



FM APPROVED ASSEMBLIES

CODES AND APPROVALS

INTRODUCTION

The Duro-Last® roofing system has been evaluated by FM Approvals, the certification and testing service of FM Global, and at the time of this publication Duro-Last, Inc. has over 800 FM approved roof assemblies. All FM approved roof assemblies have been evaluated for performance criteria that include interior fire exposure, exterior fire exposure, wind uplift resistance, corrosion resistance for roof fasteners, accelerated weathering, hail damage resistance, leakage resistance and foot traffic resistance.

Duro-Last, Inc. currently has FM approved assemblies conforming to one or more FM Approval Standards. These standards include Approval Standards 4450 for *Class 1 Insulated Steel Deck Roofs*, Approval Standard 4470 for *Class 1 Roof Covers*, Approval Standard 4471 for *Class 1 Panel Roofs* or Approval Standard 4435 for *Roof Perimeter Flashing*, or 4451 for *Steel Roof Decking*.

Design professionals who will be specifying FM approved roof assemblies are strongly urged to utilize the tools made available on FM Approval's web site RoofNav (www.roofnav.com). The web site includes a calculator which can be used to determine the appropriate FM Class to use on a project. The calculator utilizes project specific information such as building height, ground roughness, building category, and basic wind speed. The calculator allows the user to choose the level of protection from interior and exterior fire hazards as well as hail damage. The calculator is easy to use and help is provided for each step involved. Also available on RoofNav are: the complete collection of FM approved roof products and assemblies, pertinent FM Data Sheets and Standards, useful background information and a glossary of terms.

Approved Roof Assemblies

The roof assemblies within RoofNav are FM approved only when assembled as listed for each specific cover, insulation, fastener, deck or structural substrate. Their compatibility with other roofing components within the construction is the responsibility of the listed manufacturer, who should be consulted prior to their use. Their performance is extremely dependent upon the substrate to which the system is attached or anchored.

It is impractical to list all of Duro-Last's FM approved assemblies in this section. Refer to the RoofNav website for the complete listing. RoofNav has extensive tools for searching for approved products and assemblies. Contact Duro-Last Technical Services if you need assistance regarding FM approved products and roof assemblies.

FM Global Insured Projects

If the building in question is FM Global insured, contact FM Global Field Engineering. An FM Global Field Engineer will review the work to be done and provide assistance in determining the proper roof assembly to use. If you have not been through this process, contact the Duro-Last Technical Services Department for assistance.

Wind Uplift Ratings

FM approved roof assemblies have a minimum Class 1-60 wind uplift rating. In addition to the minimum Class 1-60 rating, FM approved roofs may also be rated in 15 psf increments; e.g. Class 1-75, Class 1-90, Class 1-105, etc. Duro-Last currently has FM approved roof assemblies ranging from Class 1-60 up to Class 1-495 and additional assemblies are tested for approval each year.

FM Approvals also evaluates perimeter flashings for use with FM approved roof assemblies. Duro-Last has approved perimeter flashings that range from Class 1-90 to Class 1-990. These products are listed in Table 1 on page FM-4.

CORNER AND PERIMETER ENHANCEMENT

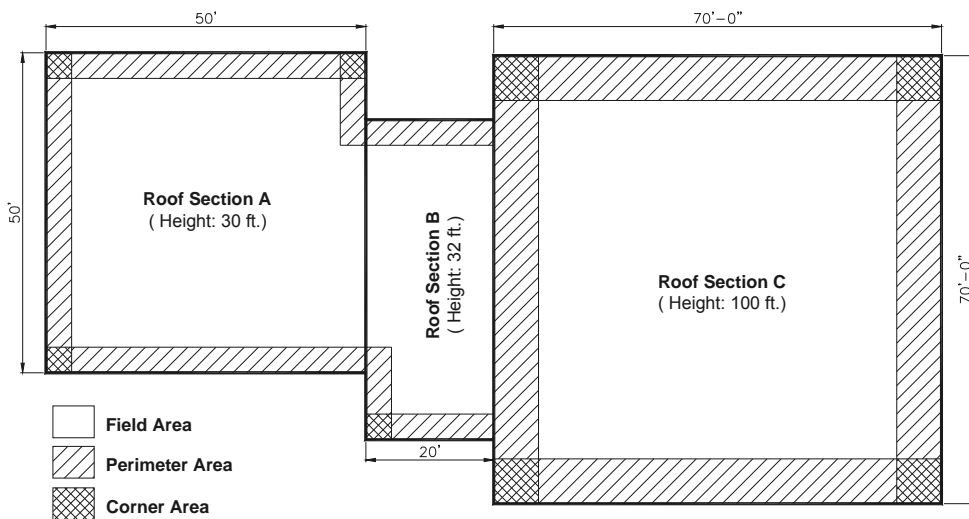
The FM approved roof assemblies have been evaluated for exposure to wind loads in the field (interior) of the roof. The wind uplift loads acting at the roof corners and the roof perimeters are generally higher than the load acting in the field of the roof. To compensate for these higher loads, enhancements must be made for the securement of all components in the roof assembly. These enhancements are discussed in detail in FM Global Property Loss Prevention Data Sheets 1-28 and 1-29.

There are two ways to compensate for the higher loads in the perimeter and corner zones,

1. Install an FM approved assembly in each area that has a wind uplift rating equal to or greater than the minimum wind rating for that area listed in Table 1 of FM Global Property Loss Prevention Data Sheet 1-29.
2. Utilize the prescriptive enhancement options as outlined in FM Global Property Loss Prevention Data Sheet 1-29. Care should be exercised when utilizing one of the prescriptive options to ensure that the option is acceptable for the project. Contact Duro-Last Technical Services for assistance in determining the appropriate option.

The width (x) of the perimeter area is defined as the lesser of either 40% of the building eave height or 10% of the lesser roof plan dimension, but in no case less than 5 ft. (Note: Duro-Last requires a minimum perimeter width of 5 ft on FM installations. This exceeds FM's minimum requirements.) The corner area is defined as x by x ft. Figure A illustrates the location of the field, perimeter and corner areas for three roofs and shows the calculations used to determine the perimeter width for each roof. Note the following when multi-level roofs meet at a common wall.

1. When the roof heights differ by less than 3 ft the edge of both the upper and lower roofs are treated as field area, except for the rectangular areas at each end, which are treated as perimeters. This is the case where roof section A is adjacent to roof section B in the drawing below.
2. When the roof heights differ by 3 ft or more the edge of the upper roof is treated as either perimeter or corner area while the edge of the lower roof is treated as field and perimeter area. This is the case where roof section B is adjacent to roof section C in the drawing below.



Roof Section A

- 40% of height = $0.4 \times 30 \text{ ft.} = 12 \text{ ft.}$
- 10% of lesser plan dimension = $0.1 \times 50 \text{ ft.} = 5 \text{ ft.}$
- Perimeter width to use = 5 ft.

Roof Section B

- 40% of height = $0.4 \times 32 \text{ ft.} = 12.8 \text{ ft.}$
- 10% of lesser plan dimension = $0.1 \times 20 \text{ ft.} = 2 \text{ ft.}$
- Perimeter width to use = 5 ft. (Duro-Last's minimum width)

Roof Section C

- 40% of height = $0.4 \times 100 \text{ ft.} = 40 \text{ ft.}$
- 10% of lesser plan dimension = $0.1 \times 70 \text{ ft.} = 7 \text{ ft.}$
- Perimeter width to use = 7 ft.

BOARD FASTENING

Insulation boards must be installed per specific FM approved assemblies whenever possible. Installation of assemblies which are not FM approved may still be acceptable to FM when installed in accordance with the design recommendations outlined in FM Global Property Loss Prevention Data Sheet 1-29. For FM Global insured projects such assemblies must be reviewed by an FM Global Field Engineer.

Refer to FM Global Property Loss Prevention Data Sheet 1-29 for a complete discussion of proper board attachment. Several key points to consider include,

1. When installing multiple layers of insulation it is acceptable to mechanically secure through all of the layers provided that:
 - a. All layers are the same FM approved insulation.
 - b. Total insulation thickness does not exceed maximum FM approved thickness of the insulation.
 - c. The roof cover/insulation/fastener combination is FM approved.
2. Acceptable board dimensions are listed in FM approved assembly or as follows:
 - a. Mechanically attached board: maximum size is 4 x 8 ft. (1.2 by 2.4 m).
 - b. Adhesive or asphalt attached board: maximum size is 4 x 4 ft. (1.2 by 1.2 m).

(Exception: Flexible boards, such as DensDeck[®], up to 4 x 8 ft (1.2 by 2.4 m).

3. Provide preliminary securement of insulation boards when mechanically fastened roof covers are used as follows.
 - a. Install a minimum of four fasteners per 4 x 4 ft (1.2 x 1.2 m) board.
 - b. Install five fasteners per 4 x 8 ft. (1.2 x 2.4 m) board. (Note: this fastener density meets the Duro-Last specification which exceeds the FM requirements.)
 - c. Additional insulation fastening is not required in the perimeter or corner areas when the roof system is mechanically attached.

Exception: As stated in the FM Global Property Loss Prevention Data Sheet 1-29, if a vapor retarder is installed below the insulation or coverboard of a mechanically secured single-ply membrane on Panel-type decks (decks with seams such as steel, wood, pre-cast planks, etc.), secure the insulation or coverboard with fasteners or plates by either:

1. A rate of 1 per 2 ft² (1 per 0.19m²) throughout the entire roof area, OR
2. A rate throughout the entire roof area that will obtain a minimum 1-90 uplift FM Approval with an adhered single-ply roofing membrane as specified in a RoofNav listing. The insulation/coverboard type used below the mechanically secured membrane must match that specified by the RoofNav listing for the adhered membrane, and the thickness of the insulation / coverboard must be equal to or greater than that specified by the RoofNav listing.

MECHANICALLY ATTACHED ASSEMBLIES INTO STEEL DECKS

Installation of mechanically attached single-ply roof covers over a steel deck (new or recover) require that the roof cover be laid so that the rows of fasteners are perpendicular to the ribs of the steel roof deck. This requirement is made to take advantage of the steel deck rib module and to engage the top flange of the steel deck. (Exception: For Class 1-75 and below, fastener rows may be installed parallel to the ribs of the steel deck within the defined building perimeter width. The fasteners still must engage the top flange of the deck.)

FM APPROVED PRODUCTS

The following Duro-Last products are approved for use in FM approved assemblies.

FM Approved Product Name	Approved Use
Duro-Last Membrane (40, 50 and 60 mil)	Cover (Single-ply)
Duro-Last Duro-Fleece [®] Membrane (50 and 60 mil)	Cover (Single-ply)
Duro-Fleece Adhesive	Adhesive (Full Application and Ribbons)
Duro-Grip Polyurethane Foam Insulation Adhesive	Adhesive (Full Application and Ribbons)
Duro-Last SB I, SB II and SB IV Adhesives	Adhesive (Full Application)
Duro-Last WB I and WB II Adhesives	Adhesive (Full Application)
Duro-Last 4725 Tab Sealer	Adhesive (Full Application)
Duro-Guard [®] HD-A	Cover Board and Insulation (Board Stock)
Duro-Guard Iso Composite-H	Insulation (Board Stock)
Duro-Guard Iso HD-H	Cover Board and Insulation (Board Stock)
Duro-Guard Iso II-H	Insulation (Board Stock)
Duro-Guard Iso II-H Tapered	Insulation (Board Stock)
Duro-Guard Iso III-H	Insulation (Board Stock)
Duro-Guard Iso III-H Tapered	Insulation (Board Stock)
Duro-Guard Iso II-A	Insulation (Board Stock)
Duro-Guard Iso II-A Tapered	Insulation (Board Stock)
Duro-Guard Iso III-A	Insulation (Board Stock)
Duro-Guard Iso III-A Tapered	Insulation (Board Stock)
Duro-Guard Iso IV-A	Insulation (Board Stock)
Duro-Guard Iso IV-A Tapered	Insulation (Board Stock)
Duro-Fold [®]	Insulation (Board Stock)
Duro-Last Fascia System	Fascia
Duro-Guard Metal Compression System	Fascia
Duro-Last Drip Edge	Fascia
Duro-Last Fascia System	Fascia
Duro-Last Gravel Stop Edgings	Fascia
Duro-Last #15 Extra Heavy Duty Drill Point Fastener	Fastening (Fastener)
Duro-Last #14 HD Fastener	Fastening (Fastener)
Duro-Last Concrete Screw	Fastening (Fastener)
Duro-Last Fluted Concrete Nails	Fastening (Fastener)
Duro-Last Liquid Auger Fastener	Fastening (Fastener)
Duro-Last Insulation Plate	Fastening (Stress Plate)
Duro-Last Poly-Plates	Fastening (Stress Plate)
Duro-Last Cleat Plate	Fastening (Stress Plate)
Duro-Last 3 in. Metal Plates	Fastening (Stress Plate)
Rhinobond Insulation Plate	Fastener (Stress Plate)