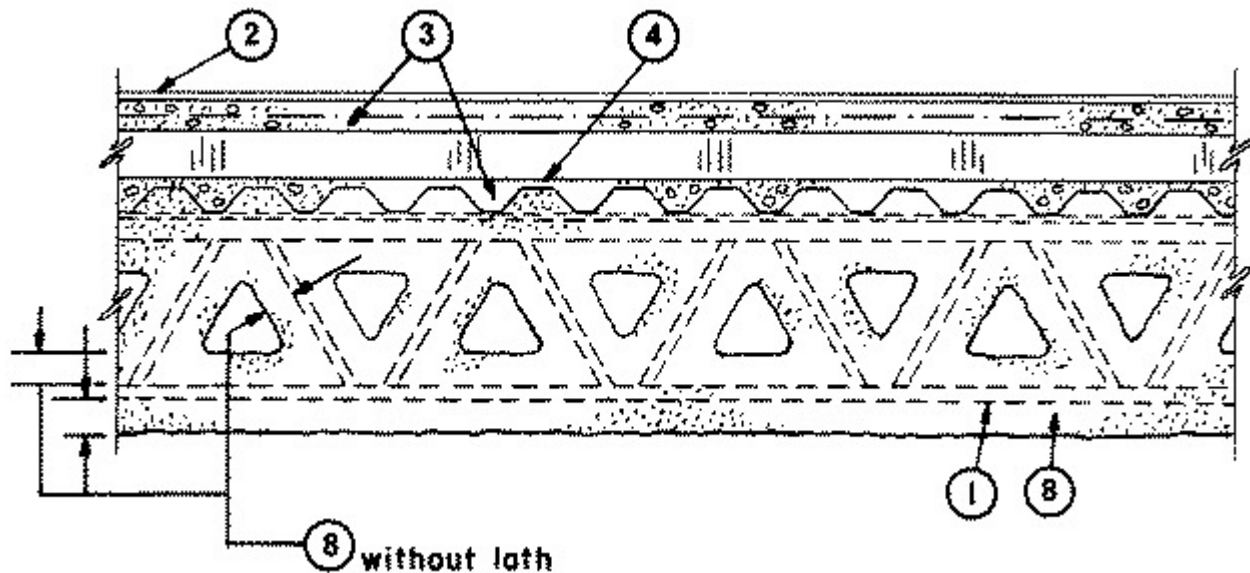
**Unrestrained Beam Rating — 1, 1-1/2 or 2 Hr (See Items 3, 5, 6 and 8)**

**Restricted Load Condition — See Items 1, 8, 8A and 8B**

**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.**





1. **Supports — Steel Beam** — W6x16 or W8x28 min size. **Steel Joists** 10K1 or 16K2 min size with a max tensile stress of 30,000 psi or 12K3 or 12K5 min size with a max tensile stress of 24,000 psi.

2. **Roof Covering\*** — Consisting of hot mopped or cold application materials compatible with insulations described herein which provide Class A, B or C coverings. See Roofing Materials and Systems Directory-Roof Covering Materials (TEVT).

2A. **In lieu of Item 2, roof covering consisting of single-ply Roofing Membrane\*** — that is either ballasted, adhered or mechanically attached as permitted under the respective manufacturer's Classification. See Fire Resistance Directory — Roofing Membranes (CHCI).

3. **Vermiculite Concrete** — 6 cu ft of **Vermiculite Aggregate\*** to 94 lb of Portland cement and 0.11 lb of air entraining agent mixed with approx 25 gal of water. Min compressive strength shall be 125 psi when tested in accordance with ASTM C495. Min thickness above foamed plastic is 2 in. Min thickness between top of steel deck and bottom of foamed plastic shall be 1/16 in. when wire mesh (Item 5) is used and 1/8 in. when the wire mesh is not used. When foamed plastic (Item No. 4 or 4A) is not used the topping thickness of Vermiculite Concrete over the crests of steel deck shall be a min of 2-3/16 in. for the 1 and 1-1/2 h ratings and 2-3/8 in. for the 2 h rating. The max Vermiculite Concrete thickness shall be determined by job site conditions.  
**ELASTIZELL CORP OF AMERICA** — Types MS16-U, MSV 200

**MANDOVAL LTD**

**MANDOVAL VERMICULITE PRODUCTS INC**

**PALMETTO VERMICULITE CO**

**SIPLAST INC**

**THE STRONG CO INC**

**VERMICULITE PRODUCTS INC**

3A. **As an alternate to Item 3, Cellular Concrete — Roof Topping Mixture\*** — Foam concentrate mixed with water and Portland cement per manufacturer's specifications. Cast dry density and 28-day compressive strength of min 190 psi as determined in accordance with ASTM C495-66. Min thickness above foamed plastic is 2 in. Min thickness between top of steel deck and bottom of foamed plastic shall be 1/8 in. When foamed plastic is not used, the min thickness of **Roof Topping Mixture\*** above the top of the steel deck shall be 2-3/4 in.

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

**CELCORE INC** — Cast dry density of 31 (+ or -) 3.0 pcf

**CONCRECEL INTERNATIONAL INC** — Cast dry density 38 (+ 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.

**SIPLAST INC** — Mix #2. Cast dry density of 36 (+ or -) 3.0 pcf.

3B. **As an alternate to Item 3** — Perlite Concrete — Mix consists of 6 cu ft of **Perlite Aggregate\*** to 94 lb of Portland cement and 1-1/2 pints of air-entraining agent. Thickness of Perlite concrete topping to be 2 in. min from the top plane of the foamed plastic. Min thickness between the top of steel deck and the bottom of the foamed plastic shall be 1/8 in.

See **Perlite Aggregate** (CFFX) category in Fire Resistive Directory for names of Classified Companies.

3C. **As an alternate to Item 3 — Cellular Concrete — Roof Topping Mixture\*** — Foam Concrete 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. A 1/8 in. min slurry coat shall be employed below the foamed plastic (Item 4). The cellular concrete topping thickness, above the foamed plastic, shall be 2 in. min. When foamed plastic is not used, the min thickness of Roof-Topping Mixture, above the top of the steel deck, shall be 2-3/4 in.

**AERIX INDUSTRIES** — Mix #3

**SIPLAST INC** — Mix #3

4. **Foamed Plastic\*** — (Optional) — Foamed plastic insulation boards with holes and/or slots. Nom size 24 by 48 in. Thickness shall be 3/4 in. to 8 in.

**SIPLAST INC**

#### **VERMICULITE PRODUCTS INC**

4A. **Foamed Plastic\*** — Nom 24 by 48 in., 48 by 48 in. or 30 by 60 in. by max 8 in. thick polystyrene foamed plastic insulation boards with holes symmetrically placed having a max density of 2.0 pcf. For use only with cellular concrete roof topping.

**STARRFOAM MFG INC**

4B. **Foamed Plastic\*** — (Optional) — Nominal 24 by 48 by max 14 in. thick expanded polystyrene foamed plastic insulation boards having a maximum density of 2.5 +/- 0.1 pcf encapsulated within cellular concrete topping. Each insulation board shall contain eight min 2 in. diameter holes oriented in two rows of four holes each with the holes spaced 12 in. OC transversely and 12 in. OC longitudinally or six min 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 the Building Materials Directory or **Foamed Plastic\*** (CCVW) category in Fire Resistance Directory for list of Classified Companies.

5. **Wire Mesh** — No. 19 SWG galv steel wire twisted to form 2 in. hexagons. In addition, straight No. 16 SWG galv steel wire woven into mesh and spaced 3 in. apart for stiffness. Mesh installed without attachment perpendicular to supports and overlapped 6 in. at the sides. As an alternate, 4 by 8 in., No 12/14 SWG or 2 by 2 in., No 14/14 SWG welded wire fabric may be used. The wire mesh may be omitted for the **1 and 1-1/2 h ratings**. Thickness of Vermiculite Concrete between the top of the roof deck and the bottom of the foamed plastic insulation shall be 1/8 in. min when wire mesh is not used.

5A. **Fiber Reinforcement\*** — (Optional, not for use to achieve 2 hr. ratings) - For use only with Roof-Topping Mixtures\* manufactured by Cellular Concrete LLC. In lieu of Wire Mesh (Item 5), Fiber Reinforcement may be added to roof topping mixtures (Items 3A or 3C).

**FORTA CORP** — Types Econo-Mono, Mini-Mono, Mighty-Mono, Stucco-Bond, Econo-Net, Master-Cast, Super-Net, Ultra-Net.

6. **Steel Roof Deck** — (Unclassified) — Noncomposite design, vented or nonvented units, 9/16 in., 15/16 in., 1-5/16 in., 1-1/2 or 2 in. deep galv units, nom 24 to 36 in. wide. When vented or nonvented 9/16 in. deep galv units are used, the **Restrained**

**Assembly and Beam Ratings shall not exceed 1-1/2 h.** Welded to supports with 3/8 in. puddle welds through weld washers spaced 15 in. OC. Adjacent units overlapped one corrugation. Max support spacings 8 ft OC unless otherwise noted for specific Classified units and their recommended loadings. Steel thickness to be No. 24 MSG min when supports are spaced not more than 8 ft OC, No. 26 MSG min when supports are spaced not more than 6 ft OC and No. 28 MSG, 9/16 in. deep steel deck may be used when supports are spaced 4 ft OC. Roof deck units to be loaded not more than 75 percent of their max allowable bending stress. For clear spans not more than 7 ft., 8-3/8 in. the **Unrestrained Assembly Rating is equal to the Restrained Assembly Rating.** or **Classified Steel Floor and Form Units\*** conforming to the same installation, steel thickness, loading requirements and **Restrained Assembly Rating** as described for unclassified units.

**ASC STEEL DECK, DIV OF ASC PROFILES L L C** — Types CP32, C1.4-32B, CP-32 Ventform, 2WH-36, and 2WHS-36. Two or three - 10 ft - 0 in. continuous spans may be used for Types B, 2WH, or 2WHS units, and 12 ft - 0 in. simple or continuous spans may be used for Type N units, provided that the total loading on these spans is based on the allowable steel stress and the deflection limitation criteria using the steel (noncomposite) section properties of these units.

**CANAM STEEL CORP** — Type P-3606, P-3615, and P-3012.

**CANAM STEEL CORP** — Types B, UFX, UFXV, UFX-36, UFXV-36

**DECK WEST INC** — 36 in. wide Type B-DW, BA-DW or 3-DW. The Type 3-DW units made from 22 ga or heavier steel may be used for a maximum 10 ft., 0 in. spans, provided that the total loading on these spans is based on the allowable steel stresses and the deflection limitation criteria using the steel (noncomposite) section properties of these units.

**EPIC METALS CORP** — Type Metricform

**H H ROBERTSON** — Type QL-3 or Sec. 3 with or without up-punched integral hanger tabs and 3 in. QL-99. The 3 in. deep Type QL-99 units made from 22 ga or heavier steel may be used for max 10 ft, 0 in. spans, provided the total loading on these spans is based on the allowable steel stresses and the deflection limitation criteria using the steel (noncomposite) section properties of these units.

**MARLYN STEEL DECKS INC** — Types B, BV, EF, EVF, F, HF, HVF, SF, SVF

**NEW MILLENNIUM BUILDING SYSTEMS L L C** — Types EHD, EHDV, HD, HDV, S, SV, SD, SDV, SDR.

**ROOF DECK INC** — Vented or Nonvented Types EHD Multi-Rib, HD Multi-Rib, S Multi-Rib.

**STEEL MASTERS INTERNATIONAL DEPENDABLE STEEL** — 36 in. wide Types 2WH-36. Two or three - 10 ft - 0 in. continuous spans may be used for Type 2WH-36 units, provided that the total loading on these spans is based on the allowable steel stress and the deflection limitation criteria using the steel (noncomposite) section properties of these units.

**VERCO DECKING INC - A NUCOR CO** — Deck types PLB, HSB, PLN3, HSN3, PLN, N, Shallow or Deep VERCOR™, Deep VERCOR VENTLOK, System 80; FORMLOK™ deck types PLB, B, PLN3, N3, PLN, N, PLW2, W2. Units may be galvanized, phos./ptd., or mill finish. Deck may be vented or non-vented. Two or three 10 ft 0 in. continuous spans may be used for the following units under the following conditions: (A) For Types PLB, PLB FORMLOK™, B, B FORMLOK™, PLW2 FORMLOK™ and W2 FORMLOK™ units the total loading on these spans shall be based on the allowable steel stress or the deflection limitation criteria using the steel (non-composite) section properties of these units. (B) For System 80 the min gauge of units is 18 MSG and use is limited to three continuous spans.

Deck types PLN, N may be used on simple or continuous 12 ft 0 in. spans with the total loading on these spans limited by the allowable bending stress and/or the deflection limitation criteria.

**VULCRAFT, DIV OF NUCOR CORP** — Types 0.6C, 0.6CPR, 0.6CPRV, 0.6CSV, 1.0C, 1.0CSV, 1.3C, 1.3CSV, 1.5C, 2C, 3C, 1.5B, 1.5BI, 1.5PLB, 3N, 3NI, 3.0PLN, 3NL-32, 3NI-32, 3PLN-32. Type 1.5B units made from 21MSG or heavier steel may be used on simple or continuous 10 ft 0 in. spans with the total load on these spans limited by the allowable bending stress and/or the deflection criteria of this deck. Type 3N made from 22MSG or heavier steel may be used on simple or continuous 12 ft 0 in. spans with the total load on these spans limited by the allowable bending stress and/or the deflection criteria of this deck.

7. **Metal Lath** — (Not Shown) — (Required on both sides of joists with Z-146, otherwise optional) — Metal lath is used to facilitate the spray application of Spray-Applied Fire Resistive Materials on steel bar joists and trusses. The diamond mesh, 3/8 in. expanded steel lath, 1.7 to 3.4 lb per sq yd, is secured to one side of each steel joist with No. 18 SWG galv steel wire at joist web and bottom chord members, spaced 15 in. OC max. When used, the metal lath is to be fully covered with Spray-Applied Fire Resistive Materials with no min thickness requirements.

7A. **Non-Metallic Fabric Mesh** — (Optional) — As an alternate to metal lath, glass fiber fabric mesh, weighing approximately 2.5 oz per sq yd, polypropylene fabric mesh, weighing approximately 1.25 oz per sq yd or equivalent, is used to facilitate the spray application. The mesh is secured to one side of each joist web member. The method of attaching the mesh must be sufficient to hold the mesh and the spray-applied Spray-Applied Fire Resistive Materials in place during application until it has cured. An acceptable method to attach the mesh is by embedding the mesh in minimum 1/4 in. long beads of hot melted glue. The beads of glue shall be spaced a maximum of 12 in. OC along the top chord of the bar joist. Another method to secure the mesh is by 1-1/4 in. long by 1/2 in. wide hairpin clips formed from No. 18 SWG or heavier steel wire.

8. **Spray-Applied Fire Resistive Materials\*** — Applied by mixing with water and spraying in more than one coat to the final thickness shown below to joist or beam surfaces which are clean, free of dirt, loose scale and oil. Min avg and min ind density of 15/14 pcf respectively. For method of density determination refer to Design Information Section.

<b>Restrained Assembly Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>Thkns In. Min Thkns on Beam W6x16</b>
1	1	9/16
1-1/2	1-1/2	1-1/16
2	1-1/2	1-7/16
2	2	1-1/2

<b>Restrained Beam Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>10K1 More than 4 ft OC</b>	<b>10K1 4 ft or Less OC</b>
1	1	1-1/8	1
1-1/2	1	1-7/16	1-7/16
1-1/2	1-1/2	1-5/8	1-7/16
2	1	1-7/8	1-7/8
2	2	2-3/16	1-7/8

<b>Restrained &amp; Unrestrained Assembly Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>Spray Applied Fire Resistive Mtl Min Thkns In. For 12K3 or 16K2 Joist Spaced</b>	
		<b>More Than 4 Ft OC</b>	<b>4 Ft or Less OC</b>
1	1	15/16	15/16
1-1/2	1-1/2	1-1/2	1-3/8
2	2	2-1/16	1-7/8

\*Note: Design load shall stress the 12K3 joist to a maximum tensile strength of 24,000 psi. For guidance on stress level adjustments, refer to the Fire Resistance Ratings with Steel Joists section of the Steel Joist Institute (SJI) publication: "Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders."

**ARABIAN VERMICULITE INDUSTRIES** — Types MK-6/CBF, MK-6/ED, MK-/HY, MK-6/HB, MK-6s, HK6-HY Extended Set, MK-10 HB, MK-10 HB Extended Set.

**GCP APPLIED TECHNOLOGIES INC** — Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6S, RG, MK-10 HB, MK-10 HB Extended Set.

**GCP KOREA INC** — Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6S, MK-10 HB, MK-10 HB Extended Set.

8A. **Spray-Applied Fire Resistive Materials\*** — (Not Shown) — In lieu of Item 8 the following Spray-Applied Fire Resistive Materials may be applied by mixing with water and spraying in multiple coats to final thicknesses shown below. Min avg and Min ind density of 22/19 pcf respectively for Types Z-106, Z-106/G, Z-106/HY. For method of density determination, refer to Design Information Section, Sprayed Material.

<b>Restrained Assembly Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>Thkns In. Min Thkns on Beam in W6x16</b>
1	1	9/16
1-1/2	1-1/2	1-1/16
2	1-1/2	1-7/16
2	2	1-1/2

<b>Restrained Beam Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>10K1 More than 4 ft OC</b>	<b>10K1 4 ft or Less OC</b>
1	1	1-1/8	1
1-1/2	1	1-7/16	1-7/16
1-1/2	1-1/2	1-5/8	1-7/16
2	1	1-7/8	1-7/8
2	2	2-3/16	1-7/8

<b>Restrained &amp; Unrestrained Assembly Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>Spray Applied Fire Resistive Mtl Min Thkns In. For *12K3 or 16K2 Joist Spaced</b>	
		<b>More Than 4 Ft OC</b>	<b>4 Ft or Less OC</b>
1	1	15/16	15/16
1-1/2	1-1/2	1-1/2	1-3/8
2	2	2-1/16	1-7/8

\*Note: Design load shall stress the 12K3 joist to a maximum tensile strength of 24,000 psi. For guidance on stress level adjustments, refer to the Fire Resistance Ratings with Steel Joists section of the Steel Joist Institute (SJI) publication: "Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders."

**ARABIAN VERMICULITE INDUSTRIES** — Types Sonophone 5, Z-106, Z-106/G, Z-106/HY

**GCP APPLIED TECHNOLOGIES INC** — Monokote Acoustic 5, KM-601, Z-106, Z-106/G, Z-106/HY

**GCP KOREA INC** — Monokote Acoustic 5, Z-106, Z-106/G, Z-106/HY

8B. **Spray-Applied Fire Resistive Materials\*** — (Not Shown) — In lieu of Item 8 or 8A the following Spray-Applied Fire Resistive Materials may be applied by mixing with water and spraying in multiple coats to final thicknesses shown below. Min avg and min ind density 40/36 pcf respectively. For method of density determination, refer to Design Information Section, Sprayed Material.

		<b>Thnkns In.</b>	
<b>Restrained Assembly Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>Min Thkns on Beam in W6x16</b>	
1	1	9/16	
1-1/2	1-1/2	1-1/16	
2	1-1/2	1-7/16	
2	2	1-1/2	

<b>Restrained Beam Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>10K1 More than 4 ft OC</b>	<b>10K1 4 ft or Less OC</b>
1	1	1-1/8	1
1-1/2	1	1-7/16	1-7/16
1-1/2	1-1/2	1-5/8	1-7/16
2	1	1-7/8	1-7/8
2	2	2-3/16	1-7/8

		<b>Spray Applied Fire Resistive Mtl Min Thkns In. For *12K3 or 16K2 Joist Spaced</b>	
<b>Restrained &amp; Unrestrained Assembly Rating Hr</b>	<b>Unrestrained Beam Rating Hr</b>	<b>More Than 4 Ft OC</b>	<b>4 Ft or Less OC</b>
1	1	15/16	15/16
1-1/2	1-1/2	1-1/2	1-3/8
2	2	2-1/16	1-7/8

\*Note: Design load shall stress the 12K3 joist to a maximum tensile strength of 24,000 psi. For guidance on stress level adjustments, refer to the Fire Resistance Ratings with Steel Joists section of the Steel Joist Institute (SJI) publication: "Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders."

**ARABIAN VERMICULITE INDUSTRIES** — Type Z-146, investigated for exterior use.



**GCP APPLIED TECHNOLOGIES INC** — Type Z-146, investigated for exterior use, Monokote Acoustic 35.

**GCP KOREA INC** — Type Z-146, investigated for exterior use, Monokote Acoustic 35.

**\* 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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