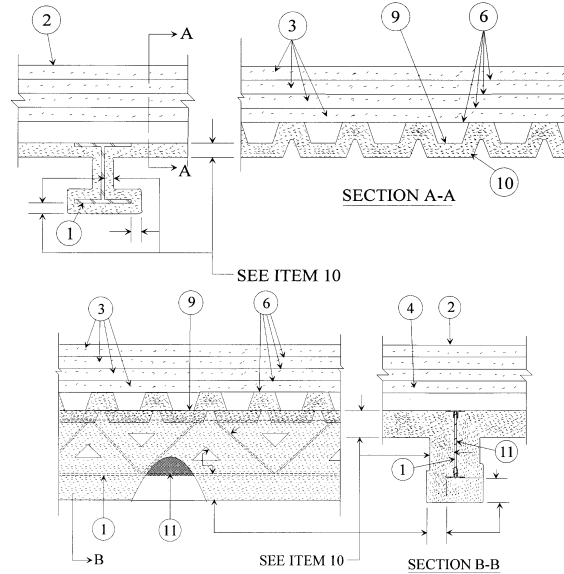


Design No. P732

Restrained Assembly Ratings — 1, 1-1/2, 2 or 3 Hr (See Item 10)
Unrestrained Assembly Ratings — 3/4, 1, 1-1/2, 2 or 3 Hr (See Item 10)
Unrestrained Beam Ratings — 1, 1-1/2, 2 or 3 Hr (See Item 10)
Restricted Load Condition — See Items 1 and 10C
Load Restricted for Canadian Applications — See Guide BXUV7



1. **Beam** — Min W6x16 or W8x28 or Steel Joist — 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 bituminous materials compatible with the insulation(s) 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 — Roof Membrane (CHCI).
- 2B. **Metal Roof Deck Panels*** — (Not shown) — In addition to or in lieu of Item 2 or 2A, the roof covering may consist of a mechanically fastened metal roof deck panel assembly. See Fire Resistance Directory — Metal Roof Deck Panels (CETW).
3. **Roof Insulation — Foamed Plastic** — Polyisocyanurate foamed plastic insulation boards nom 48 by 48 or 96 in., to be applied in one or more layers. Boards to be installed with end joints staggered a min of 6 in. Min thickness shall be selected from the Table below. No limit on max overall thickness.

Restrained or Unrestrained Assembly Rating Hr	Min Insulation Thkns In.	
	With Gypsum Wallboard	Without Gypsum Wallboard
1	1	2
1-1/2	1-1/2	3
2	2	3
3	2	3

ATLAS ROOFING CORP —Type ACfoam II, ACfoam III, ACfoam-II SL, ACfoam IV.

BUILDING MATERIALS CORP OF AMERICA,

DBA GAF —EnergyGuard RH, Tapered EnergyGuard RH

BUILDING MATERIALS CORP OF AMERICA,

DBA GAF —Isotherm R.

CARLISLE SYNTEC INCORPORATED —Types HP, HP-H, HP-N, HP-W.

DOW ROOFING SYSTEMS L L C —"Dow Termico Polyisocyanurate Insulation", "Dow Termico ISO 3000 Insulation", "Dow Termico ISO HP-FR".

FIRESTONE BUILDING PRODUCTS CO L L C —"ISO 95+ GL", "ISO 95+ FK", "ISO 95+ GW", "ISO 300", "ISO 95+ CAN", "ISOGARD HD Composite Board" or "RESISTA".

GENFLEX ROOFING SYSTEMS L L C — "GenFlex ISO"

HUNTER PANELS —H Shield

JOHNS MANVILLE —ENRGY 3 25 psi, ENRGY 3, Tapered ENRGY 3, Tapered ENRGY 3 25 psi, ENRGY 3 AGF, Tapered ENRGY 3 AGF, ENRGY 3 25 psi AGF, Tapered ENRGY 3 25 psi AGF, ENRGY 3 CGF, Tapered ENRGY 3 CGF, ENRGY 3 25 psi CGF, Tapered ENRGY 3 25 psi CGF, ISO-3, Tapered ISO-3, ValuTherm, Tapered ValuTherm, ValuTherm 25 psi, Tapered ValuTherm 25 psi, ValuTherm AGF, Tapered ValuTherm AGF, ValuTherm 25 psi AGF, Tapered ValuTherm 25 psi AGF, ValuTherm CGF, Tapered ValuTherm CGF, ValuTherm 25 psi CGF, Tapered ValuTherm 25 psi CGF.

LOADMASTER SYSTEMS INC —Type Loadmaster polyisocyanurate insulation

RMAX OPERATING L L C —Type Multi-Max-3, Multi-Max FA-3, Ultra-Max, Ultra-Max Plus, Tapered Ultra-Max Plus, Tapered Thermo-roof-3, Tapered Thermo-roof FA-3, Tapered Ultra-Max.

SIKA SARNAFIL INC —Sarnatherm r, Sarnatherm r Ultra, Sarnatherm r Tapered, Sarnatherm r Ultra Tapered.

SOPREMA INC —Sopra-ISO s, Sopra-ISO s Tapered, Sopra-ISO+ s, Sopra-ISO+ s Tapered, Sopra-ISO H+ s, Sopra-ISO H+ s Tapered.

- 3A. **Building Units*** — Not Shown — As an alternate to Item 3, composite polyisocyanurate foamed plastic insulation board with an adhered nailing surface, nom 48 by 48 or 96 in. may be used with the following limitations. These composite building units have ventilation slots internal to the panels. The thickness of the panel depends upon the thinnest portion of the polyisocyanurate insulation. The following dimensions apply to the polyisocyanurate insulation, min thickness is as measured in accordance with Item 3. There is no limit on the max insulation thickness.

JOHNS MANVILLE —Type ISO-VENT.

- 3B. **Building Units*** — Polyisocyanurate foamed plastic insulation boards, nom 48 by 48 or 96 in., faced on the top surface with ori-

- ented strand board or plywood. Min thickness of the polyisocyanurate core is 1.3 in. No limit on max overall thickness. Boards to be installed with end joints staggered a min of 6 in. in adjacent rows. Adhesive (Item 6) may be applied between the building units and the vapor retarder (or gypsum wallboard if vapor retarder is not used).
- ATLAS ROOFING CORP** —ACFoam Nailbase Insulation and Vented R, CrossVent.
FIRESTONE BUILDING PRODUCTS CO L L C —Nail Base.
SOPREMA INC —Sopra-ISO CV s.
- 3C. **Roof Insulation-Mineral and Fiber Boards*** — (Not Shown) — Optional, Applied in one or more layers over the Foamed Plastic (Item 3) to be applied with adhesive (Item 6), asphalt or coal tar pitch (Item 7) or mechanically fastened (Item 8).
JOHNS MANVILLE
ROXUL INC —MonoBoard™, MonoBoard™ Plus, “MonoBoard Plus S”, TopRock®DD, TopRock® DD Plus or TopRock DD Plus S.
SOPREMA INC —SopraRock®MD, SopraRock®MD Plus, SopraRock®DD and SopraRock®DD Plus.
- 3D. **Building Units*** — As an alternate to Item 3, polyisocyanurate foamed plastic insulation boards, nom 48 by 48 or 96 in., faced on the top surface with oriented strand board. Min thickness of the polyisocyanurate core is 1.3 in. for the 1 hr rating without gypsum wallboard (Item 4) and for the 1, 1-1/2 and 2 hr ratings with gypsum wallboard and 2.6 for the 1-1/2 hr ratings without gypsum wallboard. No limit on max overall thickness. Boards to be installed with end joints staggered a min of 6 in. in adjacent rows.
JOHNS MANVILLE —Nailboard.
- 3E. **Building Units*** — As an alternate to Item 3, polyisocyanurate foamed plastic insulation boards faced on the underside (or both sides) with mineral fiber board. Min thickness of the polyisocyanurate core is 1.3 in. for the 1 hr rating without gypsum wallboard (Item 4) and for the 1-1/2 and 2 hr ratings with wallboard and 2.6 in. for the 1-1/2 hr ratings without gypsum wallboard. No limit on max overall thickness. Boards to be installed with end joints staggered a min of 6 in. adjacent rows. Adhesive (Item 6) may be applied between the building units and the vapor retarder (or gypsum wallboard if vapor retarder is not used).
FIRESTONE BUILDING PRODUCTS CO L L C — “ISO 95+ Composite”
JOHNS MANVILLE —Fesco-Foam.
- 3F. **Building Units*** — As an alternate to Item 3, polyisocyanurate foamed plastic insulation boards faced on the underside with wood fiber board. Min thickness of the polyisocyanurate core is 1.3 in. for the 1 hr rating without gypsum wallboard (Item 4) and for the 1-1/2 and 2 hr ratings with wallboard and 2.6 in. for the 1-1/2 hr ratings without gypsum wallboard. No limit on max overall thickness. Boards to be installed with end joints staggered a min of 6 in. in adjacent rows.
FIRESTONE BUILDING PRODUCTS CO L L C — “ISO 95+ Composite” .
JOHNS MANVILLE —ENRGY-2 Plus.
- 3G. **Building Units*** — As an alternate to Item 3, polyisocyanurate foamed plastic insulation boards, nom 48 by 48 or 96 in., faced on the top surface with gypsum board. Min thickness of the polyisocyanurate core is 1.3 in. for 1 hr rating without gypsum wallboard (Item 4) and for the 1-1/2 and 2 hr ratings with wallboard (Item 4) and 2.6 in. for the 1-1/2 ratings without gypsum wallboard (Item 4). No limit on overall thickness. Boards to be installed with end joints staggered a min of 6 in. in adjacent rows. Adhesive (Item 6) may be applied between the building units and the vapor retarder (or gypsum wallboard if vapor retarder is not used).
JOHNS MANVILLE —ENRGY 2 Gypsum Composite.
- 3H. **Roof Insulation — Mineral and Fiber Boards*** — As an alternate to Item 3, to be applied in one or more layers with or without adhesive applied between vapor barrier and roof deck units, vapor barrier and board and each layer of board. When more than one layer is required, each layer of board to be offset in both directions from layer below a min of 6 in. in order to lap all joints. Min thickness is 2 in. when Item 2A or 2B is used. Min thickness is 1 in. otherwise.
BMCA INSULATION PRODUCTS INC —Permalite.
BUILDING MATERIALS CORP OF AMERICA,
DBA GAF —GARTEMP Perlite.
JOHNS MANVILLE
- 3I. **Roof Insulation - Foamed Plastic*** — (Not Shown) As an alternate to Item 3 through 3H, polystyrene foamed plastic insulation boards, applied in one or more layers over gypsum wallboard. Min. thickness is 1.0 in. with no max overall thickness max density 2.5 pcf. When applied in more than one layer, each layer to be offset in both directions from layer below a min. of 6 in. in order to lap all joints. Boards secured to gypsum wallboard (Item 4) with asphalt glaze coat or adhesive (Item 6). Adhesive and/or asphalt glaze coat may be omitted when Item 2A is used. See Foamed Plastic (BRYX) category in the Building Materials Directory or Foamed Plastic (CCVV) category in the Fire Resistance Directory of for names of manufacturers.
- 3J. **Fiber, Sprayed*** — (Not Shown) — For 1 hr rating only — As an alternate to Items 3 through 3I, Spray applied cellulose insulation material. The fiber is applied with water to a min. thickness of 10 in. as measured from the top plane of the roof deck in accordance with the application instructions supplied with the product. Minimum density of 2.6 pcf. Gypsum board not required over steel roof deck. Min. 1 in. thickness of Spray-Applied Fire Resistive Material* (Items 10, 10A, 10B) required on underside of steel deck. When Item 3J is used, Roof Covering (Items 2, 2A and 2B) shall not be directly applied over sprayed fiber.
U S GREENFIBER L L C — Cocoon stabilized cellulose insulation.
- 3K. **Roof Insulation - Foamed Plastic*** — (Not Shown) - Optional, a minimum of 1/4 in. thick - Placed over minimum 1-1/2 in. thick polyisocyanurate Foamed Plastic (Item 3) to be applied with adhesive (Item 6), asphalt or coat tar pitch (Item 7) or mechanically fastened (Item 8). Boards to be installed with end joints to be offset in both directions from layer below a min of 6 in. in order to lap all joints.
JOHNS MANVILLE —Invinsa
- 3L. **Foamed Plastic*** — Optional - (Not Shown) - Maximum 1 in. thick polyisocyanurate foamed plastic insulation boards, nom 48 by 48 or 96 in. Boards may be applied as the top layer in addition to the specified minimum thickness of any roofing system described herein, as long as the roofing system states that there is no limit on maximum thickness. Joints offset in both directions from layer below.
FIRESTONE BUILDING PRODUCTS CO L L C —“ISOGARD HD”
- 3M. **Foamed Plastic*** — As an alternate to Items 3 - 3J, polyurethane foamed plastic roof insulation. When used, gypsum board (item 4) is required. Formed by the simultaneous spraying of two liquid components applied over the gypsum board (item 4) in accordance with the manufacturer’s instructions. Min thickness shall be selected from the table above. No limit on max overall thickness.
BASF CORP —Types FE 303 2.7, FE-348, FE348-2.5, FE348-2.7, FE348-2.8, FE348-3.0, ELASTOSPRAY 81255, ELASTOSPRAY 81275, ELASTOSPRAY 81285 or ELASTOSPRAY 81305.
BASF CORP —Elastospray 5100-2.0, Elastospray 5100-2.5, Elastospray 81302, Elastospray 81272, Elastospray Alpha System, Elastospray 81252
4. **Gypsum Board** — (Not shown) — (Classified or Unclassified) — May be used to obtain various Restrained or Unrestrained Assembly Ratings as described in Item 10. Supplied in sheets nom 4 by 8 or 12 ft by 5/8 in. thick. Min weight 2.2 psf. Applied perpendicular to steel roof deck direction with end joints staggered 2 ft in adjacent rows. End joints to occur over crests of steel roof units.
ACADIA DRYWALL SUPPLIES LTD —CKNX.R25370
AMERICAN GYPSUM CO —CKNX.R14196
BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO —CKNX.R19374
CERTAINTED GYPSUM CANADA INC —CKNX.R15187
CERTAINTED GYPSUM INC —CKNX.R3660
CGC INC —CKNX.R19751
CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C —CKNX.R18482

GEORGIA-PACIFIC GYPSUM L L C —CKNX.R2717
 LOADMASTER SYSTEMS INC —CKNX.R11809
 NATIONAL GYPSUM CO —CKNX.R3501
 PABCO BUILDING PRODUCTS L L C, DBA
 PABCO GYPSUM —CKNX.R7094
 PANEL REY S A —CKNX.R21796
 SIAM GYPSUM INDUSTRY (SARABURI) CO LTD —CKNX.R19262
 THAI GYPSUM PRODUCTS PCL —CKNX.R27517
 UNITED STATES GYPSUM CO —CKNX.R1319
 USG MEXICO S A DE C V —CKNX.R16089

5. **Vapor Retarder — Sheathing Material*** — (Optional) — (Not shown) — Vinyl film or paper scrim vapor barrier, applied to steel roof deck or gypsum wallboard with adhesive (Item 6), hot asphalt (Item 7) or laid loosely, overlapped approx 2 in. on adjacent sheets. See **Sheathing Material** (CHIZ) category for names of manufacturers.
- 5A. **Sheathing Material*** — (Optional) — In lieu of Item 5, a self-adhered rubberized asphalt roofing underlayment membrane which may be placed on top of steel roof deck, gypsum wallboard or on the roof insulation.
W R GRACE & CO - CONN — Grace Ice and Water Shield, Grace Ice and Water Shield-HT®, Grace Select, Grace Ultra, and Grace Basik.
6. **Adhesive*** — (Optional) — The vapor retarder, the gypsum wallboard or the first layer of roof insulation may be secured with adhesive to the steel crest surfaces. Also used to attach the vapor retarder to gypsum wallboard, the first layer of insulation to vapor retarder or gypsum wallboard and each additional layer of insulation. Applied in 1/2 in. wide ribbons 6 in. OC at 0.4 gal/100 sq ft. See **Adhesives** (BYWR) category for names of manufacturers.
- 6A. **Adhesive* (Optional)** — (Bearing the UL Classification Marking for Roof Systems (TGFU)) - When FAST 100 adhesive is used, the Unrestrained Assembly Ratings are limited to 1, 1-1/2 and 2 hr. The vapor retarder, the gypsum wallboard or the first layer of roof insulation may be secured with adhesive to the steel crest surfaces. Also used to attach the vapor retarder to gypsum wallboard, the first layer of insulation to vapor retarder or gypsum wallboard and each additional layer of insulation. Applied at a max rate of 19.8 g/ft². When FAST 100 adhesive is used, additional **Spray-Applied Fire Resistant Materials* (CHPX)** is required on the deck for the 1-1/2 and 2 hr Unrestrained Assembly Ratings. The thickness specified for the deck shall be increased by 1/16 in. for 1-1/2 hr Unrestrained Assembly Rating and 1/4 in. for 2 hr Unrestrained Assembly Rating.
CARLISLE SYNTÉC INCORPORATED — FAST 100
7. **Asphalt or Coal Tar Pitch*** — (Optional) — (Not shown) — The vapor retarder, the gypsum wallboard of the first layer of roof insulation may be secured with asphalt or coal tar pitch to the steel crest surfaces at a max rate of 15 lb/100 sq ft. Also used to attach the vapor retarder to gypsum wallboard, the first layer of insulation to vapor retarder or gypsum wallboard and each additional layer of roof insulation, applied at a max rate of 25 lb/100 sq ft.
8. **Mechanical Fasteners — (Optional)** — (Not shown) — Mechanical screw-type fastener with metal or plastic washer designed for the purpose may be used to attach one or more layers of insulation to steel roof deck.
9. **Steel Roof Deck** — (Unclassified) — Min 1-1/2 in. deep and 36 in. wide galv fluted steel deck. Min gauge is No. 22 MSG. Ends overlapped at supports a min 1-1/2 in. and welded to supports 12 in. OC and at side laps. Side laps fastened with 1/2 in. long hex head, self-drilling, self-tapping steel screws spaced a max of 36 in. OC.
Classified Steel Floor and Form Units* — Noncomposite 1-1/2 to 3 in. deep, 24 to 36 in. wide, min 22 MSG galvanized steel fluted units. Ends overlapped at supports a min 1-1/2 in. and welded to supports 12 in. OC and at side laps. Side laps fastened with 3/4 in. long No. 12 self-drilling, self-tapping steel screws at 36 in. OC. As alternate to screw fasteners adjacent units may be button-punched or welded together 36 in. OC along side joints.
ASC STEEL DECK, DIV OF ASC PROFILES L
L C —24 through 36 in. wide, Types DGB Hi-Form, B Hi-Form, DGB, B, DGN Hi-Form, N Hi-Form, DGN, and N. All units may be galvanized or Prime Shield™.
CANAM STEEL CORP —Type P-3606, P-3615, P-2436, P-2404, P-2403, and P-2438 noncomposite.
CANAM STEEL CORP —Types B, F, N. Units may be phos./ptd or ptd/ptd.
CONSOLIDATED SYSTEMS INC —Types B, BI, F, N and NI. Units may be ptd/ptd.
NEW MILLENNIUM BUILDING SYSTEMS L L C —Types B, BI, F, N. Units may be phos/painted, ptd/ptd, or galvanized.
 Painted units may be used for ratings up to 2 h.
VERCO DECKING INC - A NUCOR CO —Types PLB, HSB, PLN and N; or Types PLN3, HSN3. Ptd/ptd units may be used for ratings up to 2 h.
VULCRAFT, DIV OF NUCOR CORP —Types BW, F, High Strength B, High Strength BW, N, ptd/ptd units may be used for ratings up to 2 h.
VULCRAFT, DIV OF NUCOR CORP —Galv Types 1.5B, 1.5BI, 1.5F, 3N and 3NI, ptd/ptd units may be used for ratings up to 2 h.

Note: Type Z-106 Spray-Applied Fire Resistive Materials to be used with galv steel roof units only.

10. **Spray-Applied Resistive Material*** — Applied by mixing with water and spraying in more than one coat to final thicknesses as shown in the illustration above and in the table below to steel surfaces which must be clean and free of dirt, loose scale and oil. Steel deck surface must be "spatter" coated with Type SK-3 Spray-Applied Fire Resistive Materials prior to application of spray-applied resistive material. Type SK-3 spray-applied resistive material applied in accordance with the manufacturer's application instructions. When steel deck is used the area between the steel deck and the beams top flange shall be filled. Min average and min individual density of 15/14 pcf, respectively. For method of density determination, see Design Information Section. Thickness of the spatter coat is included in the total final thickness of the protection material.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Steel deck thickness #		Beam Thickness	
			with Gypsum Wallboard	Without Gypsum Wallboard	full flange W8x28 Beam	1/2 flange## W8x28 Beam
1	0@	1	N/A	1	7/16	1/2
1	1	1	9/16***	1	7/16	1/2
1	1	1	5/8	1	7/16	1/2
1	1	1	1*	1-5/8*	7/16	1/2
1 1/2	1	1	3/4	1 1/4	9/16	13/16
1 1/2	1 1/2	1 1/2	13/16	1 3/8	5/8	13/16
1 1/2	1 1/2	1 1/2	1 1/2*	2 1/8*	5/8	13/16
2	1	1	1	1 1/2	3/4	1 1/16
2	1 1/2	1 1/2	1	1 1/2	3/4	1 1/16
2	2	2	1 1/8	1 11/16	7/8	1 1/16
2	2	2	2*	2 5/8*	7/8	1 1/16
3	1 1/2	1 1/2	1 1/2	2 1/8	1 3/16	1 5/8
3	2	2	1 1/2	2 1/8	1 3/16	1 5/8
3	3	3	1 5/8	2 3/8	1 3/8	1 5/8

The required minimum thickness of Spray-Applied Fire Resistive Materials on the steel deck is increased by 1/16 inch for 1-1/2 hr Un-restrained assembly rating and 1/4 inch for 2 hr Unrestrained Assembly rating when Item 6A is used.

FIRE RESISTANCE DIRECTORY - W R GRACE DESIGNS

When the thickness applied to the lower flange edges is reduced by one half, the 1/2 flange thickness is applicable.
 * No minimum insulation thickness required
 ***Minimum insulation thickness (Item 3) 2 inches.
 @ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Joist thickness 10K1 more than 4 ft OC	10K1 less than 4 ft OC	16K2 more than 4 ft OC	16K2 less than 4 ft OC
1	0@	1	1 1/8	1	15/16	15/16
1	1	1	1 1/8	1	15/16	15/16
1 1/2	1	1	1 5/16	1 5/16	1 1/4	1 3/16
1 1/2	1 1/2	1 1/2	1 7/16	1 7/16	1 1/4	1 3/16
2	1	1	1 7/16	1 7/16	1 9/16	1 1/2
2	1 1/2	1 1/2	1 7/16	1 7/16	1 9/16	1 1/2
2	2	2	2 3/16	2 3/16	1 9/16	1 1/2
3	1 1/2	1 1/2	3 1/4	2 13/16	2 1/4	2 1/8
3	2	2	3 1/4	2 13/16	2 1/4	2 1/8
3	3	3	3 1/4	2 13/16	2 1/4	2 1/8

@ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	W6x16 Beam Thickness
1	1	1	9/16
1 1/2	1	1	5/8
1 1/2	1 1/2	1 1/2	13/16
2	1	1	7/8
2	1 1/2	1 1/2	7/8
2	2	2	1 1/16
3	1 1/2	1 1/2	1 1/4
3	2	2	1 1/4
3	3	3	1 1/2

ARABIAN VERMICULITE INDUSTRIES —Types MK-6/HY, MK-6/HY Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended Set, MK-1000/HB, MK-1000/HB Extended Set, SK-3.

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, SK-3.

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, SK-3.

10A. Alternate Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in one or more coats to final thicknesses as shown in the table below to steel beam surfaces which must be clean and free of dirt, loose scale and oil. When Type Z-106/G is used, the steel deck surface must be "spatter" coated with Type SK-3 Spray-Applied Fire Resistive Materials prior to application of spray-applied resistive material. Type SK-3 spray-applied resistive material applied in accordance with the manufacturer's application instructions. 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 22/19 pcf, respectively. For method of density determination, refer to Design Information Section.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Steel deck thickness #		Beam Thickness	
			with Gypsum Wallboard	Without Gypsum Wallboard	full flange W8x28 Beam	1/2 flange W8x28 Beam
1	0@	1	N/A	1	7/16	1/2
1	1	1	9/16***	1	7/16	1/2
1	1	1	5/8	1	7/16	1/2
1	1	1	1*	1-5/8*	7/16	1/2
1 1/2	1	1	3/4	1 1/4	9/16	13/16
1 1/2	1 1/2	1 1/2	13/16	1 3/8	5/8	13/16
1 1/2	1 1/2	1 1/2	1 1/2*	2 1/8*	5/8	13/16
2	1	1	1	1 1/2	3/4	1 1/16
2	1 1/2	1 1/2	1	1 1/2	3/4	1 1/16
2	2	2	1 1/8	1 11/16	7/8	1 1/16
2	2	2	2*	2 5/8*	7/8	1 1/16
3	1 1/2	1 1/2	1 1/2	2 1/8	1 3/16	1 5/8
3	2	2	1 1/2	2 1/8	1 3/16	1 5/8
3	3	3	1 5/8	2 3/8	1 3/8	1 5/8

The required minimum thickness of Spray-Applied Fire Resistive Materials on the steel deck is increased by 1/16 inch for 1-1/2 hr Un-restrained assembly rating and 1/4 inch for 2 hr Unrestrained Assembly rating when Item 6A is used.

When the thickness applied to the lower flange edges is reduced by one half, the 1/2 flange thickness is applicable.

* No minimum insulation thickness required

***Minimum insulation thickness (Item 3) 2 inches.

@ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Joist thickness			
			10K1 more than 4 ft OC	10K1 less than 4 ft OC	16K2 more than 4 ft OC	16K2 less than 4 ft OC
1	0@	1	1 1/8	1	15/16	15/16
1	1	1	1 1/8	1	15/16	15/16
1 1/2	1	1	1 5/16	1 5/16	1 1/4	1 3/16
1 1/2	1 1/2	1 1/2	1 7/16	1 7/16	1 1/4	1 3/16
2	1	1	1 7/16	1 7/16	1 9/16	1 1/2
2	1 1/2	1 1/2	1 7/16	1 7/16	1 9/16	1 1/2
2	2	2	2 3/16	2 3/16	1 9/16	1 1/2
3	1 1/2	1 1/2	3 1/4	2 13/16	2 1/4	2 1/8
3	2	2	3 1/4	2 13/16	2 1/4	2 1/8
3	3	3	3 1/4	2 13/16	2 1/4	2 1/8

@ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

FIRE RESISTANCE DIRECTORY - W R GRACE DESIGNS

FIRE-RESISTANCE RATINGS - ANSI/UL 263 (BXUV)

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	W6x16 Beam Thickness
1	1	1	9/16
1 1/2	1	1	5/8
1 1/2	1 1/2	1 1/2	13/16
2	1	1	7/8
2	1 1/2	1 1/2	7/8
2	2	2	1 1/16
3	1 1/2	1 1/2	1 1/4
3	2	2	1 1/4
3	3	3	1 1/2

ARABIAN Vermiculite Industries —Types Z-106, Z-106/G, Z-106/HY.

GRACE KOREA INC —Types Z-106, Z-106G, Z-106/HY.

W R GRACE & CO - CONN —Types Z-106, Z-106G, Z106/HY.

10B. **Alternate Spray-Applied Fire Resistive Materials*** — Applied by mixing with water and spraying in one or more coats to final thicknesses as shown in the table below to steel beam 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. Application to steel roof deck requires the installation of expanded metal lath. See Item 11A. 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, refer to Design Information Section.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Steel deck thickness #		Beam Thickness	
			with Gypsum Wallboard	Without Gypsum Wallboard	full flange W8x28 Beam	1/2 flange# W8x28 Beam
1	0@	1	N/A	1-1/16	7/16	1/2
1	1	1	9/16***	1	7/16	1/2
1	1	1	5/8	1	7/16	1/2
1	1	1	1*	1-7/16*	7/16	1/2
1 1/2	1	1	3/4	1 1/4	9/16	13/16
1 1/2	1 1/2	1 1/2	13/16	1 3/8	5/8	13/16
1 1/2	1 1/2	1 1/2	1 1/2*	1-7/8*	5/8	13/16
2	1	1	1	1 1/2	3/4	1 1/16
2	1 1/2	1 1/2	1	1 1/2	3/4	1 1/16
2	2	2	1 1/8	1 1/16	7/8	1 1/16
2	2	2	2*	2-5/16*	7/8	1 1/16
3	1 1/2	1 1/2	1 1/2	2 1/8	1 3/16	1 5/8
3	2	2	1 1/2	2 1/8	1 3/16	1 5/8
3	3	3	1 5/8	2 3/8	1 3/8	1 5/8

The required minimum thickness of Spray-Applied Fire Resistive Materials on the steel deck is increased by 1/16 inch for 1-1/2 hr Un-restrained assembly rating and 1/4 inch for 2 hr Unrestrained Assembly rating when Item 6A is used.

When the thickness applied to the lower flange edges is reduced by one half, the 1/2 flange thickness is applicable.

* No minimum insulation thickness required

***Minimum insulation thickness (Item 3) 2 inches.

@ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Joist thickness			
			10K1 more than 4 ft OC	10K1 less than 4 ft OC	16K2 more than 4 ft OC	16K2 less than 4 ft OC
1	0@	1	1 1/8	1	15/16	15/16
1	1	1	1 1/8	1	15/16	15/16
1 1/2	1	1	1 5/16	1 5/16		1 3/16
1 1/2	1 1/2	1 1/2	1 7/16	1 7/16	1 1/4	1 3/16
2	1	1	1 7/16	1 7/16		1 1/2
2	1 1/2	1 1/2	1 7/16	1 7/16		1 1/2
2	2	2	2 3/16	2 3/16	1 9/16	1 1/2
3	1 1/2	1 1/2	3 1/4	2 13/16		2 1/8
3	2	2	3 1/4	2 13/16		2 1/8
3	3	3	3 1/4	2 13/16	2 1/4	2 1/8

@ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	W6x16 Beam Thickness
1	1	1	9/16
1 1/2	1	1	5/8
1 1/2	1 1/2	1 1/2	13/16
2	1	1	7/8
2	1 1/2	1 1/2	7/8
2	2	2	1 1/16
3	1 1/2	1 1/2	1 1/4
3	2	2	1 1/4
3	3	3	1 1/2

ARABIAN Vermiculite Industries —Type Z-146 investigated for exterior use.

GRACE KOREA INC —Type Z-146 investigated for exterior use.

W R GRACE & CO - CONN — Type Z-146, Z-146T, Z146PC, Z-156, Z-156T and Z-156PC investigated for exterior use.

10C. **Alternate Spray-Applied Fire Resistive Materials*** — Applied by mixing with water and spraying in more than one coat to final thicknesses as shown in the illustration above and in the table below to steel surfaces which must be clean and free of dirt, loose scale and oil. When steel deck is used the area between the steel deck and the beams top flange shall be filled. For minimum and

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maximum density of: Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, SK-3, RG, SK-3 see Item 10; Types Z-106, Z-106/G, Z-106/HY, Z-106/G see Item 10A; Type Z-146 see Item 10B.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Joist thickness**	
			12K3 more than 4 ft OC	12K3 less than 4 ft OC
1	0@	1	15/16	15/16
1	1	1	15/16	15/16
1 1/2	1 1/2	1 1/2	1 1/4	1 3/16
2	2	2	1 9/16	1 1/2
3	3	3	2 1/4	2 1/8

**Design load shall stress the 12K3 joist to a maximum tensile strength of 24,000 psi, which represents 80% of the maximum allowable design loading. Based on the Steel Joist Institute (SJI) Publication, "Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders" for guidance on how to increase the design loading accordingly.

@ When the maximum clear span of the steel decking is 5 ft. 2 in. or less, the Unrestrained Assembly Rating is 1-hour.

ARABIAN VERMICULITE INDUSTRIES —Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, SK-3, Z-106, Z-106/G, Z-106/HY, Type Z-146 investigated for exterior use.

GRACE KOREA INC —Types MK-6/HY, MK-6/HY Extended Set, MK-6/HB, MK-6s, MK-6 GF, MK-6 GF Extended, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, SK-3, Types Z-106, Z-106/G, Z-106/HY, Type Z-146 investigated for exterior use.

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, MK-10 HB, MK-10 HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, RG, SK-3, Types Z-106, Z-106/G, Z-106/HY, Type Z-146 investigated for exterior use.

11. **Nonmetallic Fabric Mesh** — (Optional) — As an alternate to the optional use of metal lath, glass fiber fabric mesh, weighing approx 2.5 oz/sq yd, polypropylene fabric mesh, weighing approx 1.25 oz/sq yd or equivalent, may be used to facilitate the spray application. The mesh is secured to one side of each joist web member. The method of attaching the mesh must be sufficient to hold the mesh and the spray applied Spray-Applied Fire Resistive Materials material in place during application until it has cured. An acceptable method to attach the mesh is by embedding the mesh in min 1/4 in. long beads of hot melted glue. The beads of glue shall be spaced a max of 12 in. OC along the top chord of the bar joist. Another method to secure the mesh is by 1-1/4 in. long by 1/2 in. wide hairpin clips formed from No. 18 SWG or heavier steel wire. The method of attaching the mesh must be sufficient to hold the mesh and the spray applied Spray-Applied Fire Resistive Materials material in place during application until it has cured. An acceptable method to attach the mesh is by embedding the mesh in min 1/4 in. long beads of hot melted glue. The beads of glue shall be spaced a max of 12 in. OC along the top chord of the bar joist. Another method to secure the mesh is by 1-1/4 in. long by 1/2 in. wide hairpin clips formed from No. 18 SWG or heavier steel wire.
- 11A. **Metal Lath** — (Not Shown) — (Required with Item 10B, 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.
- 11B. **Metal Lath** — (Not Shown) — (Required on both sides of joists with Z-146, Z-146T, Z146PC, Z-156, Z-156T and Z-156PC, otherwise optional) — Metal lath may be 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/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.

*Bearing the UL Classification Mark