

**FIRESTONE ULTRAPLY TPO
CODE APPROVAL GUIDE**

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“The above stated assemblies may not be suitable for a Firestone Red Shield Warranty. Contact Firestone Roofing Solutions Department, prior to installation, for approval of assembly for warranty purposes.”

I. EXTERNAL FIRE RATINGS

All regional building codes and most local building code officials require that roofing systems meet minimum performance requirements when exposed to external fire sources. The accepted method for measuring external fire resistance is ASTM Standard E-108. This test standard, and closely related standards such as Underwriters Laboratories UL-790 and Uniform Building Code 15-2, is used to determine the ability of a roof system to hinder the horizontal spread or vertical penetration of an external fire source.

Noncombustible Roof Decks (Steel, Concrete, Poured Gypsum) require testing for horizontal spread of flame.

Combustible Roof Decks (Wood, Plywood, Tectum) require testing for both horizontal spread and vertical penetration of flame.

ASTM E-108, UL-790 and UBC 15-2. All classified roof covering assemblies fall into one of the three following categories:

CLASS A: "... includes roof coverings which are effective against severe fire exposures..." *

CLASS B: "... includes roof coverings which are effective against moderate fire exposures..." *

CLASS C: "... includes roof coverings which are effective against light fire exposures..." *

For insulated assemblies over non-combustible roof decks, any classified roofing assembly may be installed over a new roof deck, an existing roof deck or over an existing roofing assembly. Underwriters Laboratories states that "any classified roofing system may be applied over a pre-existing roof system (Class A, B, C, verifiable or not) **of the same deck type** and establishes for that roof the classification of the new system". Also, an assembly classified over a combustible deck may be installed over an existing non-combustible deck and establish for the assembly the rating of the new system. A non-combustible deck rated assembly **must** be tested and classified over a combustible deck in order to obtain the desired classification of the new assembly. Total insulation thickness of combined existing and new roofing systems may not exceed the total maximum allowable for the new roofing system, and non-insulated systems are not intended for use over insulated systems.

The class of roof covering required by each regional building code depends upon many factors, including the use and location of the building and the type of construction. The local building authority should always be consulted as to what the roofing assembly classification will need to be for each roofing project.

It should be noted that these classifications apply to roofing assemblies, and ***NOT the roofing membrane***. A roofing membrane that is classified as part of a Class A assembly when installed over a particular insulation may not qualify as part of a Class A assembly with another insulation.

The column titled "UL Item Number" in the following listings has been added as a service to those who have the UL Building Materials Directory. It identifies the UL listing from which our Code Approval Guide listing derives (e.g. "A,FA,23" means Class A, Fully Adhered, item number 23; "B,MA,04" means Class B, Mechanically Attached, item number 04, etc.).

* From Underwriters Laboratories Roofing Materials and Systems Directory, January, 2006, page 1.

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UL CLASS A, B, C

SYSTEM: BALLASTED OR PROTECTED MEMBRANE
MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
CONSTRUCTION: NEW, RETROFIT OR TEAR-OFF

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
2	A	C/NC	<p>Deck:</p> <p>Insulation: Any one or combination of the following at minimum thickness indicated (no maximum thickness): minimum thickness is for fully supported insulation. Metal deck flute width may require an increase in this this thickness. Consult insulation manufacturer on flute spanability</p> <ul style="list-style-type: none"> a) 1" ISO 95+ GL b) 1" Foamular 150 or 250 c) 1" EPS d) 1" Polyurethane e) 1" Polyisocyanurate f) ½" Firestone "FiberTop B, C, E or S" g) ½" Dow SM, TG, Grayboard h) Lt. Wt. Insulating concrete <p>Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil)</p> <p>Ballast: River bottom stone (¾ to 1-1/2 inch in diameter) at 1000 lb/sq</p> <p>As an option, the Firestone Protection Mat may be installed either beneath or directly above the membrane. A thermal barrier is required below polystyrene insulation by the building codes when the polystyrene is placed over metal decks. An insulation separator is required over ltwt insulating concrete.</p> <p style="text-align: center;">PROTECTED MEMBRANE (IRMA) SYSTEMS ONLY:</p>	1	A,BA,01 A,BA,12
2	A	C/NC	<p>Deck:</p> <p>Insulation: Any one or combination of the above insulation</p> <p>Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil)</p> <p>Insulation: (no maximum thickness):</p> <ul style="list-style-type: none"> a) 1" Foamular 404 b) 1" Dow RM, PD or Styrorib c) 2" LightGuard, 3" max. (2) <p>Ballast: River bottom stone (¾ to 1-1/2 inch in diameter) at 1000 lb/sq Foamular, Dow RM, PD, or Styrorib require the placement of Firestone Protection Mat over the insulation immediately prior to placing the ballast LightGauard does not require the use of ballast</p>	1	A,BA,02

- 1) I.S.O.FIX, I.S.O.Spray, I.S.O. Twin Pack or hot asphalt may be used to attach insulation to deck and/or insulation to insulation or coverboards and maintain the above rating shown. Consult Firestone Technical for acceptable combinations for warranty purposes.

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UL CLASS A, B, C

SYSTEM: FULLY ADHERED (w/ULTRAPLY Bonding Adhesive or WBBA)
MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
CONSTRUCTION: NEW, RETROFIT OR TEAR-OFF

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
1/4	A	NC / C(2)	Deck: Insulation: Firestone ISO 95+ GL, any thickness Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA	1,2	TBD
1/2	A	NC C(2)	Deck: Insulation: (opt) Firestone ISO 95+ GL, any thickness Coverboard: min. 1/2" Firestone FiberTop B, C, E or S Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA	1,2	A, FA,101
1-1/2	A	C/NC	Deck: Insulation: (opt) Firestone ISO 95+ GL, any thickness Coverboard: min. 1/4" Dens-Deck, D-D Prime or D-D DuraGuard Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA	1	A,FA,102
1-1/4	A	NC C(2)	Deck: Insulation: Firestone ISO 95+ GL, any thickness Coverboard: 7/16" OSB Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA	1,2	A,FA,141
1/2	A	C	Deck: Slip Sheet: two layers "VersaShield Underlayment" or "VersaShield FB-2S" Insulation: Firestone ISO 95+ GL, any thickness Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA		A,FA,139
1/2	A	C	Deck: Slip Sheet: two layers "VersaShield FB-1S" Insulation: Firestone ISO 95+ GL, any thickness Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA		A,FA,140

- 1) I.S.O.FIX, I.S.O.Spray, I.S.O. Twin Pack or hot asphalt may be used to attach insulation to deck and/or insulation to insulation or coverboards and maintain the above rating shown. Consult Firestone Technical for acceptable combinations for warranty purposes.
- 2) UL Classification can be maintained, at the slope indicated, over a combustible deck by incorporating 1/2" gypsum board or 1/4" Georgia-Pacific "Dens-Deck" directly on the combustible deck.

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UL CLASS A, B, C

SYSTEM: FULLY ADHERED (w/ULTRAPLY Bonding Adhesive or WBBA)
MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
CONSTRUCTION: NEW, RETROFIT OR TEAR-OFF

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
1/2	B	C	Deck: Base Sheet: one or more plies of Firestone MB Base M Insulation: a) min. 1" FiberTop B,C,E or S b) min. 1/2" FiberTop B,C,E or S over min. 1" Firestone ISO 95+ GL Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA		B,FA,30
1/2	B	C	Deck: Insulation: a) min. 1.5" FiberTop B,C,E or S b) min. 1/2" FiberTop B,C,E or S over min. 1.5" Firestone ISO 95+ GL Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), adhered w/WBBA or UPBA		B,FA,31

- 1) I.S.O.FIX, I.S.O.Spray, I.S.O. Twin Pack or hot asphalt may be used to attach insulation to deck and/or insulation to insulation or coverboards and maintain the above rating shown. Consult Firestone Technical for acceptable combinations for warranty purposes.
- 2) UL Classification can be maintained, at the slope indicated, over a combustible deck by incorporating 1/2" gypsum board or 1/4" Georgia-Pacific "Dens-Deck" directly on the combustible deck.

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UL CLASS A, B, C

SYSTEM: FULLY ADHERED (w/TPO XR Bonding Adhesive)
MEMBRANE: ULTRAPLY TPO XR 100 or TPO XR 115
CONSTRUCTION: NEW, RETROFIT OR TEAR-OFF

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
1	A	C/NC	Insulation: (opt) Firestone ISO 95+ GL Coverboard: min. 1/4" G-P Gypsum Dens-Deck or Dens-Deck Prime Membrane: TPO XR 100 or TPO XR 115 adhered w/TPO XR BA @90 sq. ft./gal	1	A,FA,157
1	B	NC C(2)	Insulation: (opt) Firestone ISO 95+ GL Coverboard: Min. 7/16" OSB Membrane: TPO XR 100 or TPO XR 115 adhered w/TPO XR BA @90 sq. ft./gal	1,2	B,FA,44
1	B	NC	Existing Class A APP or SBS modified bitumen assembly (non-coated) Membrane: TPO XR 100 or TPO XR 115 adhered w/TPO XR BA @90 sq. ft./gal		B,FA,45 B,FA,46
1	B	NC	Existing Class A Mineral cap sheet assembly, (MA) Base Sheet (non-coated) Membrane: TPO XR 100 or TPO XR 115 adhered w/TPO XR BA @90 sq. ft./gal		B,MA,16

- 1) I.S.O.FIX, I.S.O.Spray, I.S.O. Twin Pack or hot asphalt may be used to attach insulation to deck and/or insulation to insulation or coverboards and maintain the above rating shown. Consult Firestone Technical for acceptable combinations for warranty purposes.
- 2) UL Classification can be maintained, at the slope indicated, over a combustible deck by incorporating 1/2" gypsum board or 1/4" Georgia-Pacific "Dens-Deck" directly on the combustible deck.

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UL CLASS A, B, C

SYSTEM: **FULLY ADHERED (W XR Bonding Adhesive)**
MEMBRANE: **UltraPly TPO XR 100 or TPO XR 115**
CONSTRUCTION: **RECOVER**

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
1	A,B,C	C	Existing Roof System: Class A, B, or C BUR (smooth surface or cap sheet), to retain Existing Classification, cover with: Membrane: UltraPly TPO XR 100 or TPO XR 115 adhered with XR Bonding Adhesive		MR, 03

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UL CLASS A, B, C

SYSTEM: MECHANICALLY ATTACHED
MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
CONSTRUCTION: NEW, RETROFIT OR TEAR-OFF

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
3	A	C/NC	Deck: Insulation: (opt) Firestone ISO 95+ GL, any thickness Coverboard: min. 1/4" Dens-Deck, D-D Prime, D-D DuraGuard Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached	1	A,MA,69
1-3/4	A	NC C(2)	Deck: Insulation: (opt) Firestone ISO 95+ GL, any thickness Coverboard: min. 1/2" Firestone FiberTop B, C, E or S Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached	1,2	A, MA,68
1/2	A	NC C(2)	Deck: Insulation: Firestone ISO 95+ GL, any thickness Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached	1,2	A,MA,67
1/2	A	C	Deck: Slip Sheet: two or more layers of Atlas "FR 50" Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		A,MA,75
1	A	C	Deck: Slip Sheet: two layers "VersaShield Underlayment" or "VersaShield FB-2S" Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		A,MA,88
1/2	A	C	Deck: Slip Sheet: two layers "VersaShield Underlayment" or "VersaShield FB-2S" Insulation: Firestone ISO 95+ GL, any thickness Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		A,MA,89

- 1) I.S.O.FIX, I.S.O.Spray, I.S.O. Twin Pack or hot asphalt may be used to attach insulation to deck and/or insulation to insulation or coverboards and maintain the above rating shown. Consult Firestone Technical for acceptable combinations for warranty purposes.
- 2) UL Classification can be maintained, at the slope indicated, over a combustible deck by incorporating 1/2" gypsum board or 1/4" Georgia-Pacific "Dens-Deck" directly on the combustible deck.

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UL CLASS A, B, C

SYSTEM: MECHANICALLY ATTACHED
MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
CONSTRUCTION: NEW, RETROFIT OR TEAR-OFF

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
1/2	A	C	Deck: Slip Sheet: two layers "VersaShield FB-1S" Insulation: (opt) Firestone ISO 95+ GL, any thickness Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		A,MA,90
1	B	C	Deck: Base Sheet: one or more plies of Firestone MB Base M Insulation: a) min. 1.5" Firestone ISO 95+ GL b) min. 1" FiberTop B,C,E or S c) min. 1/2" FiberTop B,C,E or S over min. 1" Firestone ISO 95+ GL Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		B,MA,06
1	B	C	Deck: Insulation: a) min. 1.5" FiberTop B,C,E or S b) min. 1/2" FiberTop B,C,E or S over min. 1.5" Firestone ISO 95+ GL Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		B,MA,07
1/2	B	C	Deck: Slip Sheet: one or more layers of Atlas "FR 50" Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		B,MA,05
1	B	C	Deck: Slip Sheet: two layers "VersaShield Underlayment" or "VersaShield FB-2S", preliminary attachment Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		B,MA,15

- 1) I.S.O.FIX, I.S.O.Spray, I.S.O. Twin Pack or hot asphalt may be used to attach insulation to deck and/or insulation to insulation or coverboards and maintain the above rating shown. Consult Firestone Technical for acceptable combinations for warranty purposes.
- 2) UL Classification can be maintained, at the slope indicated, over a combustible deck by incorporating 1/2" gypsum board or 1/4" Georgia-Pacific "Dens-Deck" directly on the combustible deck.

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UL CLASS A, B, C

SYSTEM: MECHANICALLY ATTACHED
MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
CONSTRUCTION: RECOVER

Max Slope	Class	Deck	Insulation Assembly	Remarks	UL Item No.
1	A,B,C	C	Existing Roof System: Class A, B, or C BUR (smooth surface or cap sheet), to retain Existing Classification, cover with: Slip Sheet: Atlas "FR 10" or "FR 11", one layer Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		MR, 01
1	A,B,C	C	Existing Roof System: Class A, B, or C BUR (smooth surface or cap sheet), to retain Existing Classification, cover with: Slip Sheet: "VersaShield Underlayment", one layer Membrane: Membrane: UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil), mechanically attached		MR,02

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II. INTERNAL FIRE RATINGS

In order to determine the resistance of a building to internal sources of fire, Underwriters Laboratories has conducted extensive testing and classification of wall, floor/ceiling and roof/ceiling assemblies. UL classified assemblies are rated according to the time in hours the assembly will contain a fire and still maintain structural integrity. Testing is conducted in accordance with UL Standard 263 (ASTM E-119), which is recognized by all major building codes.

Roof/Ceiling Assemblies are listed in the UL Fire Resistance Directory - Vol. 1 under the prefix "P" and are classified by hourly fire rating according to the type of protection used to contain a fire:

ASSEMBLY	PROTECTION USED
P000 - P099	Concealed grid suspended ceiling
P200 - P299	Exposed grid suspended ceiling
P400 - P499	Metal lathe (plaster) ceiling
P500 - P599	Gypsum board ceiling
P600 - P699	Miscellaneous fireproofing
P700 - P799	Spray-Applied Resistive Material
P800 - P899	Spray-Applied Resistive Material
P900 - P999	Unprotected concrete or composite decks

It should be noted that the roof membrane forms only a small part of the total roof/ceiling assembly. In order for a structure to qualify for a particular "P" Assembly or Roof Deck Construction, all materials used to construct the assembly (including roof decking, ceiling materials, light fixtures, duct work and structural support members) must be UL classified and installed as described in the appropriate UL Directories.

The insulations listed with each of the following "P" Assemblies are not, in most cases, the only UL accepted insulations for that assembly. Consult the UL Fire Resistance Directory - Vol. 1 for "P" Assembly information and the UL Roofing Materials and Systems Directory for Roof Deck Construction information, or call Firestone Technical Services for additional accepted insulations.

UL has indicated on page 8 of the 2006 Fire Resistance Directory - Vol. 1 that "Class A, B or C roof coverings consisting of hot mopped or cold applied bituminous materials or a roof covering material Classified under 'Roofing Membranes' (CHCI) may be applied directly to the concrete or wood surface of floor designs being used as roofs without a reduction of fire resistance ratings." They further state on page 8 that "Roof insulation is to be carefully controlled relative to manufacturer, type and thickness as specified. Less than the specified thickness could result in higher temperatures on the roof covering while a greater thickness of insulation could cause earlier structural failure. Classified polystyrene insulation, with a density of 5 pcf or less, may be placed on concrete floors or structural concrete roofs without reducing the assembly rating. When ...polyisocyanurate insulation are used over concrete in D 900 Series Designs, the unrestrained beam rating shall be increase by a minimum of ½ hour."

Roof Deck Constructions are listed in the UL Roofing Materials and Systems Directory and are rated according to the interior flame spread of the assembly as compared to the flame spread of a typical built-up roof installed over a metal deck (UL 1256). Roof Deck Constructions may also be classified according to wind uplift performance. The fire rating of a UL Roof Deck Construction is similar to the Factory Mutual Class I internal fire (calorimeter) rating and they are deemed equivalent by the Model Building Code Agencies.

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UL ROOF DECK CONSTRUCTIONS AND "P" ASSEMBLIES

DECK CONSTRUCTIONS

Firestone TPO 96/120 Roofing Systems are Classified for use in the following Deck Construction (tested to UL 1256).
1, 2, 9, 14, 120, 123, 158, 200, 219, 237, 260, 276, 289, 292, 325, 374, 411, 412, 413, 419, 421, 440, 441, 444, 457, and 458

Consult Roof Deck Constructions (TGKX) in the UL Roofing Materials and Systems Directory, your regional technical coordinator or the Firestone Codes Department for an acceptable insulation for use in these constructions.

"P" ASSEMBLIES

Firestone's TPO 96/120 Roofing Systems are Classified for use in the following Hourly Roof / Ceiling Designs ("P" Designs).

P211, P214, P215, P216, P224, P 225, P227, P229, P230, P231, P232, P235, P237, P241, P242, P246, P251, P259, P405, P406, P407, P410, P411, P505, P507, P508, P509, P510, P511, P 513, P514, P519, P701, P708, P709, P710, P711, P712, P713, P717, P718, P719, P720, P722, P 723, P724, P725, P726, P727, P728, P729, P730, P731, P732, P733, P734, P735, P736, P737, P738, P739, P801, P802, P803, P804, P805, P810, P811, P812, P813, P814, P815, P816, P817, P818, P819, P822, P823, P825, P826, P827, P902, P903, P904, P905, P906 P907, P908, P909, P910, P911, P912, P913, P914, P915, P916 P917, P918, P919, P920, P921, P922, P923, P924, P925, P926, P927, P928, P929, P930, P931.

Consult Fire Resistance Ratings (BXUV) in the UL Fire Resistance Directory, your regional technical coordinator or the Firestone Codes Department for an acceptable insulation, thickness and additional requirements.

Note: The accepted insulation must be used in a UL Class A, B or C rated roofing assembly. UL acceptable system (e.g. adhering EPDM to Perlite or Fiberglas) listed for "P" design may not be approved for installation and warranty by Firestone. Contact Firestone Specifications and/or your Firestone Regional Technical Coordinator concerning acceptance. Please refer to Pages 3 through 9 of this Approval Guide to determine the appropriate insulation/membrane assembly.

UPLIFT RATINGS

FACTORY MUTUAL UPLIFT RATINGS

Although Factory Mutual Class 1 Approvals cover a wide range of testing of roofing products, including tests for fire resistance, corrosion resistance, fuel contribution and hail damage, Factory Mutual Approvals are known best for the uplift resistance, 1-60, 1-90, etc. afforded by an FM Approved roofing assembly:

FM 1-60 assemblies have been tested to withstand 60 psf air pressure applied for a period of one minute as well as one minute at the 30 and 45 psf levels.

FM 1-90 assemblies have been tested to withstand 90 psf air pressure applied for a period of one minute as well as one minute at the 30, 45, 60 and 75 psf levels.

Higher uplift ratings are possible based on the deck type and its attachment, fastener density and row spacing where applicable.

When Factory Mutual 1-60 or 1-90 uplift ratings are specified, additional insulation attachment and reduced perimeter and corner batten (in-seam plate or batten for Reinforced Systems) spacing will/may be required. Consult the current edition of Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29 for instructions for determining the required corner and perimeter dimensions and reduced spacing and increased fastener densities.

BALLASTED SYSTEMS

Although Factory Mutual tests and rates only fully adhered and mechanically attached systems, Factory Mutual does accept the use of Ballasted Roof Systems on a job-to-job basis for FM insured clients. According to Mr. Edward J. Ward, Construction Standards Manager for Factory Mutual Research, "... the Factory Mutual system windstorm loss experience has been extremely favorable for single ply ballasted roof systems. When these roofs are installed in accordance with (Factory Mutual) Loss Prevention Data Sheet 1-29, they are equally acceptable to Factory Mutual approved roofs."

Page 25-27 of this Approval Guide provides a summary of FM's current guideline for ballasted roof systems.

ADHERED SYSTEM UPLIFT RATINGS

MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
Adhered w/ULTRAPLY Bonding Adhesive
DECK: CONCRETE (primed)
CONSTRUCTION: NEW OR TEAR-OFF

<u>Insulation</u>	<u>Min. Top Layer Thickness</u>	<u>Rating</u>	<u>Notes</u>
ISO 95+ GL	1.5" (1)	1-360	1,2
Firestone FiberTop B, C, E, S	1/2" (1)	1-270	1,3
Georgia-Pacific "Dens-Deck"	1/4" (1)	1-390	1,4

- (1) Hot mopped with min ASTM Type III Asphalt @ 25 lbs/sq or full coverage rate of Firestone I.S.O.Spray
- (2) Achieves 1A rating at max. 1/4:12
- (3) Achieves 1A rating at max. 1/2:12
- (4) Achieves 1A rating at max. 2-1/2:12

a) I.S.O. Twin Pack – concrete

1. Min. 1/4" Dens-Deck or Dens-Deck Prime secured to concrete with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive, **achieves 1-390 rating; Class A @ max. 1/2:12**
2. Min. 1/4" Dens-Deck or Dens-Deck Prime secured with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to min. 1.5" ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to (opt) min 1.5" ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to the concrete deck. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive **achieves 1-315 rating; Class A @ max. 1/2:12**
3. Min. 1/4" Dens-Deck or Dens-Deck Prime secured to new asphaltic vapor barrier or properly prepared BUR with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive, **achieves max. 1-315 rating; Class A @ max. 1/2:12**
4. Tapered ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to (opt) subsequent layers of ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. secured to min. 1.5" ISO 95+ GL with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. secured to concrete deck. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive, **achieves 1-315; Class C @ max. 1/2:12 .**
5. Min. 1/2" FiberTop Wood fiberboard secured with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to min. 1.5" ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to (opt) min 1.5" ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to the concrete deck. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive **achieves 1-255 ratings; Class A @ max. 1/2:12 .**
6. Min. 1/2" FiberTop Wood fiberboard secured with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to min. 1.5" ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to (opt) min 1.5" ISO 95+ GL secured with 1/2" – 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to new asphaltic vapor barrier or properly prepared BUR. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive **achieves max. 1-255 ratings; Class A @ max. 1/2:12 .**

b) I.S.O. Twin Pack – gypsum (re-roof)

1. Min. 1/4" Dens-Deck or Dens-Deck Prime (4 x 4) or min. 1/2" FiberTop Wood Fiberboard (4 x 4) secured to properly prepared gypsum deck with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive, **achieves 1-90 rating; Class A @ max. 1/2:12**
2. (opt) min. 1/4" Dens-Deck or Dens-Deck Prime (4 x 4) or (opt) min. 1/2" FiberTop Wood Fiberboard (4 x 4) secured with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to flat or tapered ISO 95+ GL secured to (opt) subsequent layers of ISO 95+ GL secured with 1/2" to 3/4" ribbons of I.S.O. Twin Pack 12" o.c. to properly prepared gypsum deck. Firestone UltraPly TPO adhered membrane with UltraPly Bonding Adhesive, **achieves 1-90 rating; Class A @ max. 1/2:12 with FiberTop or Dens-Deck, Class C @ 1/2:12 with only ISO 95+ GL**

"The above stated assemblies may not be suitable for a Firestone Red Shield Warranty. Contact Firestone Roofing Solutions Department, prior to installation, for approval of assembly for warranty purposes."

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ADHERED SYSTEM UPLIFT RATINGS

MEMBRANE: ULTRAPLY TPO XR 100/115
Adhered w/XR Bonding Adhesive
DECK: CONCRETE (primed)
CONSTRUCTION: NEW OR TEAR-OFF

Insulation	Coverboard	Rating/Notes
Flat or tapered ISO 95+GL set in 3/4" to 1" ribbons of I.S.O. Fixx adhesive 12" o.c., multiple layers acceptable	min. 1/4" Dens-Deck Prime set in 3/4" to 1" ribbons of I.S.O. Fixx adhesive 12" o.c.	1-315 (1)
Flat or tapered ISO 95+GL set in 3/4" to 1" ribbons of I.S.O. Fixx adhesive 12" o.c., multiple layers acceptable	N/A	1-375 (2)
Flat or tapered ISO 95+GL set in 1/2" to 3/4" ribbons of I.S.O. Twin Pack adhesive 12" o.c., multiple layers acceptable	min. 1/4" Dens-Deck Prime set in 3/4" to 1" ribbons of I.S.O. Twin Pack adhesive 12" o.c.	1-375 (1)
Flat or tapered ISO 95+GL set in 1/2" to 3/4" ribbons of I.S.O. Twin Pack adhesive 12" o.c., multiple layers acceptable	N/A	1-555 (2)

Notes:

- 1) Class A at max. 1/2:12
- 2) Class C at max. 1/2:12

MEMBRANE: ULTRAPLY TPO XR 100/115
Adhered w/XR Bonding Adhesive
DECK: Lightweight Insulating Concrete
CONSTRUCTION: NEW OR TEAR-OFF

Lightweight Insulating Concrete	Rating/Notes
Celcore (min. 36# wet cast density-insulated) steel deck attached to 4' o.c bar joists	1-135 (1)
Elastizell (Range II est cast density-insulated) steel deck attached to 5' o.c. bar joists	1-75 (1)

Notes:

- 1) Class A at max. 1/2:12

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ADHERED SYSTEM UPLIFT RATINGS

MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
Adhered w/ULTRAPLY Bonding Adhesive or WBBA
DECK: STEEL OR CONCRETE
CONSTRUCTION: NEW OR TEAR-OFF

Note: For 1-60 and 1-75 assemblies, insulation fastener density must be increased by 50% but not less than 1 per 2 sq. ft. in the perimeters and 100% but not less than 1 per 1 sq. ft. in the corners. For 1-90 and above must meet the pressures state in Table 1 of PDS 1-29 (2006) Example: field – 90 psf, perimeters – 150 psf, corners – 225 psf. Perimeter/corners are determined as 10% of the buildings lesser plan dimension or 40% of the buildings roof height, whichever is least, but not less than 3 feet.

<u>Insulation</u>	<u>Min. Top Layer Thickness</u>	<u>Rating</u>	<u>Notes</u>
ISO 95+ GL	1.5" (12 per 4 x 8)	1-90	1,2,5
ISO 95+ GL	1.5" (18 per 4 x 8)	1-120	1,2,5
ISO 95+ GL	2.0" (8 per 4 x 8)	1-90	1,2,5
Firestone FiberTop C, S	1/2" (12 per 4 x 8)	1-75	1,3,5
Firestone FiberTop B, E	1/2" (16 per 4 x 8)	1-90	1,3,5
Firestone FiberTop B, C, E, S	1" (16 per 4 x 8)	1-90	1,3,5
Georgia-Pacific "Dens-Deck"	1/4" (15 per 4 x 8)	1-90	1,4,5
Georgia-Pacific "Dens-Deck"Prime	1/4" (12 per 4 x 8)	1-90	1,4,5
7/16" OSB or 15/32" plywood (UP BA only)	(16 per 4 x 8)	1-150	1,3,5
7/16" OSB or 15/32" plywood (UP BA only)	(12 per 4 x 8)	1-90	1,3,6
7/16" OSB or 15/32" plywood (UP BA only)	(20 per 4 x 8)	1-105	1,3,6
Hailgard (UP BA only)	(16 per 4 x 8)	1-150	1,3,5
Hailgard (UP BA only)	(12 per 4 x 8)	1-90	1,3,6
Hailgard (UP BA only)	(20 per 4 x 8)	1-105	1,3,6

- (1) See chart and diagrams pages 12 - 17
- (2) Achieves 1A rating at max. 1/4:12*
- (3) Achieves 1A rating at max. 1/2:12*
- (4) Achieves 1A rating at max. 2-1/2:12*
- (5) AP or HD fastener/insulation plate
- (6) Hailgard fastener only

* Exterior fire rating can be maintained over FM Approved Wood Decks (up to and including a maximum slope of 2:12) when min. 1/4" Georgia-Pacific "Dens-Deck" is placed directly on the Wood Deck under the insulation.

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ADHERED SYSTEM UPLIFT RATINGS

MEMBRANE: ULTRAPLY TPO XR 100/TPO XR 115
Adhered w/XR Bonding Adhesive or Hot Asphalt
DECK: STEEL OR CONCRETE
CONSTRUCTION: NEW OR TEAR-OFF

Insulation/Assembly	Membrane attached with XR Bonding Adhesive	Membrane attached with Hot asphalt	Rating	Notes
Existing smooth surface or properly prepared BUR	Yes	N/A	Existing or 1-90	3
Existing smooth surface or properly prepared BUR	N/A	Yes	Existing or 1-90	3
Existing Class A APP or SBS Mod.Bit system (no coating)	Yes	N/A	Existing or 1-90	3
Existing Class A APP or SBS Mod.Bit system (no coating)	N/A	Yes	Existing or 1-90	3
Min. 1.5" ISO 95+ GL attached at 1/2.67 sq.ft. (12 per 4x8)	Yes	N/A	1-90	3
Min. ¼" Dens-Deck or Dens-Deck Prime over min. 1.5" ISO 95+ GL. Dens-Deck attached at 1/2.67 sq.ft. (12 per 4x8)	Yes	N/A	1-90	1
Min. ½" FiberTop Wood Fiberboard over min. 1.5" ISO 95+ GL. WFB attached at 1/2 sq.ft. (16 per 4x8)	Yes	N/A	1-90	1
Min. 1.5" ISO 95+ GL attached at 1/2.67 sq.ft. (12 per 4x8)	N/A	Yes	1-90	3
Min. ¼" Dens-Deck or Dens-Deck Prime over min. 1.5" ISO 95+ GL. Dens-Deck attached at 1/2.67 sq.ft. (12 per 4x8)	N/A	Yes	1-90	2
Min. ½" FiberTop Wood Fiberboard over min. 1.5" ISO 95+ GL. WFB attached at 1/2 sq.ft. (16 per 4x8)	N/A	Yes	1-90	2
Min. ½" FiberTop Wood Fiberboard hot mopped to min. 1.5" ISO 95+ GL that is attached at 1/2 sq.ft. (16 per 4x8)	Yes	N/A	1-90	1
Min. ½" FiberTop Wood Fiberboard hot mopped to min. 1.5" ISO 95+ GL that is attached at 1/2 sq.ft. (16 per 4x8)	N/A	Yes	1-90	2

Notes:

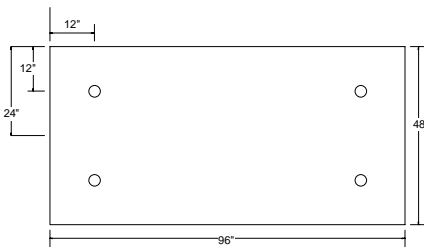
- 1) Class A at max. ½:12
- 2) Class B at max. ½:12
- 3) Class C at max. ½:12

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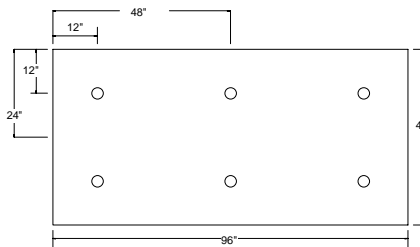
Fastener / Plate Density Chart
for 4 x 8 boards

Field	Perimeters	Corners		Field	Perimeters	Corners
4	6	7		15	23	27
5	8	9		16	24	28
6	9	11		17	26	30
7	11	13		18	27	32
8	12	14		19	29	34
9	14	16		20	30	35
10	15	18		21	32	37
11	17	20		22	33	39
12	18	21		23	35	41
13	20	23		24	36	42
14	21	25				

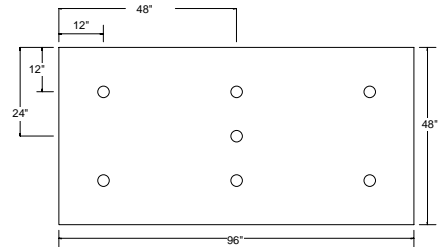
Fastener Patterns



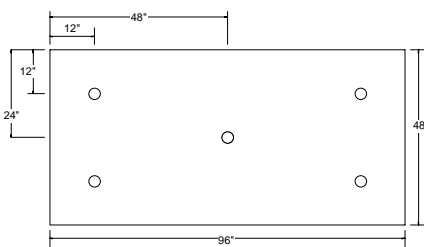
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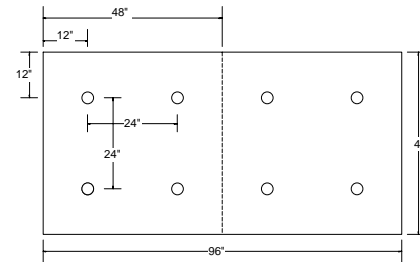
Perimeters (6)



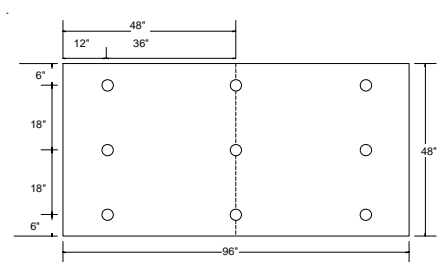
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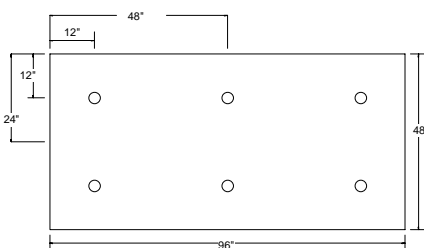
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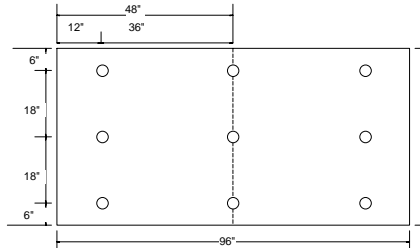
Perimeters (8)



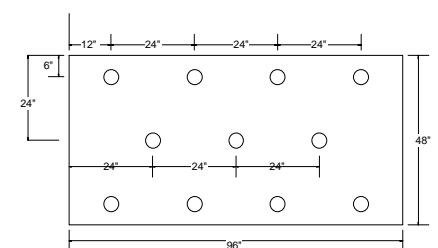
Corners (9)



Field (6)



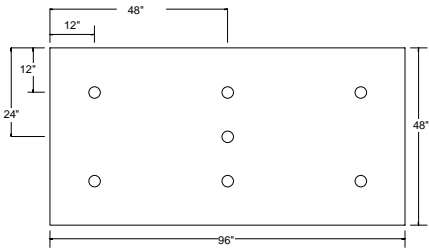
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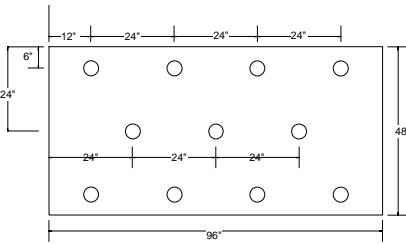
Corners (11)

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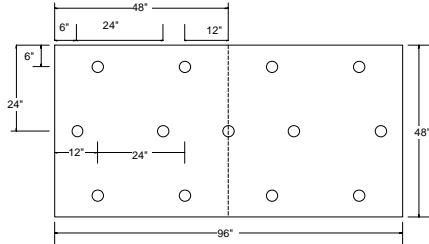
Fastener Patterns



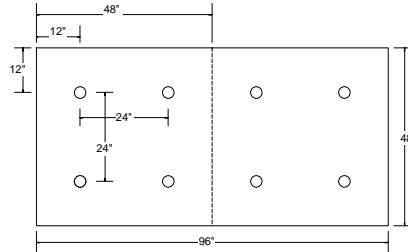
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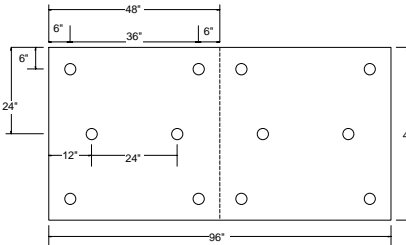
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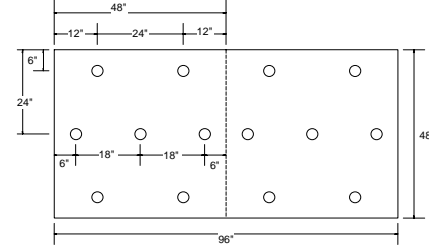
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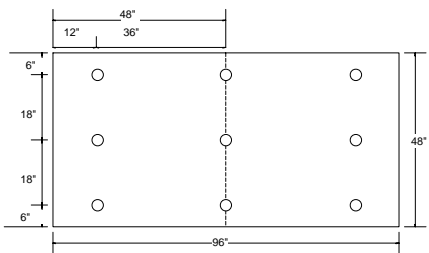
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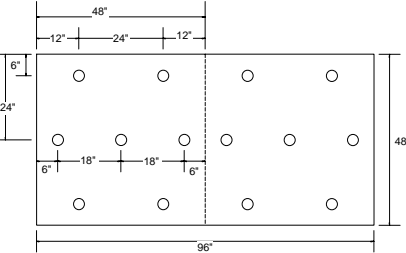
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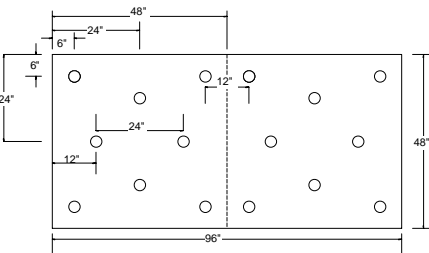
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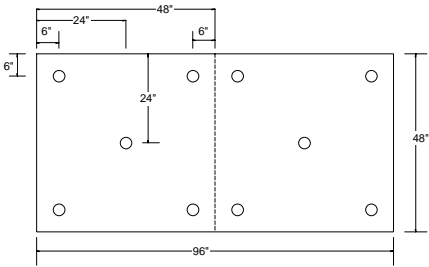
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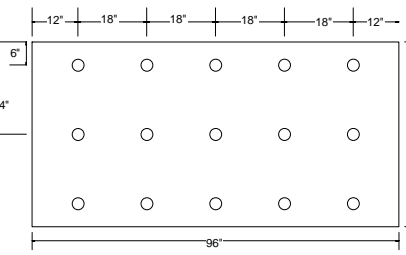
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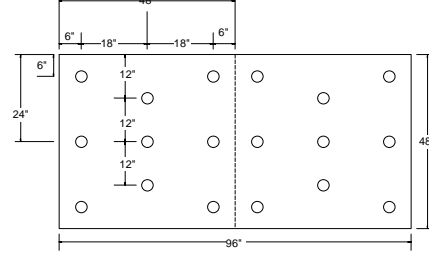
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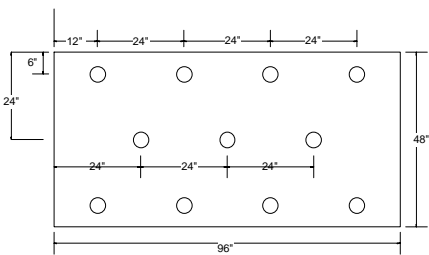
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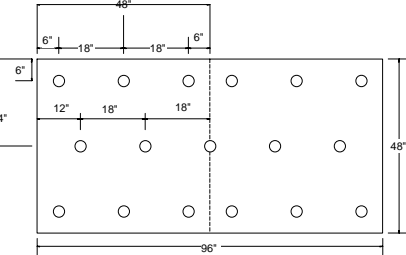
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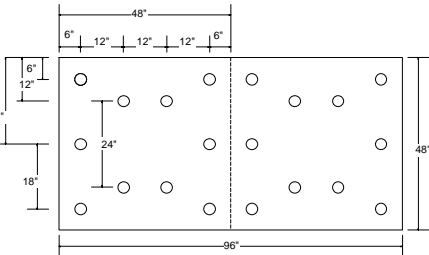
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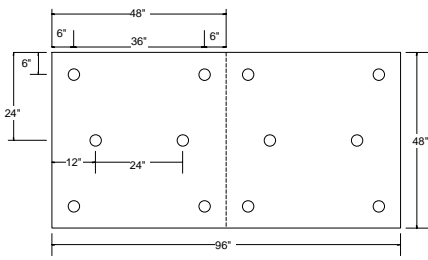
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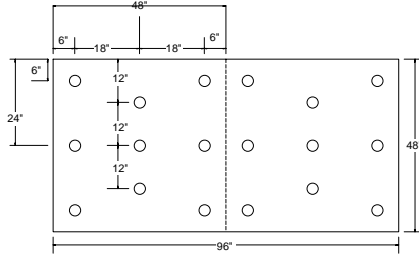
Corners (20)

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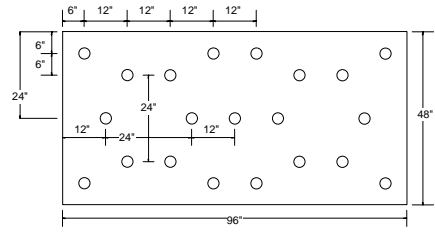
Fastener Patterns



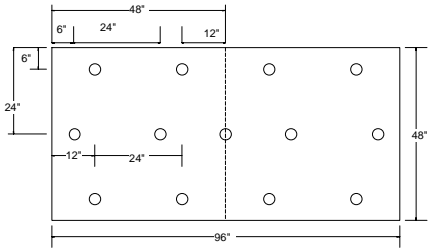
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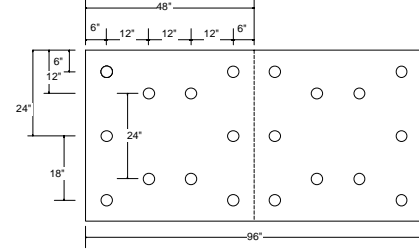
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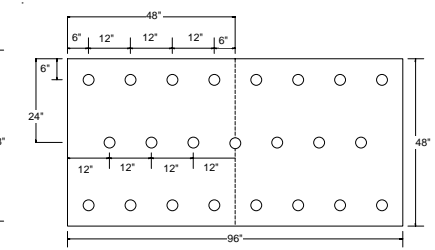
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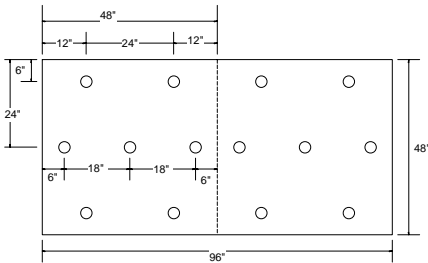
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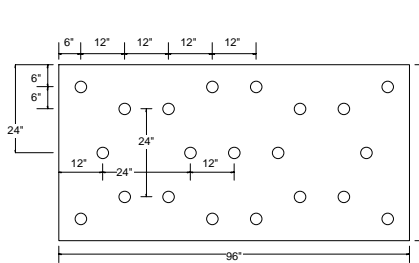
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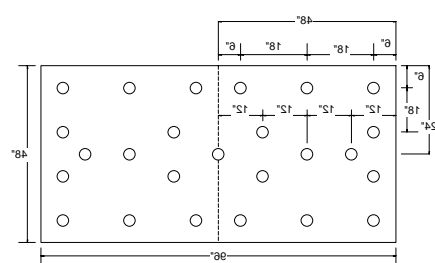
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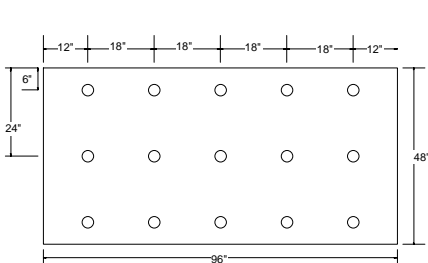
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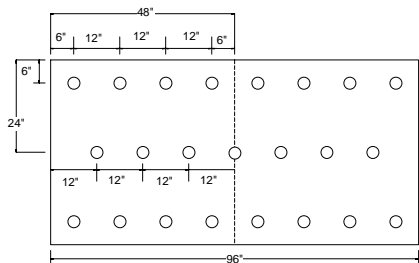
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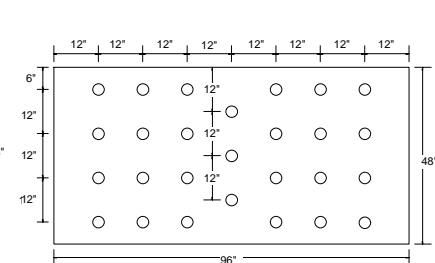
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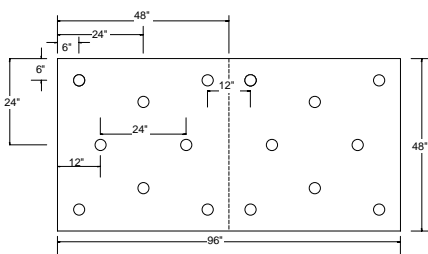
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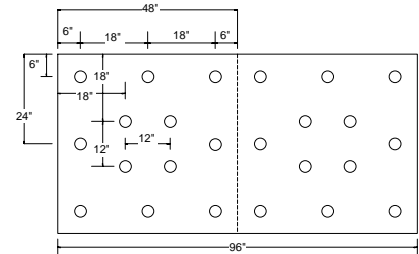
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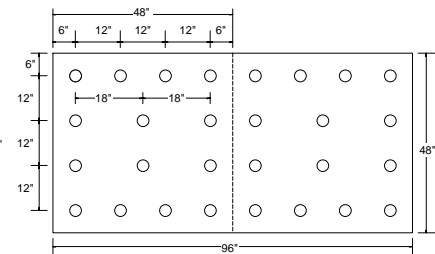
Corners (27)



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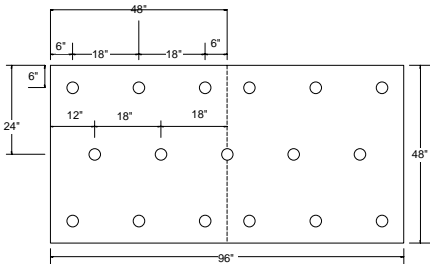
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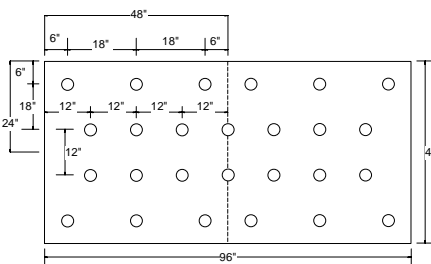
Corners (28)

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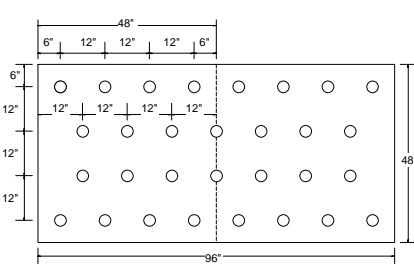
Fastener Patterns



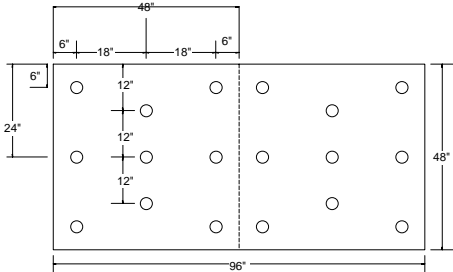
Field (17)



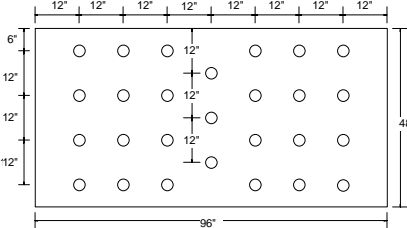
Perimeters (26)



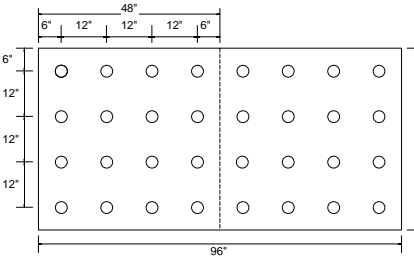
Corners (30)



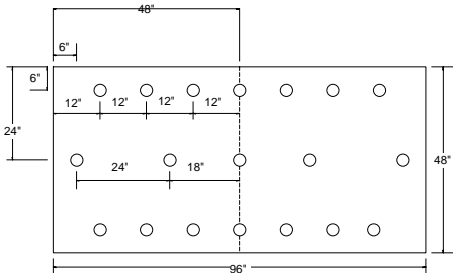
Field (18)



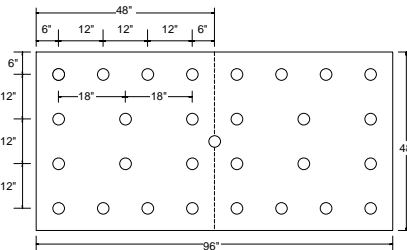
Perimeters (27)



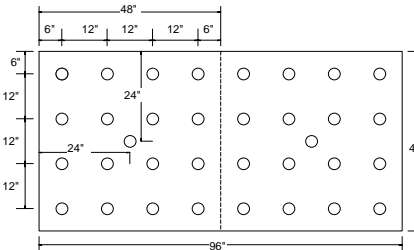
Corners (32)



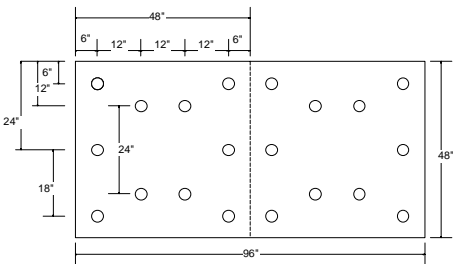
Field (19)



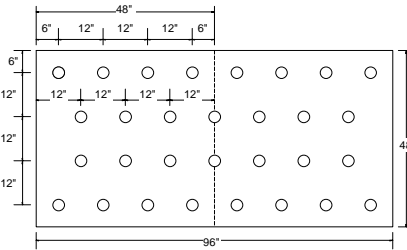
Perimeters (29)



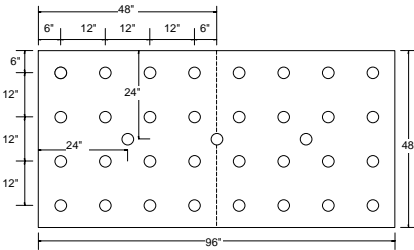
Corners (34)



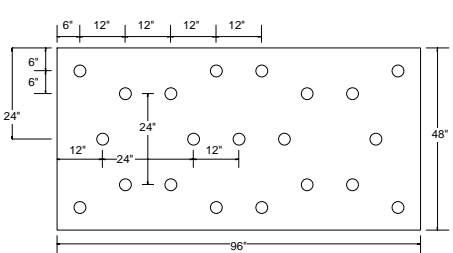
Field (20)



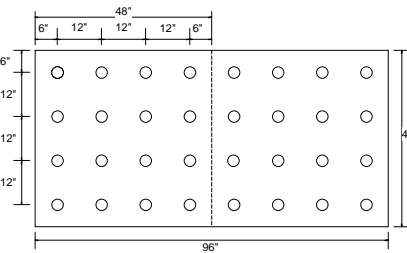
Perimeters (30)



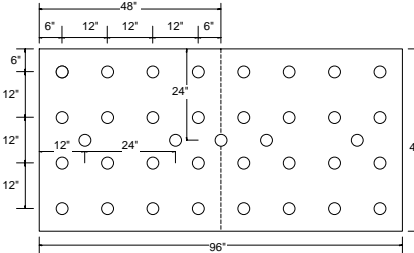
Corners (35)



Field (21)



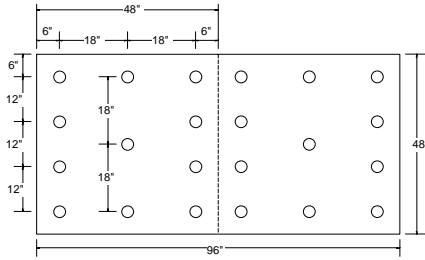
Perimeters (32)



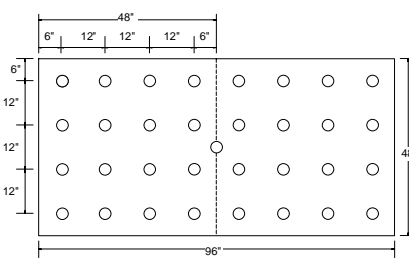
Corners (37)

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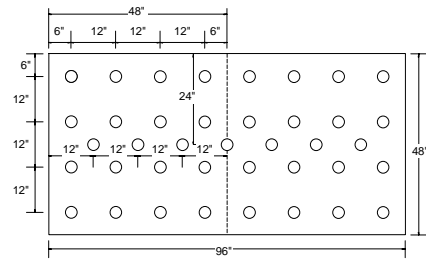
Fastener Patterns



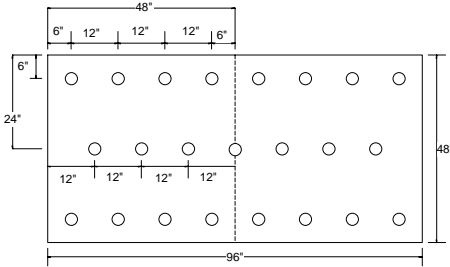
Field (22)



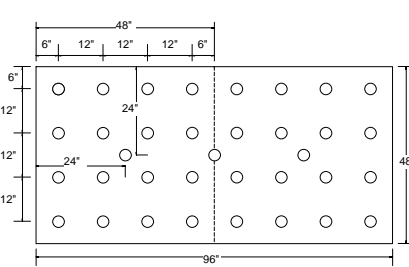
Perimeters (33)



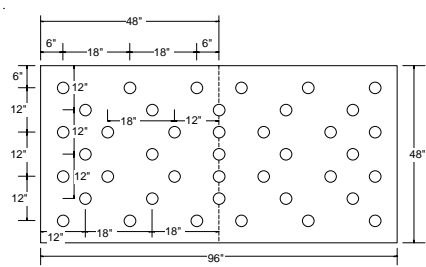
Corners (39)



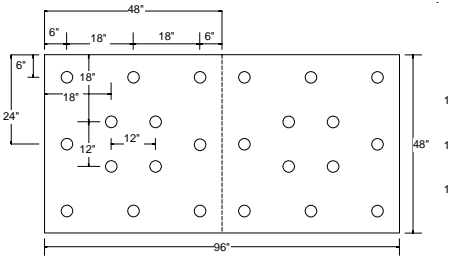
Field (23)



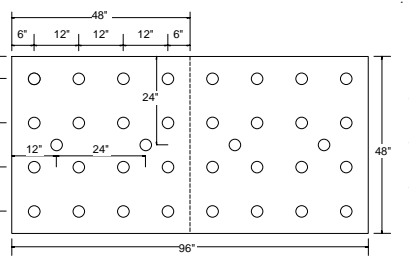
Perimeters (35)



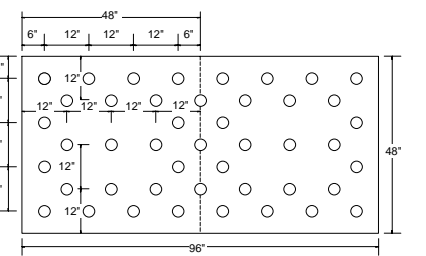
Corners (41)



Field (24)



Perimeters (36)



Corners (42)

“The above stated assemblies may not be suitable for a Firestone Red Shield Warranty. Contact Firestone Roofing Solutions Department, prior to installation, for approval of assembly for warranty purposes.”

MECHANICALLY ATTACHED SYSTEMS

MEMBRANE: UltraPly TPO, UltraPly Platinum, ReflexEON, ReflexEON Platinum
DECK: STEEL OR CONCRETE
CONSTRUCTION: NEW OR TEAR OFF

Note: Rows of fasteners with plates or battens may be no greater than 60% of the field spacing in the perimeter areas and no greater than 40% of the field spacing in the corner areas. Perimeter / corners are determined as 10% of the buildings lesser plan dimension or 40 % of the roof height, whichever is least, but not less than 3 feet. Rows with plates or battens should run perpendicular to steel deck ribs. Exception: for Class 1-75 or below rows may be parallel in the defined perimeter width if the row spacing is less than or equal to 3 feet and 2 FM Approved Deck fasteners or 2 min. 5/8” welds are installed in each flute of the deck in the perimeter / corner areas. Insulation attachment in perimeter / corner areas does not need to be enhanced provided the assembly DOES NOT incorporate an air or vapor barrier.

<u>Insulation</u>	<u>Thickness</u>	<u>Rating</u>	<u>Notes</u>
ISO 95+ GL	1.5" to 12"	1	2
Firestone FiberTop B, C, E, S (coverboard)	1/2" minimum	1	3
Georgia-Pacific “Dens-Deck” (coverboard)	1/4" minimum	1	4

- (1) See page 18 for approved system fastening spacings.
- (2) Achieves 1A rating at max. 3/4:12*
- (3) Achieves 1A rating at max. 1-3/4:12*
- (4) Achieves 1A rating at max. 3-1/2:112*

* Exterior fire rating can be maintained over FM Approved Wood Decks (up to and including a maximum slope of 2:12) when min. ¼” Georgia-Pacific “DensDeck” is placed directly on the Wood Deck under the insulation.

“The above stated assemblies may not be suitable for a Firestone Red Shield Warranty. Contact Firestone Roofing Solutions Department, prior to installation, for approval of assembly for warranty purposes.”

**FACTORY MUTUAL APPROVED FASTENING PATTERNS FOR
FIRESTONE MECHANICALLY ATTACHED SYSTEMS
(STEEL OR CONCRETE DECKS)**

System	Rating	Batten/Seam Plate Spacing (1)	Fastener Spacing	Deck	Fastener
UltraPly TPO (45, 60 or 80 mil), ReflexEON (60 or 80 mil)					
(single weld)					
“C” deck					
	1-90	7-1/2' oc (9)	12" oc	8	6
	1-90	9-1/2' oc (2)	6" oc	8	3
“E” deck					
	1-90	7-1/2' oc (2)	12" oc	4	3
	1-60	9-1/2' oc (2)	12" oc	4	3
	1-90	9-1/2' oc (9)	12" oc	4	6
	1-105	9-1/2' oc (2)	6" oc	4	3
UltraPly TPO (45, 60 or 80 mil), UltraPly Platinum (80 mil), ReflexEON (60 or 80 mil), ReflexEON Platinum (80 mil)					
(Wide Weld)					
“C” deck					
	1-60	7-1/2' oc (11) (7)	12" oc	8	3
	1-75	7-1/2' oc (10) (7)	12" oc	8	3
	1-90	7-1/2' oc (12) (7)	12" oc	8	6
	1-120	7-1/2' oc (12) (7)	6" oc	8	6
	1-135	7-1/2' oc (5) (7)	6" oc	8	3
	1-165	7-1/2' oc (12) (7)	6" oc	8	6
	1-90	9-1/2' oc (2) (10) (7)	6" oc	8	3
	1-105	9-1/2' oc (11) (7)	6" oc	8	3
	1-135	9-1/2" oc (10) (7)	6" oc	8	3
“E” deck					
	1-60	7-1/2' oc (5) (7)	12" oc	4	3
	1-75	7-1/2' oc (12) (7)	18" oc	4	6
	1-90	7-1/2' oc (2) (10) (7)	12" oc	4	3
	1-135	7-1/2' oc (5) (7)	6" oc	4	3
	1-180	7-1/2' oc (10) (7)	6" oc	4	3
	1-180	7-1/2' oc (12) (7)	6" oc	4	6
	1-195	7-1/2' oc (10) (7)	6" oc	4	6
	1-60	9-1/2' oc (12) (7)	18" oc	4	6
	1-90	9-1/2' oc (12) (7)	12" oc	4	6
	1-120	9-1/2' oc (5) (7)	6" oc	4	3
	1-150	9-1/2' oc (5) (7)	6" oc	4	6
	1-150	9-1/2' oc (10) (7)	6" oc	4	3

- (1) Rows of fasteners with plates or battens may be no greater than 60% of the field spacing in the perimeter areas and no greater than 40% of the field spacing in the corner areas. Perimeter / corners are determined as 10% of the buildings lesser plan dimension or 40% of the roof height, whichever is least, but not less than 3 feet. Rows with plates or battens should run perpendicular to steel deck ribs. Exception: for Class 1-90 or below rows may be parallel in the defined perimeter width if the row spacing is less than or equal to 3 feet. Insulation attachment in perimeter / corner areas does not need to be enhanced by the required 50% and 75% provided the assembly DOES NOT incorporate an air or vapor barrier.
- (2) Firestone HD seam plate
- (3) Firestone HD fasteners only.
- (4) ASTM A611 Grade E (min 80 ksi yield)
- (5) 1" metal batten or 3/4" polymer batten
- (6) HD+ fastener
- (7) Wide Weld
- (8) ASTM A611 Grade C (min 33 ksi yield)
- (9) Firestone HD+ seam plate
- (10) 1" metal batten only
- (11) 3/4" polymer batten
- (12) HD+ seam plate or 1" metal batten

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FACTORY MUTUAL BALLAST GUIDELINES
(Taken from FM Loss Prevention Data Sheet 1-28 AND 1-29)
FM RECOMMENDED BALLAST WEIGHT (LB/SQ FT) FOR ROOF FIELD/PERIMETERS/CORNERS

Ground Roughness B

Steel or pre-cast panel deck with $\leq 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 89$	10/12/15	$>0 \leq 60$	10/12/15	$>0 \leq 60$	12/15/15	$>0 \leq 30$	12/15/15
$>89 \leq 130$	12/15/18	$>60 \leq 89$	12/15/15	$>60 \leq 89$	12/15/18	$>30 \leq 55$	12/15/18
$>130 - ?$	See Note 1	$>89 - ?$	See Note 1	$>89 - ?$	See Note 1	$>55 - ?$	See Note 1

Ground Roughness B

Steel or pre-cast panel deck with $> 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 89$	10/10/12	$>0 \leq 60$	10/10/12	$>0 \leq 60$	12/12/12	$>0 \leq 30$	12/12/12
$>89 \leq 130$	12/12/15	$>60 \leq 89$	12/12/12	$>60 \leq 89$	12/12/15	$>30 \leq 55$	12/12/15
$>130 \leq 220$	12/15/18	$>89 \leq 150$	12/15/18	$>89 - ?$	See Note 1	$>55 \leq 89$	12/15/18
$>220 - ?$	See Note 1	$>150 - ?$	See Note 1			$>89 - ?$	See Note 1

Ground Roughness B

Cementitious Wet Fill (Concrete) deck with $\leq 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 89$	10/10/10	$>0 \leq 60$	10/10/10	$>0 \leq 60$	10/12/12	$>0 \leq 30$	10/12/12
$>89 \leq 130$	12/12/15	$>60 \leq 89$	10/12/12	$>60 \leq 89$	12/12/15	$>30 \leq 55$	12/12/15
$>130 \leq 220$	12/15/18	$>89 \leq 140$	12/15/18	$>89 - ?$	See Note 1	$>55 \leq 89$	12/15/18
$>220 - ?$	See Note 1	$>140 - ?$	See Note 1			$>89 - ?$	See Note 1

Ground Roughness B

Cementitious Wet Fill (Concrete) deck with $> 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 89$	10/10/10	$>0 \leq 60$	10/10/10	$>0 \leq 60$	10/10/12	$>0 \leq 30$	10/10/12
$>89 \leq 130$	12/12/12	$>60 \leq 89$	10/10/12	$>60 \leq 89$	12/12/12	$>30 \leq 55$	12/12/12
$>130 \leq 220$	12/12/15	$>89 \leq 140$	12/12/15	$>89 \leq 165$	15/15/18	$>55 \leq 89$	12/12/15
$>220 - 500$	15/15/18	$>140 - 350$	15/15/18	$>165 - ?$	See Note 2	$>89 - ?$	See Note 2

Note 1: Use an Adhered or Mechanically attached system that is rated for 90 psf or greater.

Note 2: Use an Adhered or Mechanically attached system that is rated for 105 psf or greater.

Ground Roughness B - Urban and suburban areas, well wooded areas or other terrain with numerous closely-spaced obstructions the size of single family dwellings or larger.

Ground Roughness C - Open terrain with scattered obstructions of heights generally less than 30 ft. (9 m). This includes flat, open country and grasslands.

Ground Roughness D - flat, unobstructed areas directly exposed to wind blowing over large bodies of water. This category should be used for areas extending inland from the shore a distance of 1500 ft. (460m) or ten times the height of the building or structure, whichever is greater.

- (1) Width of perimeter is 10% of the building width or 40% of the building height, whichever is smaller, but not less than 8.5 feet. Corner areas are square with side dimensions equal to the perimeter width, but the 10% lesser building dimension limit **is not** applied in determining the **corner** dimension.
- (2) Wind speeds are taken from Factory Mutual Loss Prevention Data Sheet 1-28 and are based on a 100 year mean recurrence interval.
- (3) Stone ballast shall be smooth stone, 1" to 2" nominal diameter, which meets the gradation requirements of standard size No. 3 for coarse aggregate per ASTM D448 (85% larger than 1" diameter).

"The above stated assemblies may not be suitable for a Firestone Red Shield Warranty. Contact Firestone Roofing Solutions Department, prior to installation, for approval of assembly for warranty purposes."

FACTORY MUTUAL BALLAST GUIDELINES
(Taken from FM Loss Prevention Data Sheet 1-28 AND 1-29)
FM RECOMMENDED BALLAST WEIGHT (LB/SQ FT) FOR ROOF FIELD/PERIMETERS/CORNERS

Ground Roughness C

Steel or pre-cast panel deck with ≤ 36" parapet

≤85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
>0 ≤ 25	10/12/15	>0 ≤ 15	10/12/15	>0 ≤ 15	12/15/15	>0 ≤ 15	12/12/15
>25 ≤ 75	12/15/15	>15 ≤ 45	12/15/15	>15 ≤ 35	12/15/18	>15 - ?	See Note 1
>75 ≤ 89	12/15/18	>45 ≤ 89	12/15/18	>35 - ?	See Note 1		
>89 - ?	See Note 1	>89 - ?	See Note 1				

Ground Roughness C

Steel or pre-cast panel deck with > 36" parapet

≤85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
>0 ≤ 25	10/10/12	>0 ≤ 15	10/10/12	>0 ≤ 15	12/12/12	>0 ≤ 15	12/12/15
>25 ≤ 75	12/12/12	>15 ≤ 45	12/12/12	>15 ≤ 35	12/12/15	>15 ≤ 30	12/15/18
>75 ≤ 89	12/12/15	>45 ≤ 89	12/12/15	>35 ≤ 70	12/15/18	>30 - ?	See Note 1
>89 ≤ 90	12/15/18	>89 - ?	See Note 1	>70 - ?	See Note 1		
>90 - ?	See Note 1						

Ground Roughness C

Cementitious Wet Fill (Concrete) deck with ≤ 36" parapet

≤85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
>0 ≤ 25	10/10/10	>0 ≤ 15	10/10/10	>0 ≤ 15	10/12/12	>0 ≤ 15	12/12/15
>25 ≤ 75	10/12/12	>15 ≤ 45	10/12/12	>15 ≤ 35	12/12/15	>15 ≤ 30	12/15/18
>75 ≤ 89	12/12/15	>45 ≤ 89	12/12/15	>35 ≤ 70	12/15/18	>30 - ?	See Note 1
>89 ≤ 90	12/15/18	>89 - ?	See Note 1	>70 - ?	See Note 1		

Ground Roughness C

Cementitious Wet Fill (Concrete) deck with > 36" parapet

≤85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
>0 ≤ 25	10/10/10	>0 ≤ 15	10/10/10	>0 ≤ 15	10/10/12	>0 ≤ 15	12/12/12
>25 ≤ 75	10/10/12	>15 ≤ 45	10/10/12	>15 ≤ 35	12/12/12	>15 ≤ 30	12/12/15
>75 ≤ 89	12/12/12	>45 ≤ 89	12/12/12	>35 ≤ 70	12/12/16	>30 ≤ 89	15/15/18
>89 ≤ 90	12/12/15	>89 ≤ 165	15/15/18	>70 ≤ 89	15/15/18	>89 - ?	See Note 2
>90 ≤ 275	15/15/18	>165 - ?	See Note 2	>89 - ?	See Note 2		

Note 1: Use an Adhered or Mechanically attached system that is rated for 90 psf or greater.

Note 2: Use an Adhered or Mechanically attached system that is rated for 105 psf or greater.

Ground Roughness B - Urban and suburban areas, well wooded areas or other terrain with numerous closely-spaced obstructions the size of single family dwellings or larger.

Ground Roughness C - Open terrain with scattered obstructions of heights generally less than 30 ft. (9 m). This includes flat, open country and grasslands.

Ground Roughness D - flat, unobstructed areas directly exposed to wind blowing over large bodies of water. This category should be used for areas extending inland from the shore a distance of 1500 ft. (460m) or ten times the height of the building or structure, whichever is greater.

- (1) Width of perimeter is 10% of the building width or 40% of the building height, whichever is smaller, but not less than 8.5 feet. Corner areas are square with side dimensions equal to the perimeter width, but the 10% lesser building dimension limit **is not** applied in determining the **corner** dimension.
- (2) Wind speeds are taken from Factory Mutual Loss Prevention Data Sheet 1-28 and are based on a 100 year mean recurrence interval.
- (3) Stone ballast shall be smooth stone, 1" to 2" nominal diameter, which meets the gradation requirements of standard size No. 3 for coarse aggregate per ASTM D448 (85% larger than 1" diameter).

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FACTORY MUTUAL BALLAST GUIDELINES
(Taken from FM Loss Prevention Data Sheet 1-28 AND 1-29)
FM RECOMMENDED BALLAST WEIGHT (LB/SQ FT) FOR ROOF FIELD/PERIMETERS/CORNERS

Ground Roughness D

Steel or pre-cast panel deck with $\leq 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 30$	12/15/15	$>0 \leq 15$	12/15/15	$>0 \leq 15$	12/15/18	N/A	See Note 1
$>30 \leq 89$	12/15/18	$>15 \leq 50$	12/15/18	$>15 - ?$	See Note 1		
$>89 - ?$	See Note 1	$>50 - ?$	See Note 1				

Ground Roughness D

Steel or pre-cast panel deck with $> 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 30$	12/12/12	$>0 \leq 15$	12/12/12	$>0 \leq 15$	12/12/15	N/A	See Note 1
$>30 \leq 89$	12/12/15	$>15 \leq 50$	12/12/15	$>15 \leq 35$	12/15/18		
$>89 - ?$	See Note 1	$>50 \leq 89$	12/15/18	$>35 - ?$	See Note 1		
		$>89 - ?$	See Note 1				

Ground Roughness D

Cementitious Wet Fill (Concrete) deck with $\leq 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 30$	10/12/12	$>0 \leq 15$	10/12/12	$>0 \leq 15$	12/12/15	N/A	See Note 1
$>30 \leq 89$	12/12/15	$>15 \leq 50$	12/12/15	$>15 \leq 35$	12/15/18		
$>89 - ?$	See Note 1	$>50 \leq 89$	12/15/18	$>35 - ?$	See Note 1		
		$>89 - ?$	See Note 1				

Ground Roughness D

Cementitious Wet Fill (Concrete) deck with $> 36''$ parapet

≤ 85 mph		90 mph		100 mph		110 mph	
Roof Height (ft)	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights	Roof Height	Ballast weights
$>0 \leq 30$	10/10/12	$>0 \leq 15$	10/10/12	$>0 \leq 15$	12/12/12	$>0 \leq 45$	15/15/18
$>30 \leq 89$	12/12/12	$>15 \leq 50$	12/12/12	$>15 \leq 35$	12/12/15	$>45 - ?$	See Note 2
$>89 \leq 165$	15/15/18	$>50 \leq 89$	12/12/15	$>35 \leq 89$	15/15/18		
$>165 - ?$	See Note 2	$>89 \leq 90$	15/15/18	$>89 - ?$	See Note 2		
		$>90 - ?$	See Note 2				

Note 1: Use an Adhered or Mechanically attached system that is rated for 90 psf or greater.

Note 2: Use an Adhered or Mechanically attached system that is rated for 105 psf or greater.

Ground Roughness B - Urban and suburban areas, well wooded areas or other terrain with numerous closely-spaced obstructions the size of single family dwellings or larger.

Ground Roughness C - Open terrain with scattered obstructions of heights generally less than 30 ft. (9 m). This includes flat, open country and grasslands.

Ground Roughness D - flat, unobstructed areas directly exposed to wind blowing over large bodies of water. This category should be used for areas extending inland from the shore a distance of 1500 ft. (460m) or ten times the height of the building or structure, whichever is greater.

- (1) Width of perimeter is 10% of the building width or 40% of the building height, whichever is smaller, but not less than 8.5 feet. Corner areas are square with side dimensions equal to the perimeter width, but the 10% lesser building dimension limit **is not** applied in determining the **corner** dimension.
- (2) Wind speeds are taken from Factory Mutual Loss Prevention Data Sheet 1-28 and are based on a 100 year mean recurrence interval.
- (3) Stone ballast shall be smooth stone, 1" to 2" nominal diameter, which meets the gradation requirements of standard size No. 3 for coarse aggregate per ASTM D448 (85% larger than 1" diameter).

"The above stated assemblies may not be suitable for a Firestone Red Shield Warranty. Contact Firestone Roofing Solutions Department, prior to installation, for approval of assembly for warranty purposes."