Custom Seal TPO

Codes

Manual

Custom Seal TPO Codes Manual

Table of Contents

Section	Page
Factory Mutual Guidelines	1 – 7
Factory Mutual Ballasted System Guidelines	8, 9
Factory Mutual Test Method and Criteria	10
Underwriters Laboratories Guidelines	11
Underwriters Laboratories Test Method and Criteria	12
Underwriters Laboratories P-Assemblies	13
Underwriters Laboratories Ballasted Approvals	14, 15
Underwriters Laboratories Mechanically Attached Approvals	16-18
Factory Mutual Mechanically Attached Approvals	19-20
Underwriters Laboratories Fully Adhered Approvals	21, 22
Factory Mutual Fully Adhered Approvals	23
Factory Mutual Fully Adhered Fastener Tables	24, 25

GUIDELINES FOR COMPLIANCE TO FACTORY MUTUAL REQUIREMENTS

These guidelines are designed to aid you in the process of meeting Factory Mutual requirements when they are specified. Custom Seal published specifications are the minimum requirements necessary to obtain the applicable Custom Seal warranty. Factory Mutual requirements are not covered in Custom Seal specifications and are considered to be above and beyond the provisions of the Custom Seal warranty. It is not the responsibility of Custom Seal Roofing Systems to ensure that all Factory Mutual requirements have been satisfied. This is the responsibility of the roofing contractor and the specifying party.

All materials used in the roofing systems must be FM approved and have been tested together as part of a complete roofing assembly. Individual components may be FM approved but may not have been tested together as part of an Approved roofing assembly. Approved assemblies are listed in the current Factory Mutual Approval Guide.

If the building is insured by Factory Mutual, the local FM office must be contacted for specific system requirements regardless of the published approvals.

All fasteners used for the securement of the insulation and membrane must penetrate the top flutes of the steel deck. (Exception: Recover) Standard metal decks cannot be less than 22 gauge. Some assemblies require a Grade E steel deck, please refer to the current FM Approval Guide for more information.

In addition to the assembly requirements listed in this manual and the current published FM Approval Guide, other criteria are required to obtain FM ratings and will require that additions be made to the standard system. The following is a short overview of the Factory Mutual requirements.

INSULATION FASTENING/ATTACHMENT

As per FM Loss Prevention Data Sheets 1-28[1] & 1-29[2] and the September 1999 Approval Guide[3], the fastening requirements for mechanically attached and fully adhered insulation attachment are as follows:

Mechanically Attached Insulation/Mechanically Attached Single Ply Membrane

- FM requires a minimum of 4 fasteners and plates for the securement of insulation boards with any one dimension over 4 ft. (1 fastener and plate per 8 sq ft)[3]
  (Note Custom Seal requires a minimum of 6 fasteners and plates per 4 ft by 8 ft board)
- FM **DOES NOT** require an increase in insulation board fastener density in the perimeter or corner areas over the field fastening rate [2]
- Use of vapor or air barrier requires insulation fastening at 1 every 2 sq ft with 50% increase in perimeter and 75% increase in the corner areas[2]
- Recover maximum 1 in thick insulation[2]
- Corner and perimeter width is defined as either 10% of the building lesser plan dimension or 40% of the building eave height, which ever is less, but never less than 4 ft

Mechanically Attached Insulation/Fully Adhered Single Ply Membrane

- See insulation attachment tables in Approval Guide for Approval (note brackets “( )” indicate 1-90 fastener density)[3]
- Insulation fastener density must be increased by 50% in the perimeter areas and 75% in the corner areas
- Corner and perimeter width is defined as either 10% of the building lesser plan dimension or 40% of the building eave height, which ever is less, but never less than 4 ft

INSULATION FASTENING/ATTACHMENT (cont.)

Fully Adhered Insulation/Fully Adhered Single Ply Membrane

- For use over structural concrete with Approved insulation (see Approval Guide).
- Insulation adhesive application rate must be increased by at least 70% in the perimeter and 160% in the corners.
- Corner and perimeter width is defined as either 10% of the building lesser plan dimension or 40% of the building eave height, which ever is less, but never less than 4 ft.

MEMBRANE ATTACHMENT

Additional membrane attachment is required by FM Loss Prevention Data Sheet 1-29 in the perimeter and corner areas. The perimeter and corner width is defined as either 10% of the building lesser plan dimension or 40% of the building eave height, which ever is less, but never less than 4 ft.

The increase in fastening of the membrane for the perimeter area is accomplished by reducing distance between fastening rows by using half sheets. The fastening rate for the half sheets is the same as the field of the roof.

The increase in the corner areas can be accomplished by either of the following ways:

- Overlap all half sheets in the corners. (see Fig. 1)
- Additional anchor bars or plates in between the half sheet rows in the corner areas. If anchor bars or discs are used they must be covered with an approved cover strip. (see Fig 2)

Example:

Building Height = 15.3 m (50 ft)

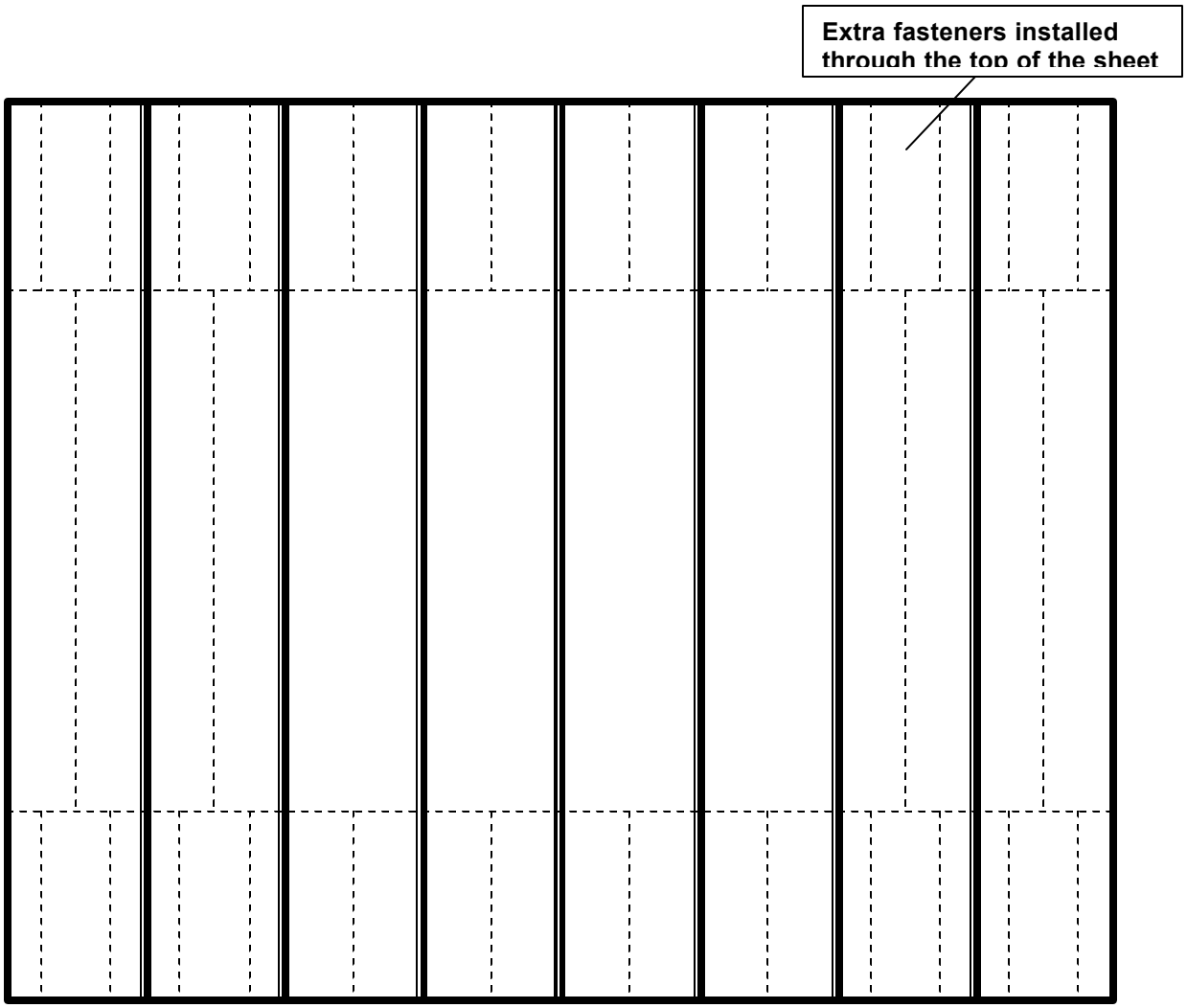
15.3 m X 0.4 = 6.1 m
(50 ft X 0.4 = 20 ft)

Lesser Plan Dimension = 45.7 m X 27.5 m
(150 ft X 90 ft)

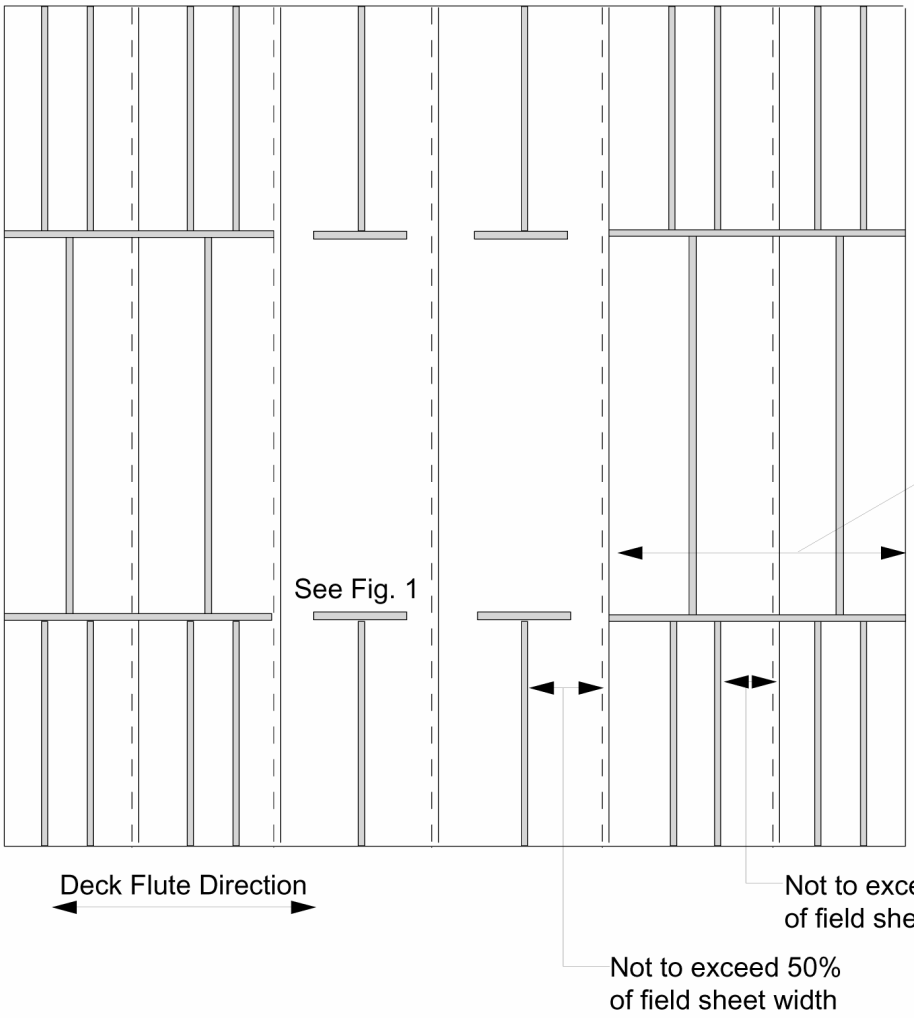
27.5 m X 0.1 = 2.8 m
(90 ft X 0.1 = 9 ft)

In this example, 2.8 m (9 ft) is the lesser perimeter width based on 90 ft X 0.1 = 9 ft. If the system requires increased attachment of the insulation in the perimeter and corner areas (example – air barrier under insulation), the perimeter area would be rounded up to the next full board, which is 12 ft or 16 ft depending on layout. The corner area will be 12 ft by 12 ft (round up). (See Figure 3 for insulation board layout). The number of half sheets required will depend on the width of the half sheet. Divide the perimeter width by the half sheet width to determine the number of half sheets required in the perimeter of a building. (Note - Always round up perimeter to a whole number of half sheets.) In the example, if the half sheets were fastened at 3 ft o.c. fastening rows, it would require 3 half sheets, = 9 ft. If the half sheets are 4 ft o.c. then it will also require 3 half sheets (12 ft).

- **Corner layout with increased fasteners through the top of the sheet**



A. All roof cover fasteners should engage the top flanges of the steel deck.
B. Battens or plates and fasteners must be installed perpendicular to steel deck flutes. Exception: for class 1-90 and below, fastener rows or batten bars can be installed parallel to the building edge within the defined perimeter width if the distance between fastener rows in this area is $\leq$ 3ft.
C. Perimeter enhancement is achieved by installing batten bars or rows of fasteners and plates in the configuration shown in the above detail and located so as to reduce the area of roof secured by the integral seam fastener assemblies by 50% in the designated perimeter area of the roof and by 60% in the designated corner areas of the roof.



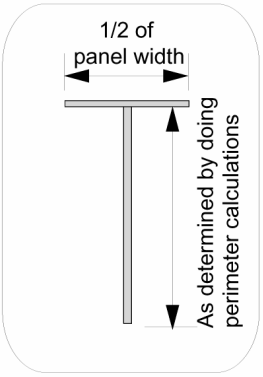


Fig. 1

A. All roof cover fasteners should engage the top flanges of the steel deck.
B. Battens or Plates and Fastners must be installed perpendicular to steel deck flutes. Exception: for class 1-90 and below, fastener rows or batten bars can be installed parallel to the building edge within the defined perimeter width if the distance between fastener rows in this area is <3ft.
C. Perimeter enhancement is achieved by installing batten bars or rows of fasteners and plates in the configuration shown in the above detail and located so as to reduce the area of roof secured by the integral seam fastener assemblies by 50% in the designated perimeter area of the roof and by 60% in the desigated corner areas of the roof.

Mechanical Securement Pattern For Supplemental Perimeter Enhancement	Detail #: MAS Layout	For FM 1-90 MAS Systems

- **Membrane corner layout with perimeter sheets**

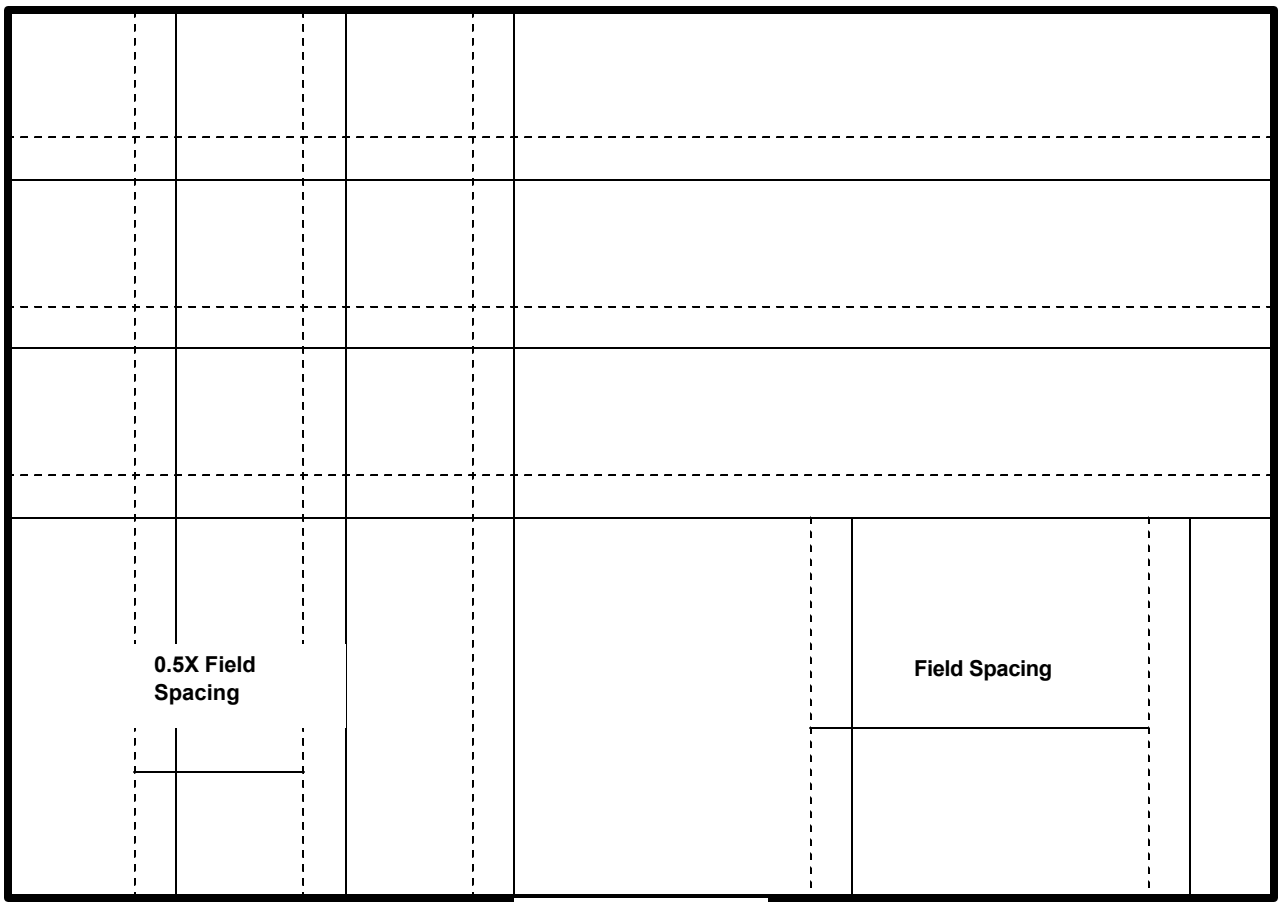
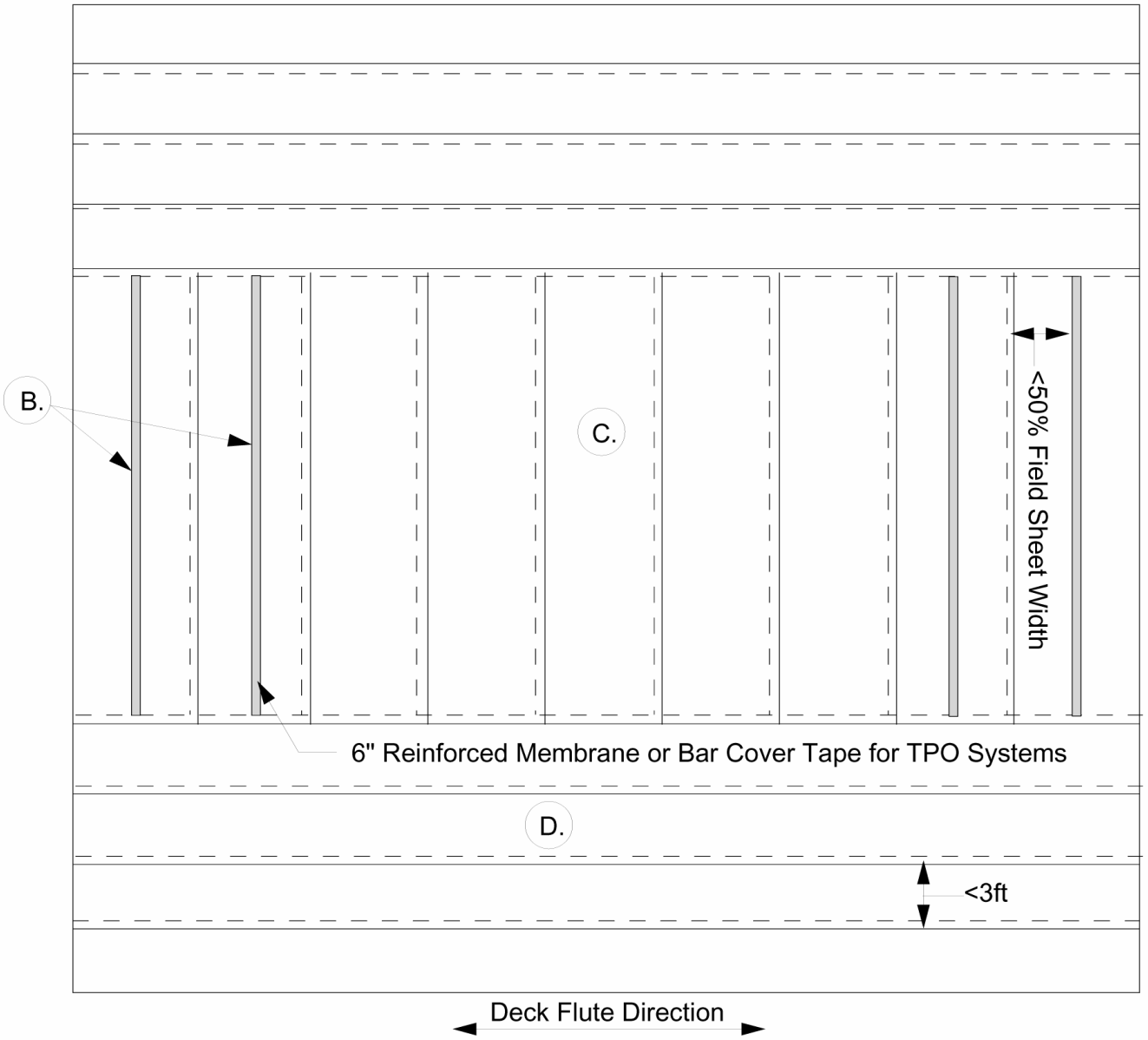


Figure 1

IF TWO LAYERS OF MEMBRANE ARE INSTALLED IN THE CORNER AREAS, ALL FASTENERS MUST SECURE THE TOP LAYER.

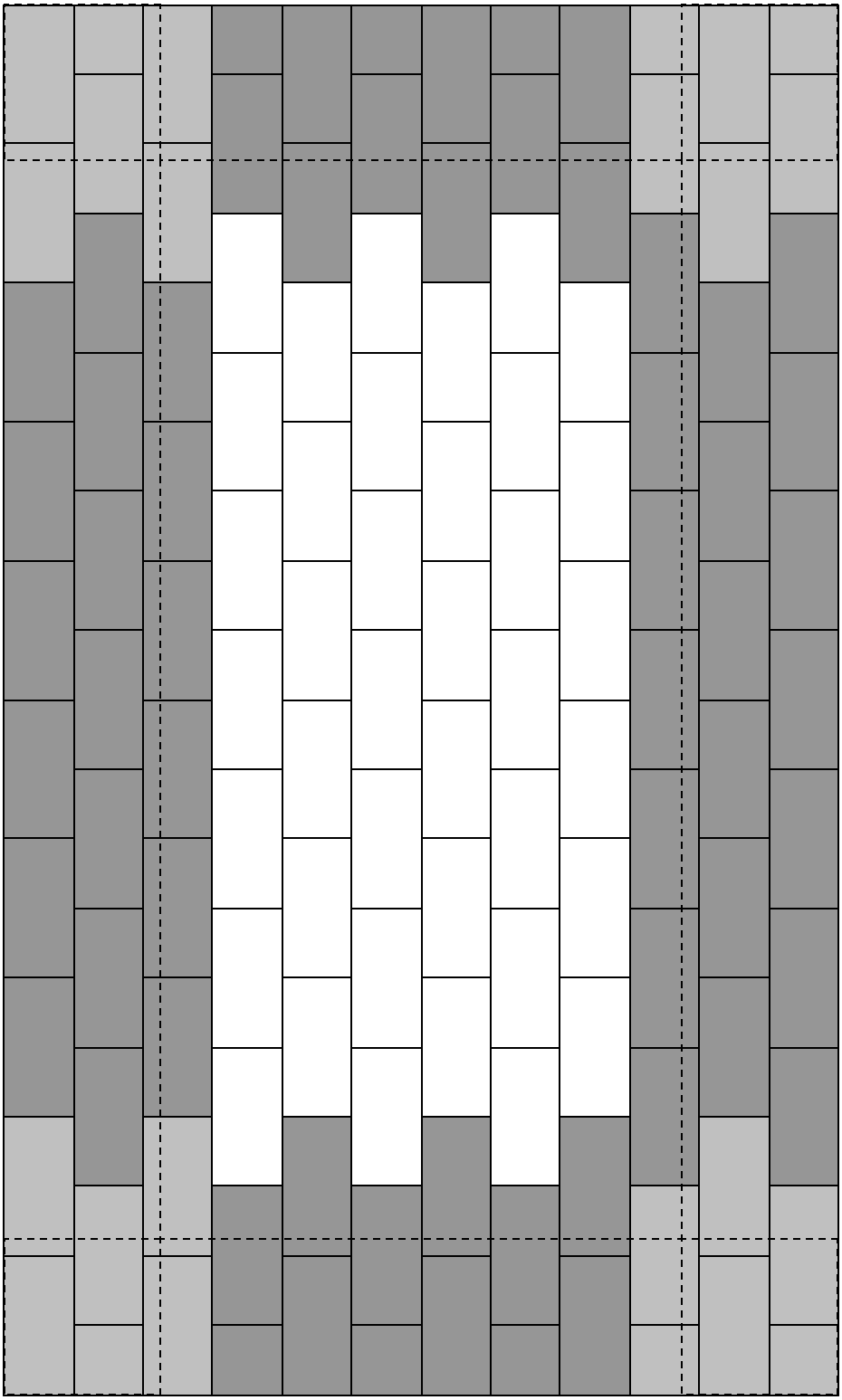


A. All roof covering fasteners should engage the top flange of steel deck.
B. Batten Bars or Fastener & Plate rows should be properly located within the designated perimeter area to divide the roofing panels in half reducing the area to be secured by the fastener assemblies in the field seam by 50% .
C. Field panels must be installed perpendicular to the steel deck flutes to facilitate proper securement into the top flanges of the steel deck.
D. Perimeter half sheets must not exceed 3' in width between rows of securement when installed parrallel to the steel deck flutes. When run perpendicular to the flutes the perimeter half sheet may be sized up to half the width of the FMRC approved field sheet.

Mechanical Securement Pattern for Half Sheets Run Parrallel to Deck Flutes	Detail #: MAS Layout	For FM 1-90 or Less MAS Systems

Figure 3

- **Insulation perimeter layout for 9 ft wide perimeter and corner area.**
- **All insulation boards are 4 ft by 8 ft.**
- **All corner areas are light gray**
- **All perimeter areas are dark gray**



FACTORY MUTUAL BALLAST GUIDELINES
(TAKEN FROM FM DATA SHEET 1-29)

FM RECOMMENDED BALLAST WEIGHT (lb/ft^2) FOR ROOF FIELD/PERIMETER/CORNERS

Ground Roughness B

	Steel deck with ≤ 36" parapet				Steel deck with > 36" parapet			
Building Height	70 mph	80 mph	90 mph	100 mph	70 mph	80 mph	90 mph	100 mph
15'	10/12/15	10/12/15	10/12/15	10/12/15	10/10/12	10/10/12	10/10/12	10/10/12
30'	10/12/15	10/12/15	10/12/15	12/15/15	10/10/12	10/10/12	10/10/12	12/12/12
50'	10/12/15	10/12/15	10/12/15	12/15/15	10/10/12	10/10/12	10/10/12	12/12/12
75'	10/12/15	10/12/15	12/15/15	12/15/18	10/10/12	10/10/12	12/12/12	12/12/15
100'	10/12/15	10/12/15	12/15/18	See note 1	10/10/12	10/10/12	12/12/12	12/15/18

Ground Roughness C

	Steel deck with ≤ 36" parapet				Steel deck with > 36" parapet			
Building Height	70 mph	80 mph	90 mph	100 mph	70 mph	80 mph	90 mph	100 mph
15'	10/12/15	10/12/15	12/15/15	12/15/18	10/10/12	10/10/12	12/12/12	12/12/15
30'	10/12/15	12/15/15	12/15/18	See note 1	10/10/12	12/12/12	12/12/15	12/15/18
50'	10/12/15	12/15/15	See note 1	See note 1	10/10/12	12/12/12	12/12/15	See note 1
75'	10/12/15	12/15/18	See note 1	See note 1	10/10/12	12/12/15	12/15/18	See note 1
100'	12/15/15	12/15/18	See note 1	See note 1	12/12/12	12/12/15	12/15/18	See note 1

Ground Roughness D

	Steel deck with ≤ 36" parapet				Steel deck with > 36" parapet			
Building Height	70 mph	80 mph	90 mph	100 mph	70 mph	80 mph	90 mph	100 mph
15'	10/12/15	12/12/15	12/15/18	See note 1	10/10/12	12/12/12	12/12/15	See note 1
30'	10/12/15	12/15/15	See note 1	See note 1	10/10/12	12/12/12	12/15/18	See note 1
50'	12/15/15	12/15/18	See note 1	See note 1	12/12/12	12/12/15	12/15/18	See note 1
75'	12/15/15	12/15/18	See note 1	See note 2	12/12/12	12/12/15	See note 1	See note 2
100'	12/15/15	See note 1	See note 1	See note 2	12/12/12	12/15/18	See note 1	See note 2

Note 1: Use FM 1-90 system instead of ballast system, Note 2: Use FM 1-120 system instead of ballast system

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. This includes flat, open country and grasslands. (Example - airport)

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 a shore a distance of 1500 ft. or ten times the height of the building or structure, which ever is greater.

1. Width of perimeter is calculated as either 10% of the lesser plan dimension or 40% of the eave height of the building, which ever is smaller, but never less than 8.5 ft. Corner areas are square and equal to 40% of the building height only!
2. Wind speeds are taken from ANSI A58.1 – 1982 and 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.
4. Insulation shall be of type and thickness currently approved for FM 1-60 and 1-90 rated systems.
5. Factory Mutual no longer allows for a reduction in ballast weight for fastening the insulation in the perimeter and corners. Additionally, Custom Seal does not accept mechanically attached insulation beneath a ballast system.

FACTORY MUTUAL BALLAST GUIDELINES
(TAKEN FROM FM DATA SHEET 1-29)

FM RECOMMENDED BALLAST WEIGHT (lb/ft^2) FOR ROOF FIELD/PERIMETER/CORNERS

Ground Roughness B

Concrete deck with £ 36" parapet					Concrete deck with > 36" parapet			
Building Height	70 mph	80 mph	90 mph	100 mph	70 mph	80 mph	90 mph	100 mph
15'	10/10/10	10/10/10	10/10/10	10/10/10	10/10/10	10/10/10	10/10/10	10/10/10
30'	10/10/10	10/10/10	10/10/10	10/12/12	10/10/10	10/10/10	10/10/10	10/10/12
50'	10/10/10	10/10/10	10/10/10	10/12/12	10/10/10	10/10/10	10/10/10	10/10/12
75'	10/10/10	10/10/10	10/12/12	12/12/15	10/10/10	10/10/10	10/10/12	12/12/12
100'	10/10/10	10/10/10	10/12/12	12/15/18	10/10/10	10/10/10	10/10/12	12/12/15

Ground Roughness C

Concrete deck with £ 36" parapet					Concrete deck with > 36" parapet			
Building Height	70 mph	80 mph	90 mph	100 mph	70 mph	80 mph	90 mph	100 mph
15'	10/10/10	10/10/10	10/12/12	12/12/15	10/10/10	10/10/10	10/10/12	12/12/12
30'	10/10/10	10/12/12	12/12/15	12/15/18	10/10/10	10/10/12	12/12/12	12/12/15
50'	10/10/10	10/12/12	12/12/15	See note 1	10/10/10	10/10/12	12/12/12	15/15/18
75'	10/10/10	12/12/15	12/15/18	See note 1	10/10/10	12/12/12	12/12/15	15/15/18
100'	10/12/12	12/12/15	12/15/18	See note 1	10/10/12	12/12/12	12/12/15	15/15/18

Ground Roughness D

Concrete deck with £ 36" parapet					Concrete deck with > 36" parapet			
Building Height	70 mph	80 mph	90 mph	100 mph	70 mph	80 mph	90 mph	100 mph
15'	10/10/10	10/12/12	12/12/15	12/15/18	10/10/10	10/10/12	12/12/12	12/12/15
30'	10/10/10	10/12/12	12/15/18	15/15/18	10/10/10	10/10/12	12/12/15	15/15/18
50'	10/12/12	12/12/15	12/15/18	15/15/18	10/12/12	12/12/12	12/12/15	15/15/18
75'	10/12/12	12/12/15	See note 1	See note 2	10/12/12	12/12/12	15/15/18	See note 2
100'	10/12/12	12/15/18	See note 1	See note 2	10/12/12	12/12/15	15/15/18	See note 2

Note 1: Use FM 1-90 system instead of ballast system, Note 2: Use FM 1-120 system instead of ballast system

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. This includes flat, open country and grasslands. (Example - airport)

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 a shore a distance of 1500 ft. or ten times the height of the building or structure, which ever is greater.

1. Width of perimeter is calculated as either 10% of the lesser plan dimension or 40% of the eave height of the building, which ever is smaller, but never less than 8.5 ft.. Corner areas are square and equal to 40% of the building height only!
2. Wind speeds are taken from ANSI A58.1 – 1982 and 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.
4. Insulation shall be of type and thickness currently approved for FM 1-60 and 1-90 rated systems.
5. Factory Mutual no longer allows for a reduction in ballast weight for fastening the insulation in the perimeter and corners. Additionally, Custom Seal does not accept mechanically attached insulation beneath a ballast system.

FACTORY MUTUAL
TEST METHOD AND CRITERIA

TEST METHOD

Factory Mutual Research approves roof constructions that have passed FM tests related to combustibility, wind resistance, hail resistance, water leakage, resistance to foot traffic and corrosion resistance. All of these tests are incorporated in FM Approval Standard #4470.

1. Combustibility testing is done via two methods, external (above the deck) and fuel contribution (below the deck) sometimes referred to as calorimeter testing.

    - Above the deck or external combustibility testing is per ASTM E108 (similar to UL 790 described in the UL portion of this manual).
    - Below the deck or calorimeter testing is where the complete roof assembly is exposed to an internal fire source for a period of 30 minute intervals. The fuel contribution from the roof assembly is accurately measured at 3, 5, 10 and 30 minute intervals. FM has predetermined fuel contribution levels that cannot be exceeded at any time during this test.

2. Wind resistance testing is done on one of two test tables depending on the system type and rating expected.

    - Fully adhered systems tested for 1-60, 1-75 and 1-90 are tested on the 1.5 m X 2.7 m (5 ft. X 9 ft.) table.
    - All mechanically attached systems (1-60, 1-90, 1-120, etc.) and fully adhered systems above 1-90 are tested on the 3.7 m X 7.3 m (12 ft. X 24 ft.) table.
    - A test assembly, on either table, is comprised of a roof deck, insulation, fasteners and a roof membrane. The test assembly is subjected to air pressure from below in 15 psf increments starting at 30 psf for 1 minute at each pressure until failure occurs. Failure can occur in many ways including fastener pulling out, membranes rupturing, or seam failure.
    - Structural concrete deck systems are tested on a dynamometer with a 2 ft by 2 ft assembly.

3. Water leakage is tested by subjecting a field seam to a ponded water condition for 7 days, if any leakage is observed the sample fails this test.

4. Resistance to foot traffic is simulated by placing a 91 kg (200 pound) load a minimum of 5 times on the same area. If cracking, puncturing or tearing is observed, the sample fails this test.

5. Corrosion resistance of all metal components (screws, bars, etc.) is tested in a cabinet where they are exposed to sulfurous acid for 15 days. Sulfur dioxide is used to simulate acid rain. The most common cabinet that is used is called a Kesternich cabinet. A failure of this test occurs when more than 15% rust develops after 15 days.

6. Hail damage is simulated by subjecting the sample to impact testing.

    - A rating of Class I-SH (Severe Hail Damage Resistant) is achieved by dropping a 1.75 in. diameter steel ball weighing 0.79 lb. From a height of 17 ft 9.5 in. 10 times. No damage is a pass.
    - A rating of Class I-MH (Moderate Hail Damage Resistant) is achieved by dropping a 2 in. diameter weighing 1.625 lb. From a height of 5 ft. 10 times. No damage is a pass.

GUIDELINES FOR COMPLIANCE TO UNDERWRITERS LABORATORIES REQUIREMENTS

DECK TYPE

Combustible Decks

- Wood Plank
- Plywood
- Oriented Strand Board (OSB)
- Chip Board
- Wafer Board

Noncombustible Decks

- Steel
- Aluminum
- Structural Concrete (PIP, precast, plank or channel slab, T's, etc.)
- Lightweight cementious (Gypsum, minimum 2" Tectum, etc.)

GENERAL REQUIREMENTS

- The minimum thickness of OSB, plywood, etc. is 7/16".
- UL Classified gypsum wallboard, any thickness, may be included in any roofing system without adversely effecting the Classification.
- ¼" Dens-Deck may be used in lieu of ½" gypsum wallboard.
- Insulations may be attached to the deck with fasteners, hot mopping asphalt or UL Classified adhesive.

RECOVER/REROOF

- Classified insulated systems may be installed over existing Classified insulated systems when:
    1. The new system is Classified for use with the existing roof insulation type (glass fiber, perlite, wood fiber, polyisocyanurate, etc.) and
    2. The total thickness of insulation in both systems does not exceed the maximum specified for the new system being applied.

NONCOMBUSTIBLE DECKS

- For installations over noncombustible decks, any UL Classified insulated system utilizing minimum 1" thick insulation (glass fiber, polyisocyanurate or perlite) may be used over any existing insulated system regardless of the type of its insulation provided that the total thickness of insulation in both systems does not exceed the maximum approved for the new system being applied. Classification is determined by the new construction system.
- Insulated roof systems may be utilized over any type of existing roof system and maintain its new construction rating when the roof deck is noncombustible.
- Insulated roof systems Classified for use over noncombustible deck may be used over any type of Class A, B or C existing roof systems. The resultant Class will be the lesser rating of the existing system or the new construction (recover) system.

COMBUSTIBLE DECKS

- Insulated roof systems Classified for use over combustible decks can be used over any type of existing roof system and maintain its new construction rating.

UNDERWRITERS LABORATORIES
EXTERNAL FIRE TEST METHOD AND CRITERIA

TEST METHOD

When external fire resistance is required, most specifiers use UL 790 as the procedure of choice. UL 790 is similar to ASTM E 108 and is composed of three (3) components. These components are the "Spread of Flame Test", the "Intermittent Flame Test", and the "Burning Brand Test".

UL 790 rates roof coverings as having either class "A", "B", or "C" fire ratings. Class "A" is the best rating and is defined as being "Effective against severe fire exposures". The type of roof deck upon which the membrane and insulation roofing assembly is to be applied determines the number and type of tests required. The deck types are classified as combustible or noncombustible. The combustible decks are wood, plywood and cementitious wood fiber (Tectum). Tectum is considered a combustible deck when it is less than 50 mm (2 inches) in thickness. Noncombustible decks are metal, concrete (structural and lightweight), Gypsum and Tectum that is at least 50 mm (2 inches) thick.

SPREAD OF FLAME TEST CRITERIA

- Class "A" (10 Minutes Exposure) - 1.8 m (6 Ft.) Maximum flame spread.
- Class "B" (10 Minutes Exposure) - 2.4 m (8 Ft.) Maximum flame spread.
- Class "C" (4 Minutes Exposure) - 4 m (13 Ft.) Maximum flame spread.

In all cases, there can be no lateral flame spread that burns off of the sides of the test deck. In addition, the deck cannot be exposed upon completion of the test.

INTERMITTENT FLAME TEST CRITERIA

- Class "A" - 15 Cycles (2 minutes on, 2 minutes off)
- Class "B" - 8 Cycles (2 minutes on, 2 minutes off)
- Class "C" - 3 Cycles (2 minutes on, 2 minutes off)

There cannot be any sustained flaming on the underside of the deck during or after the test.

BURNING BRAND TEST CRITERIA

- Class "A" - 2000 grams (Approx. 4.5 Pounds)
- Class "B" - 500 grams (Approx. 1.1 Pounds)
- Class "C" - 9.25 grams (Approx. 0.3) Pounds)

There cannot be any sustained flaming on the underside of the deck during or after the test.

NOTE: While only UL classified components can be included in a test assembly, only the assembly has the listed fire rating. The individual components do not have that rating and any substitutions will void the rating.

UL P-ASSEMBLIES (UL 263. ASTM E-119)

The resistance of a building to internal sources of fire has been extensively tested and classified at Underwriters Laboratories. Classification of wall, floor/ceiling and roof/ceiling assemblies can be divided into different series based on the fire protection used in the assembly.

P-ASSEMBLY INDEX

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	Sprayed cementitious fireproofing
P800 – P899	Sprayed fiber fireproofing
P900 – P999	Unprotected concrete or composite decks

P-ASSEMBLY LISTINGS (BXUV)

P215	P407	P710	P810	P907	P918
P216	P410	P711	P814	P908	P919
P225	P508	P712	P815	P909	P920
P227	P510	P717	P816	P910	P921
P230	P511	P719	P818	P911	P922
P231	P513	P732	P819	P912	P923
P242	P514	P801	P902	P913	
P246	P519	P802	P903	P914	
P251	P701	P803	P904	P915	
P405	P708	P804	P905	P916	
P406	P709	P805	P906	P917	

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.

UL LISTINGS
CUSTOM SEAL TPO
BALLASTED SYSTEM

UL Classification: **Class "A"**
Deck Type: **Noncombustible**
System Type: **Custom Seal TPO Ballasted**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Atlas "AC Foam II"	Any	17% (2")
RMax "Multimax FA"	Any	17% (2")
NRG Barriers "E'NRG'Y 2"	Any	17% (2")
Apache "Pyrox"	Any	17% (2")
Firestone "ISO 95+GL"	Any	17% (2")
Celotex "Hy-Therm AP"	Any	17% (2")
[1,3] Wood Fiberboard	13 mm (1/2") min.	17% (2")
[1,2] Polyisocyanurate	Any	17% (2")
[1,2] Perlite	Any	17% (2")
[1,2] Glass Fiber	Any	17% (2")
[3] Gypsum Board	13 mm (1/2") min.	17% (2")
[1,3] Georgia Pacific "Dens-Deck"	6 mm (1/4") min.	17% (2")
Polyurethane or Fiberglass/polyurethane composite	Any	17% (2")
Polystyrene or polystyrene/perlite composite	Any	17% (2")

1. All insulations must be UL Classified.
2. These insulations may be placed under either 13 mm (1/2")min. Wood Fiberboard or 6 mm (1/4")min. Dens-Deck or 13 mm (1/2")min. Gypsum board with out affecting the rating.
3. These materials may be used without any other insulation or barrier board.

UL LISTINGS
CUSTOM SEAL TPO
BALLASTED SYSTEM

UL Classification: **Class "A"**
Deck Type: **Combustible**
System Type: **Custom Seal TPO Ballasted**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Atlas "AC Foam II"	Any	17% (2")
RMax "Multimax FA"	Any	17% (2")
NRG Barriers "E'NRG'Y 2"	Any	17% (2")
Apache "Pyrox"	Any	17% (2")
Firestone "ISO 95+GL"	Any	17% (2")
Celotex "Hy-Therm AP"	Any	17% (2")
[1,3] Wood Fiberboard	13 mm (1/2") min.	17% (2")
[1,2] Polyisocyanurate	Any	17% (2")
[1,2] Perlite	Any	17% (2")
[1,2] Glass Fiber	Any	17% (2")
[3] Gypsum Board	13 mm (1/2") min.	17% (2")
[3] Georgia Pacific "Dens-Deck"	6 mm (1/4") min.	17% (2")

1. All insulations must be UL Classified.
2. These insulations may be placed under either 13 mm (1/2")min. Wood Fiberboard or 6 mm (1/4")min. Dens-Deck or 13 mm (1/2")min. Gypsum board with out affecting the rating.
3. These materials may be used without any other insulation or barrier board.

UL LISTINGS
CUSTOM SEAL TPO
MECHANICALLY ATTACHED SYSTEMS

UL Classification: **Class "A"**
Deck Type: **Noncombustible**
System Type: **Custom Seal TPO Mechanically Attached**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Atlas "AC Foam II"	Any	4% (1/2")
RMax "Multimax FA"	Any	4% (1/2")
Johns Manville "E'NRG'Y 2"	Any	4% (1/2")
Apache "Pyrox"	Any	4% (1/2")
Firestone "ISO 95+GL"	Any	4% (1/2")
Celotex "Hy-Therm AP"	Any	4% (1/2")
[3] Wood Fiberboard	13 mm (1/2") min.	4% (1/2")
[2] Polyisocyanurate	Any	4% (1/2")
[2] Perlite	Any	4% (1/2")
[2] Glass Fiber	Any	4% (1/2")
[3,4] Gypsum Board	13 mm (1/2") min.	4% (1/2")
[3,4] Georgia Pacific "Dens-Deck"	6 mm (1/4") min.	4% (1/2")

1. All insulations must be UL Classified.
2. These insulations may be placed under either 13 mm (1/2") min. Wood Fiberboard or 6 mm (1/4") min. Dens-Deck or 13 mm (1/2") min. Gypsum board without affecting the rating.
3. These materials may be used without any other insulation or barrier board.
4. These insulations must be covered with 13 mm (1/2") min. gypsum board or 6 mm (1/4") Dens-Deck.
5. 6.4 mm (1/4") Dens-Deck may be used as an alternate.

UL LISTINGS
CUSTOM SEAL TPO
MECHANICALLY ATTACHED SYSTEMS

UL Classification: **Class "A"**
Deck Type: **Combustible**
System Type: **Custom Seal TPO Mechanically Attached**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Atlas "AC Foam II" or "AC Foam III"	4" min.	2% (1/4")
Atlas "AC Foam III" & one layer Atlas FR 10 or 50	1.5" min.	2% (1/4")
RMax "Multimax FA"	4" min.	2% (1/4")
NRG Barriers "E'NRG'Y 2"	4" min.	2% (1/4")
Apache "Pyrox"	4" min.	2% (1/4")
Celotex "Hy-Therm AP"	4" min.	2% (1/4")
[2] Firestone "ISO 95+GL"	Any	4% (1/2")
[2] Wood Fiberboard	Any	4% (1/2")
[3] Gypsum Board	13mm(1/2") min.	4% (1/2")
[3] Georgia Pacific "Dens-Deck"	6 mm (1/4") min.	4% (1/2")

1. All insulations must be UL Classified.
2. These insulations must be covered with 13 mm (1/2") min. Gypsum Board or 6 mm (1/4") min. Dens-Deck.
3. Any of the above listed insulations may be placed under these products without effecting the rati

MECHANICALLY ATTACHED SYSTEMS

UL Classification: **Class "B"**
Deck Type: **Combustible**
System Type: **Custom Seal TPO Mechanically Attached**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Johns Manville “E’NRG’Y2A”	[1] 2.5”	2% (1/4”)
Firestone “Iso 95+GL”	[1] 2.5”	2% (1/4”)
Apache Products “Pyrox”	[1] 2.5”	2% (1/4”)
Atlas Roofing “AC Foam II or AC Foam III	[1] 2.5”	2% (1/4”)
One layer of Atlas “FR50”	NA	4%(1/2”)

1. Decking must be minimum 1-1/2” T & G, otherwise a minimum 3” of the above-mentioned insulation must be installed with all joints staggered a min. 6 in. from the plywood joints.

CODE APPROVALS
CUSTOM SEAL TPO
MECHANICALLY ATTACHED SYSTEM

Rating	Membrane	Fastener Rows	Fastener Spacing	Weld Type	Weld Width	Lap Width	Fastener	Plate or Bar	Deck Type	Max. Deck Span
1-150	TPO	70.25”	6”	2X	0.75” inside, 1” outside	4.5”	#15 XHD	Bar	Metal 22 ga. E	6’
1-120	TPO	142.5”	6”	2X	1” inside, 1” outside	4.5”	#15 XHD	Bar	Metal 22 ga. E	5.5’
1-105	TPO	70.25”	12”	2X	0.75” inside, 1” outside	4.5”	#15 XHD	Bar	Metal 22 ga. E	6’
1-105	TPO	142.5”	6”	2X	1” inside, 1” outside	4.5”	#15 XHD	Bar	Metal 22 ga. E	6’
1-90	TPO	142.5”	12”	2X	0.75” inside, 1” outside	4.5”	#15 XHD	Bar	Concrete	Na
1-90	TPO	90”	12”	1X	1.75”	6”	#15 XHD & #15 WH XHD	2-3/8” Barbed Plate & 2-3/8” WH Plate	Metal 22 ga, E	6’
1-90	TPO	114”	12”	1X	2”	6”	#16 SXHD	3” Barbed Seam plate	Metal 22 ga. E	6’
1-90	TPO	114”	6”	1X	1-3/4”	6”	#15 XHD & #15 WH XHD	2-3/8” Barbed Seam plate or 2-3/8” WH XHD	Metal 22 ga. C	6’
1-90	TPO	70”	12”	2X	1.5” each	4.5”	SFS ELF HD	Bar	Metal 22 ga. E	6’
1-90	TPO	70.5”	6”	1X	1.5”	4.5”	#14 Custom Seal	2” RM Seam Plate	Metal 22 ga. C	6’
1-90	TPO	70”	12”	1X	1.5”	4.5”	#15 Washer Head	Buildex 2-3/8” Barbed	Metal 22 ga. E	6’
1-90	TPO	70”	12”	1X	1.5”	4.5”	#15 XHD or SPM	2-3/8” XHD Barbed	Metal 22 ga. E	6’
1-60	TPO	70”	18”	2X	1.5” each	5”	#15 SPM	Bar	Metal 22 ga. E	6’
1-60	TPO	90”	18”	1X	1-3/4”	6”	#15 WH XHD #15 XHD	2-3/8” WH Barbed plate 2-3/8” Barbed plate	Metal 22 ga. E	6’
1-60	TPO	114”	12”	1X	1-3/4”	6”	#15 WH XHD #15 XHD	2-3/8” WH Barbed Plate 2-3/8” Barbed seam plate	Metal 22 ga. E	6’
1-60	TPO	70”	18”	1X	2”	5”	#15 Washer Head	Buildex 2-3/8” Barbed	Metal 22 ga. E	6’
1-60	TPO	70”	18”	1X	2”	5”	#15 SPM	SPM Plate	Metal 22 ga. E	6’
1-60	TPO	142.5”	12”	2X	0.75” inside, 1” outside	4.5”	#15 XHD	Bar	Metal 22 ga. E	6’
1-60	TPO	68.5”	12”	2X	1.5” each	4.5”	#14 Custom Seal	Bar	Metal 22 ga. C	6’
1-60	TPO	70”	12”	2X	1.5” each	4.5”	SFS ELF HD	Bar	Metal 22 ga. C	6’

Note

- Insulations Approved include: E”NRG”Y-2, Multi Max FA, Pyrox, AC Foam II, Celotex High Density Fiberboard, AC Foam Composite, Thermaroof Composite. Contact Custom Seal Roofing Systems for additional information.
- **Custom Seal #15 Washer Head (WH) fastener and Polymer Batten Bar can be substituted for #15 XHD and Metal Anchor Bar**
- Per Loss Prevention Data Sheet 1-29 only 4 fasteners and plates are required to secure the insulation to the deck under a mechanically attached single ply roof cover. Custom Seal requires a minimum of 5 fasteners and plates per 4’ x 8’ insulation board. (no increase is necessary in the perimeter and corner) Systems with an air or vapor barrier under the insulation must be attached at 1 fastener and plate every 2 sq ft.
- Maximum thickness of insulation in a recover system must be 1” or less. Greater than 1” will effect the Class 1 rating.

Note

- Insulations Approved include: E”NRG”Y-2, Multi Max FA, Pyrox, AC Foam II, Celotex High Density Fiberboard, AC Foam Composite, Thermaroof Composite. Contact Custom Seal Roofing Systems for additional information.
- **Custom Seal #15 Washer Head (WH) fastener and Polymer Batten Bar can be substituted for #15 XHD and Metal Anchor Bar**
- Per Loss Prevention Data Sheet 1-29 only 4 fasteners and plates are required to secure the insulation to the deck under a mechanically attached single ply roof cover. Custom Seal requires a minimum of 5 fasteners and plates per 4’ x 8’ insulation board. (no increase is necessary in the perimeter and corner) Systems with an air or vapor barrier under the insulation must be attached at 1 fastener and plate every 2 sq ft.
- Maximum thickness of insulation in a recover system must be 1” or less. Greater than 1” will effect the Class 1 rating.

UL LISTINGS
CUSTOM SEAL TPO
FULLY ADHERED SYSTEMS

UL Classification: **Class "A"**
Deck Type: **Noncombustible**
System Type: **Custom Seal TPO Fully Adhered**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Atlas "AC Foam II"	Any	4% (1/2")
RMax "Multimax FA"	Any	4% (1/2")
Johns Manville "E'NRG'Y 2"	Any	4% (1/2")
Apache "Pyrox"	Any	4% (1/2")
Firestone "ISO 95+GL"	Any	4% (1/2")
Celotex "Hy-Therm AP"	Any	4% (1/2")
[3] Wood Fiberboard, Perlite	13 mm (1/2") min.	4% (1/2")
[2] Polyisocyanurate	Any	4% (1/2")
[3] Gypsum Board	13 mm (1/2") min.	4% (1/2")
[3] Georgia Pacific "Dens-Deck"	6 mm (1/4") min.	4% (1/2")

1. All insulations must be UL Classified.
2. These insulations may be placed under either 13 mm (1/2") min. Wood Fiberboard or 6 mm (1/4")min. Dens-Deck or 13 mm (1/2")min. Gypsum board with out affecting the rating.
3. These materials may be used without any other insulation or barrier board.

UL LISTINGS
CUSTOM SEAL TPO
FULLY ADHERED SYSTEMS

UL Classification: **Class "A"**
Deck Type: **Combustible**
System Type: **Custom Seal TPO Fully Adhered**
Membrane: **Custom Seal TPO** 1.1 mm or 1.5 mm (.045" or .060")

[1]INSULATION	THICKNESS	MAXIMUM SLOPE
Atlas "AC Foam II" or "AC Foam III"	4" min.	2% (1/4")
Atlas "AC Foam III" & Atlas FR "10" or "50" (one layer)	1.5" min.	4% (1/2")
[2] RMax "Multimax FA"	Any	4% (1/2")
[2] NRG Barriers "E'NRG'Y 2"	Any	4% (1/2")
[2] Apache "Pyrox"	Any	4% (1/2")
[2] Celotex "Hy-Therm AP"	Any	2% (1/4")
[2] Firestone "ISO 95+GL"	Any	4% (1/2")
[2] Wood Fiberboard	Any	4% (1/2")
[3] Gypsum Board	13mm(1/2") min.	4% (1/2")
[3] Georgia Pacific "Dens-Deck"	6 mm (1/4") min.	4% (1/2")

1. All insulations must be UL Classified.
2. These insulations must be covered with 13 mm (1/2") min. Gypsum Board or 6 mm (1/4") min. Dens-Deck.
3. Any of the above listed insulations may be placed under these products without affecting the rating.

FM APPROVALS
CUSTOM SEAL TPO
FULLY ADHERED SYSTEM

Rating	Deck	Insulation	Insulation Thickness Minimum	Insulation Attachment	Field	Perimeter	Corner	Fastener
1-90	2,5	Atlas AC Foam II	1.5”	MA	16	24	28	See Note
1-90	2,5	E”NRG”Y-2	1.5”	MA	16	24	28	See Note
1-90	2,5	Rmax Multi Max FA	1.5”	MA	16	24	28	See Note
1-90	2,5	Georgia Pacific Dens-Deck	¼”	MA	18	27	32	See Note
1-75	2,5	Celotex FM90 High Density Fiberboard	½”	MA	16	24	28	See Note
1-60	2,5	Georgia Pacific Dens-Deck	¼”	MA	16	24	28	See Note

Note

- Insulation is secured to the deck using ITW Buildex, Construction Fasteners, Olympic, SFS Stadler or Tru-Fast screws and metal plates (see Custom Seal TPO fastener table for screws and plates) applied at 2 sq ft maximum contributory area per fastener and cover with Custom Seal TPO roof cover adhered using Custom Seal Bonding Adhesive to both the substrate and the bottom side of the roof cover at a combined rate of 60 sq ft per gallon.
- Polyisocyanurate insulation may be attached to concrete deck using Custom Seal Insulation Adhesive applied at approximately ¾” wide ribbons at 12” on center and covered with Custom Seal TPO roof cover adhered per above note. Meets Class 1-90
- Polyisocyanurate insulation may be attached to concrete deck using Custom Seal Insulation Adhesive applied at approximately ¾” wide ribbons at 12” on center and covered with a layer of Celotex ½” FM90 High Density Fiberboard adhered to the polyisocyanurate using Custom Seal Insulation Adhesive applied at approximately ¾” wide ribbons at 12” on center and covered with Custom Seal TPO roof cover adhered per above note. Meets Class 1-75

FM APPROVALS
CUSTOM SEAL TPO
FULLY ADHERED FASTENER TABLE NOTES

	1 Cementitious Woodfiber	2 Structural Concrete	3 Gypsum (recover only)	5 Steel
A – CFI, Construction Fasteners		1. Dekfast Stainless Steel with 3" Round Plate 2. #14 Dekfast withLock or Hex plate 3. Dekfast #15 Heavy, #15HS with Lock Hex Plate 4. Dekspike with Hex Plate		1. Dekfast Stainless Steel with 3" Round Plate 2. #12, #14 Dekfast or Omega with Lock or Hex Plate 3. Dekfast #15 Heavy, #15HS with Lock or Hex Plate 4. HWH Dekfast with #12 Hex Plate
B –Custom Seal		1. Custom Seal #14, #15 with Steel Square or Round		1. GenFast #12, #14, #15 with GenFast Steel Square or Round
C – ITW, Buildex		1. #14-10 or #15 Roofgrip with Recessed, Flat Bottom, King-Con with Flat Bottom or Gearlok Plate		1. AccuTrac or Hextra with Recessed, Accutrac or Gearlok Plate 2. #12, ¼", #14-10 or #15 Roofgrip with Recessed, Flat Bottom, Gearlok Plate 3. Hextra Plus Pre-assembled system 4. Roofgrip Plus Pre-assembled System
D – OMG, Olympic	1. NTB Magnum 2" with NTB Plastic Plate 2. NTB Magnum 1" with NTB Plate 3. Lite-Deck or GTL with Lite-Deck Plate	1. Hex Head #12, #14, Olympic Heavy Duty, CD-10 or Fluted Nail with Standard, G-2 or Olympic Plate	1. NTB Magnum 2" with NTB Plastic Plate 2. NTB Magnum 1" with NTB Plate 3. Lite-Deck or GTL with Lite-Deck Plate 4. Iron-Lok or Strap Toggle with Standard, G-2 or Olympic Plate	1. Olympic #10, Olympic Standard, Olympic Heavy Duty, Stainless #12, Hex Head #12, #14, Iron-Lok or Strap Toggle with Standard, G-2 or Olympic Metal or Plastic Plate 2. Olympic Standard or Olympic Heavy Duty with LGP

FM APPROVALS
CUSTOM SEAL TPO
FULLY ADHERED FASTENER TABLE NOTES (cont.)

	1 Cementitious Woodfiber	2 Structural Concrete	3 Gypsum (recover only)	5 Steel
E –Custom Seal		1. #14HD with 3" Round Insulation Plate		1. #14HD with 3" Round Insulation Plate
F – RPC, Powers	1. Powerlite with Powerlite 3" Insulation plate	1. RawlSpike, T-Spike, Lok/Bolt, Drive Speed-Lock Toggle Bolt or Zamac Nailin with Rawl 3" Insulation plate	1. Powerlite with Powerlite 3" Insulation Plate	1. Rawl #12, #14 or Speed-Lock Toggle Bolt with Rawl 3" Insulation Plate
G – SFS, Stadler		1. #14-10 Insul-Fixx with Insul-Fixx S IF-3"-S Type II Nbore (Metal ES) or P; #14 System ES-1		1. Isofast IF2C, Isofast IF2C-S with Isofast IFC/IW-70x70 2. Isofast IF2C, Isofast IF2C-S, Isofast IG or Isofast IG-S with Isofast IF/IG-70x70 3. Isofast IF2 with IF-3"-S Type 1 or Isofast IF/IFT-70x70 4. #12-11 or #14-10 Insul-Fixx with Insul-Fixx S, IF-3"-S Type II Bore (Metal ES) or P 5. System ES-1 #12 or #14
H – TRU, Tru-Fast	1. TL with TL 3" Insulation Plate	1. Tru-Fast Ultra S.S., HD, DL, CF or CF Tap Grip with MP-3 or Plastic Plate	1. TL with TL 3" Insulation Plate	1. Tru-Fast TP, DP, Ultra S.S., HD or DL with MP-3 or Plastic Plate 2. Tru-Fast DP-H with MP-3 3. Tru-Fast PA System