

# ICC-ES Evaluation Report

**ESR-1597**

Issued July 1, 2009

This report is subject to re-examination in one year.

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**DIVISION: 07—THERMAL AND MOISTURE PROTECTION**  
**Section: 07540—Thermoplastic Membrane Roofing**
**REPORT HOLDER:**
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**EVALUATION SUBJECT:**
**EVERGUARD® TPO AND TPO FB ULTRA SINGLE-PLY  
ROOF MEMBRANE SYSTEMS**
**1.0 EVALUATION SCOPE**
**Compliance with the following code:**

 2006 *International Building Code*® (IBC)

**Properties evaluated:**

- Weather resistance
- Fire classification
- Wind uplift resistance
- Impact resistance

**2.0 USES**

EverGuard® TPO and TPO FB (fleece-backed) Ultra single-ply roof membranes are used as roof coverings in fire-classified roof assemblies with or without insulation and barrier boards.

**3.0 DESCRIPTION**
**3.1 Materials:**
**3.1.1 Membranes:**

**3.1.1.1 EverGuard® TPO:** A nominally 45-, 60- or 80-mil-thick [0.045 inch (1.1 mm), 0.060 inch (1.5 mm) or 0.080 inch (2.0 mm)], thermoplastic polyolefin roof covering with woven polyester reinforcement. The membrane has a white, tan or grey weathering surface and a dark grey underside. It is supplied in rolls 120 inches (3048 mm) or 60 inches (1523 mm) wide by 100 feet (30.5 m) long.

**3.1.1.2 EverGuard® TPO FB Ultra:** A nominally 45-, 60- or 80-mil-thick [0.045 inch (1.1 mm), 0.060 inch (1.5 mm) or 0.080 inch (2.0 mm)], thermoplastic polyolefin roof covering with woven polyester reinforcement and a 3.5 oz/yd<sup>2</sup> (120 g/m<sup>2</sup>) polyester fleece fabric backing. The products are designated as EverGuard® TPO FB Ultra 450, EverGuard® TPO FB Ultra 600, and EverGuard® TPO FB Ultra 800, respectively. The membrane has a white, tan or

grey weathering surface and a black underside. It is supplied in rolls 120 inches (3048 mm) or 60 inches (1523 mm) wide by 100 feet (30.5 m) long.

**3.1.2 Sealant:** EverGuard® Cut Edge Sealant is a polymeric sealant, used for sealing exposed cut edges of the membrane. The sealant has a shelf life of 12 months and is required to be stored in a dry, well-ventilated area, where the temperature is 50°F to 90°F (10°C to 32°C).

**3.1.3 Roof Deck:** Combustible roof decks are limited to minimum nominally 1<sup>5</sup>/<sub>32</sub>-inch-thick (11.9 mm) Exposure 1 wood structural panels, which must comply with IBC Section 2603.4.1.5. Noncombustible decks are steel or concrete decks recognized in the IBC or a current ICC-ES evaluation report. The steel deck must be minimum No. 22 gage steel [base-metal thickness of 0.0273 inch (0.69 mm)], having a minimum yield strength,  $F_y$ , of 33 ksi or 80 ksi (227 or 550 MPa), depending on the wind uplift capacity of the roof assemblies shown in Table 2. Concrete decks must have a minimum 2500 psi (17.2 MPa) compressive strength at 28 days at the time of roofing system installation.

**3.1.4 Insulation:** Polyisocyanurate foam plastic insulation specified in Tables 1 and 2 must comply with ASTM C 1289, Type II or III, and IBC Chapter 26. Foam plastic insulation must be recognized in a current ICC-ES evaluation report or comply with the labeling and identification, surface-burning characteristics, and thermal barrier requirements of IBC Section 2603.4. The foam plastic insulation must be classified for roofing applications.

When foam plastic insulation is installed directly over a steel deck, the roof assembly, which includes the foam plastic insulation and the EverGuard® membrane, must be specifically recognized for direct installation over steel decks in an ICC-ES evaluation report.

Wood fiber board specified in Table 1 must be classified for roofing applications.

**3.1.5 Barrier Board/Slip Sheet:** Barrier boards and slip sheets specified in Table 1 must be classified for roofing applications.

**3.1.6 Fasteners and Plates:** Corrosion-resistant mechanical fasteners and plates used to attach the roof insulation and/or the roof membrane must be as follows:

**3.1.6.1 DRILL.TEC™ Standard #12 or HD #14 Fasteners:** The standard #12 fastener is a #12 diameter by maximum 8-inch-long (203 mm) drill-point screw with a #3 Phillips head. The HD #14 fastener is a #14 diameter by maximum 12-inch-long (305 mm) drill-point screw with a #3 Phillips head. The fasteners are coated with a black proprietary coating. The fasteners are for use with

DRILL.TEC™ Standard Insulation 3-inch (76 mm) Steel Plates for preliminary fastening of insulation boards to plywood, steel and concrete (#14 only) decks. See Table 2 for preliminary attachment requirements.

**3.1.6.2 DRILL.TEC™ XHD Fastener or TruFast EHD Fastener:** The XHD fastener or TruFast EHD fastener is a #15 diameter by maximum 14-inch-long (356 mm) drill-point screw with a #3 Phillips head coated with a black proprietary coating. The XHD fasteners must be of sufficient length to penetrate a minimum of  $\frac{1}{2}$  inch (13 mm) through steel deck or  $\frac{3}{4}$  inch (19 mm) through plywood sheathing. The XHD fasteners are for use with DRILL.TEC™  $2\frac{3}{8}$ -inch (60 mm) XHD barbed steel plates or DRILL.TEC™ 2-inch (51 mm) Steel Plates, and TruFast EHD fasteners are for use with TruFast 2.4-inch (61 mm) Barbed Metal Seam Plates or 2-inch (51 mm) Barbed Metal Seam Plates for attachment of the EverGuard® membrane to plywood and steel decks. See Table 2 for membrane attachment requirements.

**3.1.6.3 DRILL.TEC™ Spikes:** The spike 0.25 inch (6.3 mm) in diameter and a maximum of 12 inches (305 mm) long is a split-bulb fastener with a flat top pan head coated with a black proprietary coating. The spikes must be of sufficient length for a minimum 1-inch (25.4 mm) embedment into concrete decking. A predrilled  $\frac{7}{32}$ -inch-diameter (5.5 mm) pilot hole must be  $\frac{1}{2}$  inch (13 mm) deeper than the fastener embedment. The spikes are for use with DRILL.TEC™  $2\frac{3}{8}$ -inch (60 mm) XHD barbed steel plates or DRILL.TEC™ 2-inch (51 mm) Steel Plates for attachment of the EverGuard® membrane to concrete decks. See Table 2 for membrane attachment requirements.

**3.1.6.4 DRILL.TEC™ Insulation Steel Plate 3":** The Insulation Steel Plate 3" is a 3-inch-diameter (76 mm), 0.020-inch-thick (0.51 mm), Galvalume AZ-55 coated stress plate. The Insulation Steel Plate 3" is for use with DRILL.TEC™ Standard #12 or HD #14 fasteners for preliminary attachment of insulation boards to plywood, steel and concrete (#14 only) decks. See Table 2 for preliminary attachment requirements.

**3.1.6.5 DRILL.TEC™  $2\frac{3}{8}$ " Barbed XHD Plate and DRILL.TEC™ Steel Plate 2":** The  $2\frac{3}{8}$ " Barbed XHD Plate is a  $2\frac{3}{8}$ -inch-diameter (60 mm), 0.040-inch-thick (1.02 mm), Galvalume AZ-55 coated stress plate. The Steel Plate 2" is a 2-inch-diameter (51 mm), 0.040-inch-thick (1.02 mm), Galvalume AZ-55 coated stress plate. The plates have pointed barbs projecting downward  $\frac{1}{8}$  inch (3.2 mm) from the underside between raised circular stampings. DRILL.TEC™  $2\frac{3}{8}$ " Barbed XHD Plates and DRILL.TEC™ Steel Plate 2" are for use with DRILL.TEC™ XHD Fasteners or DRILL.TEC™ Spikes for attachment of the EverGuard® membrane to plywood, steel and concrete decks. See Table 2 for membrane attachment requirements.

**3.1.6.6 TruFast 2.4" and 2.0" Barbed Metal Seam Plates:** The 2.4" Barbed Metal Seam Plate is a 2.4-inch-diameter (61 mm), 0.040-inch-thick (1.02 mm), Galvalume AZ-55 coated stress plate. The 2.0" Barbed Metal Seam Plate is a 2.0-inch-diameter (51 mm), 0.040-inch-thick (1.02 mm), Galvalume AZ-55 coated stress plate. The plates have pointed barbs projecting downward  $\frac{1}{8}$  inch (3.2 mm) from the underside between raised circular stampings. The 2.4" and 2.0" Barbed Metal Seam Plates are for use with TruFast EHD Fasteners to secure the EverGuard® membrane to plywood, steel and concrete decks. See Table 2 for membrane attachment requirements.

### 3.2 Impact Resistance:

The roofing membranes described in this report meet the requirements for impact resistance in IBC Section 1504.7, based on testing in accordance with FM 4770.

## 4.0 INSTALLATION

Installation of EverGuard® TPO and TPO FB Ultra single-ply roof membranes must comply with this report and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

### 4.1 General:

The membranes and insulation must be installed in accordance with Tables 1 and 2. EverGuard® TPO and TPO FB Ultra are attached to the roof deck by mechanical fastening systems. The membranes must be field-installed by a GAF Materials Corporation approved applicator. All substrates must be clean and smooth, and free of sharp edges, foreign materials, oil and grease. Refer to Figures 1 through 6 for installation details.

**4.1.1 Mechanical Attachment:** Mechanically fastened systems consist of rigid insulation boards mechanically presecured to noncombustible or combustible roof decks with appropriate fasteners and plates described in Tables 2 and 3. The insulation is covered with EverGuard® TPO or TPO FB Ultra membrane, which is mechanically fastened through the insulation and into the roof deck using the appropriate fasteners and plates as described in Tables 2 and 3.

**4.1.2 Lap Joints:** EverGuard® TPO and TPO FB Ultra are lapped and heat-welded in accordance with Table 2.

### 4.2 Wind Uplift:

Installations of the EverGuard® TPO and TPO FB Ultra roof membrane systems described in this report are limited to the exposure areas, wind speeds, and building heights shown in Table 2. Metal edge securement of roofing systems must be designed in accordance with ANSI/SPRI ES-1, complying with IBC Section 1504.5.

## 5.0 CONDITIONS OF USE

The EverGuard® TPO and TPO FB Ultra single-ply roof membranes described in this report comply with, or are suitable alternatives to what is specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

- 5.1** Installation of the roofing systems must comply with the IBC, the manufacturer's published installation instructions and this report. In the event of a conflict between the installation instructions and this report, this report governs.
- 5.2** The roof-membrane system must be installed by applicators authorized by GAF Materials Corporation.
- 5.3** Roof classification requirements are as shown in Table 1, and wind design requirements are as shown in Tables 2 and 3.
- 5.4** Foam plastic insulation must be separated from the interior of the building by an approved thermal barrier in accordance with IBC Section 2603.4.1.5, except when use without a thermal barrier is specifically recognized in an ICC-ES evaluation report.
- 5.5** Foam plastic insulation, where used, must bear the label of an approved agency indicating that the foam plastic has a flame-spread index of not more than 75 when tested, at the maximum thickness intended for use, in accordance with ASTM E 84.

- 5.6 Above-deck thermal insulation board must comply with the applicable standards listed in Table 1508.2 of the IBC.
- 5.7 Design wind-uplift pressure on any roof area, including edge and corner zones, must not exceed the allowable wind pressure for the system installed in that particular area. Refer to the allowable wind uplift pressure for roof coverings as listed in Table 2.
- 5.8 The allowable wind uplift pressures listed in Table 2 are for the roof covering only. The deck and framing to which the roof covering is attached must be designed for the applicable components and cladding wind loads in accordance with the IBC.
- 5.9 Calculations demonstrating that the required wind resistance is less than the allowable wind resistance must be submitted to the code official.
- 5.10 EverGuard® TPO and TPO FB Ultra single-ply roof membranes are manufactured in Mt. Vernon, Indiana, and Gainesville, Texas, under a quality control program with inspections by Underwriters Laboratories Inc. (AA-668).

**6.0 EVIDENCE SUBMITTED**

Data in accordance with the ICC-ES Acceptance Criteria for Membrane Roof-covering Systems (AC75), dated April 2007.

**7.0 IDENTIFICATION**

The EverGuard® TPO and TPO FB Ultra single-ply roof membranes described in this report must be identified by a stamp bearing the manufacturer’s name (GAF Materials Corporation), the product type, the name of the inspection agency (Underwriters Laboratories Inc.) and the evaluation report number (ESR-1597).

Fasteners must be identified by the manufacturer’s name, the trade name and the size.

Foam plastic insulation must be labeled in accordance with the applicable ICC-ES evaluation report or with the IBC.

**TABLE 1—ROOF CLASSIFICATIONS**

SYSTEM NO.	ROOF CLASS	SUBSTRATE <sup>2,3</sup>	MAXIMUM ROOF SLOPE	SLIP SHEET, INSULATION, AND BARRIER OR COVER BOARD				MEMBRANE	
				Slip Sheet	Insulation <sup>4,5</sup>	Barrier or Cover Board	Attachment <sup>6</sup>	Type	Membrane Attachment for Wind Classification (See Table 2 for System No.)
1	A	Noncombustible (steel or concrete)	1/2:12 (4.2%)	None	One or more layers of polyisocyanurate, a minimum of 1.4 inches thick (maximum thickness unlimited) and 2 pcf density	(Optional) <sup>7</sup> Wood, fiber, glass-fiber, or perlite (any thickness)	Presecured (see Figure 1)	GAF EverGuard TPO, or TPO FB ULTRA, mechanically attached	System No. 1, 1b, 2, 3a, or 3b
2	B	Noncombustible (concrete only)	Unlimited	None	None	None	Not applicable	GAF EverGuard TPO, or TPO FB ULTRA, mechanically attached	System No. 1b, 2, or 3a
3	B	Combustible (plywood)	1/2:12 (4.2%)	One layer of Atlas FR50 loosely laid with minimum 2-inch laps	None	None	Not applicable	GAF EverGuard TPO, or TPO FB ULTRA, mechanically attached	System No. 1a or 2a

For SI: 1 inch = 25.4 mm, 1 pcf = 160.18 kg/m<sup>3</sup>.

<sup>1</sup>Systems installed over existing Class B built-up roof system to retain existing classification. Systems installed over existing Class A, B or C cap sheet or smooth-surfaced built-up roof, insulated or noninsulated, and/or single-ply membrane (EPDM, PVC or CPE), to maintain existing classification.

<sup>2</sup>Noncombustible deck classifications are applicable for use over combustible decks (plywood) when minimum 1/4-inch Dens-Deck® (G-P Gypsum Corporation) is used directly over the deck or insulation with all joints staggered 6 inches from plywood joints.

<sup>3</sup>Unless otherwise noted, noncombustible substrates include structural concrete, lightweight concrete and steel decks.

<sup>4</sup>All insulation must be UL classified. Additionally, all foam plastic must be covered in a current evaluation report. If the foam plastic is installed over a steel deck without a thermal barrier, the evaluation report on the insulation must address its use in such an installation.

<sup>5</sup>Unless otherwise noted, polyisocyanurate insulation must comply with ASTM C 1289, Type II or Type III, requirements.

<sup>6</sup>Presecurement of insulation or coverboards consists of four fasteners per board for a board having any dimension greater than 4 feet, and two fasteners per board for a board having a maximum dimension of 4 feet.

<sup>7</sup>For roof coverings placed over concrete decks only. Barrier coverboard not permitted for systems over steel decks.

TABLE 2—ATTACHMENT OF MEMBRANES FOR WIND CLASSIFICATION<sup>1,2</sup>

SYSTEM NO	SUBSTRATE <sup>3</sup>	INSULATION		COVERBOARD		EVERGUARD TPO OR TPO FB ULTRA MEMBRANE					ALLOWABLE WIND UPLIFT CAPACITY (psf)	ALLOWABLE LOCATION BASED ON WIND UPLIFT CAPACITY <sup>7</sup>	
		Type <sup>4</sup>	Attach. <sup>5</sup>	Type	Attach. <sup>5</sup>	Fastener and Plates	Lap Width (inches)	Weld Width (inches)	Max. Lap Spacing (inches)	Max. Fastener Spacing (inches)		3-second Gusts (mph)	Exposure
1	Steel, minimum No. 22 gage, minimum $F_y = 80$ ksi	One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or presecured (stand alone)			DT XHD fasteners with DT 2 <sup>3</sup> / <sub>8</sub> " XHD plates or TruFast EHD with TruFast 2.4" Barbed Metal Seam Plates	5	1.75 outside	114.5	12	30	95	B
1a	Plywood, minimum <sup>15</sup> / <sub>32</sub> inch thick.	(Optional) One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or presecured (stand alone)			DT XHD fasteners with DT 2 <sup>3</sup> / <sub>8</sub> " XHD plates	5	1.75 outside	114.5	7	30	95	B
1b	Concrete, minimum $f'_c = 2,500$ psi.	(Optional) One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or presecured (stand alone)	(Optional) Wood-fiber, glass-fiber, or perlite	Presecured	DT Spikes with DT 2 <sup>3</sup> / <sub>8</sub> " XHD plates	5	1.75 outside	114.5	12	30	95	B
2	Steel, min. No. 22 gage, min. $F_y = 30$ ksi; or concrete, min. $f'_c = 2,500$ psi.	(Optional for concrete deck) One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or Presecured (stand alone)			DT XHD Fasteners (steel) or DT Spikes (concrete) with DT 2 <sup>3</sup> / <sub>8</sub> " XHD plates or TruFast EHD (Steel) with TruFast 2.4 in. Barbed Metal Seam Plates	5	1.75 outside	114.5	6	45	105	B
												95	C
												84	D
2a	Plywood, min. <sup>15</sup> / <sub>32</sub> inch thick	(Optional) One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or Presecured (stand alone)			DT XHD Fasteners with DT 2 <sup>3</sup> / <sub>8</sub> " XHD plates	5	1.75 outside	114.5	5	45	105	B
												95	C
												84	D

TABLE 2—ATTACHMENT OF MEMBRANES FOR WIND CLASSIFICATION<sup>1,2</sup> (Continued)

SYSTEM NO	SUBSTRATE <sup>3</sup>	INSULATION		COVERBOARD		EVERGUARD TPO OR TPO FB ULTRA MEMBRANE					ALLOWABLE WIND UPLIFT CAPACITY (psf)	ALLOWABLE LOCATION BASED ON WIND UPLIFT CAPACITY <sup>7</sup>	
		Type <sup>4</sup>	Attach. <sup>5</sup>	Type	Attach. <sup>5</sup>	Fastener and Plates	Lap Width (inches)	Weld Width (inches)	Max. Lap Spacing (inches)	Max. Fastener Spacing (inches)		3-second gusts (mph)	Exposure
3	Steel, min. No. 22 gage, min. $F_y = 80$ ksi	One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or Presecured (stand alone)			DT XHD fasteners with DT 2 <sup>7</sup> / <sub>8</sub> " XHD plates or TruFast EHD with TruFast 2.4" Barbed Metal Seam Plates	5	5 (encapsulating screws and plates)	114	6	68	105	D
3a	Concrete, min. $f'_c = 2,500$ psi	(Optional) One or more layers of polyisocyanurate, min. 1.4 inches thick (max. thickness unlimited) and 2 pcf density	Loose (with coverboard) or Presecured (stand alone)	(Optional) Wood-fiber, glass-fiber, or perlite	Presecured	DT Spikes with DT 2" Steel Plates	5	5 (encapsulating screws and plates)	114	6	68	105	D

For SI: 1 inch = 25.4 mm, 1 ksi = 6.89 MPa, 1 ft<sup>3</sup>/gallon = 0.025 m<sup>3</sup>/liter, 1 mph = 1.61 km/h, 1 psf = 47.88 Pa.

<sup>1</sup>For mechanically fastened membrane, the fastener density must be doubled at roof corners and perimeters, which are defined in Note 4 of UBC Table 16-11.  
<sup>2</sup>Refer to Table 1 for roof classification. Roof systems installed over noncombustible roof decks at a maximum slope of 1/2:12 have a Class A roof classification.  
<sup>3</sup>For steel decks, reference to "Grade" relates to ASTM A 653 or A 1008, Grade 33 or 80, as noted.  
<sup>4</sup>Polyisocyanurate insulation shall comply with ASTM C 1289, Type II of Type III, requirements.  
<sup>5</sup>Presecurement of insulation or coverboard consists of four fasteners per board for a board having any dimension greater than 4 feet, and two fasteners per board for a board having a maximum dimension of 4 feet.  
<sup>6</sup>Fasteners shall be of sufficient length to penetrate a minimum of 3/4 inch through steel substrates; penetrate a minimum of 3/4 inch into or through the thickness of plywood sheathing, whichever is less; or a minimum of 1 inch into concrete substrates. Pilot holes in concrete substrates must be 1/2 inch deeper than the fastener embedment.  
<sup>7</sup>Maximum roof covering height above grade is 40 feet when using the tabulated data herein. Engineering evaluation is needed to document performance at higher roof levels.

TABLE 3—FASTENERS FOR INSULATION AND ROOFING MEMBRANES

DECK MATERIAL		FASTENER IDENTIFICATION <sup>1</sup>
Type	Physical Properties	
Steel <sup>2</sup>	Minimum No. 22 gage steel having a minimum yield strength, $F_y$ , of 33 or 80 ksi, as required by Table 2	DRILL.TEC™ XHD Fastener or TruFast EHD Fastener (refer to Section 2.2.6.2)
Concrete <sup>3</sup>	Concrete decks must have a minimum 2,500 psi compressive strength at 28 days at time of roofing system installation	DRILL.TEC™ Spikes (refer to Section 2.2.6.3)
Plywood <sup>4</sup>	Minimum 1 <sup>5</sup> / <sub>32</sub> -inch-thick Exposure 1 plywood	DRILL.TEC™ XHD Fastener or TruFast EHD Fastener (refer to Section 2.2.6.2)

For SI: 1 ksi = 6.89 MPa, 1 psi = 6.879 kPa, 1 inch = 25.4 mm.

<sup>1</sup>Plates for the fasteners are described in Section 2.2.6 of this report.  
<sup>2</sup>Fasteners must protrude through steel deck a minimum of 3/4 inch (12.7 mm).  
<sup>3</sup>Fasteners must embed in the concrete deck a minimum of 1 inch (25.4 mm).  
<sup>4</sup>Fasteners must protrude through the plywood deck a minimum of 1/8 inch (12.7 mm).



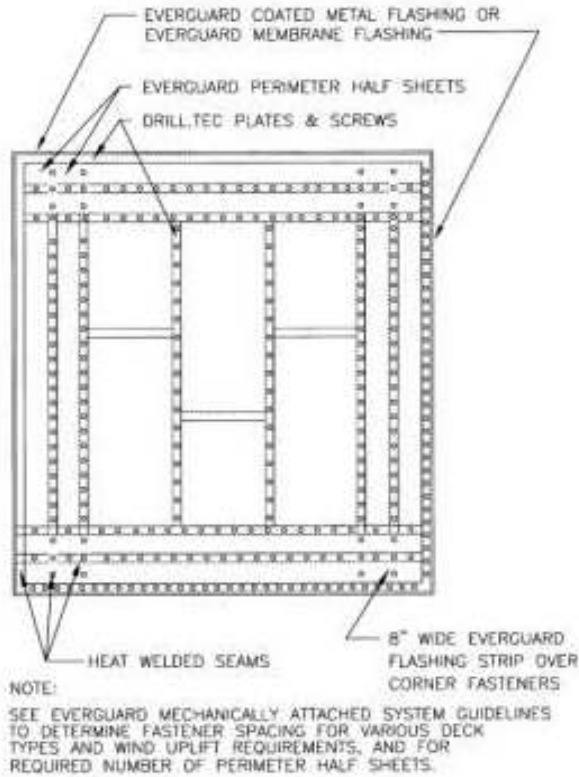


FIGURE 1—ROOF MEMBRANE LAYOUT

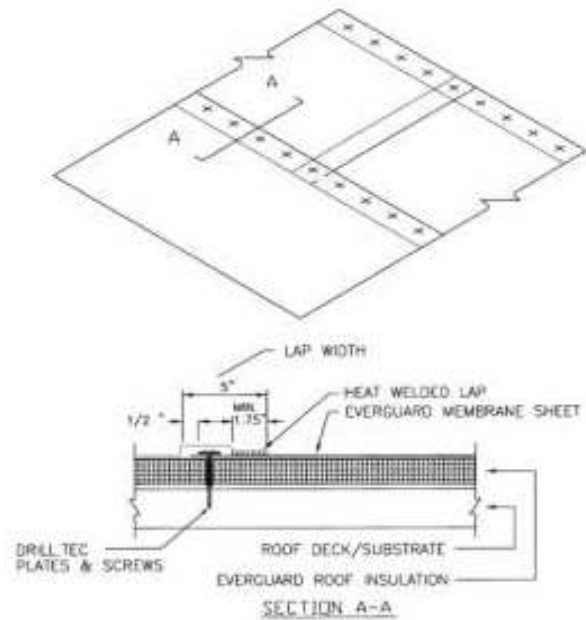


FIGURE 2—SIDE LAP CROSS SECTION

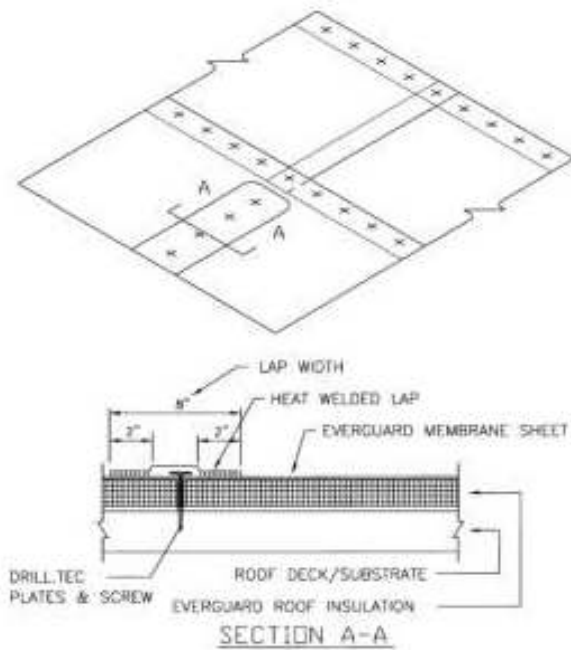


FIGURE 3—COVER STRIP CROSS SECTION

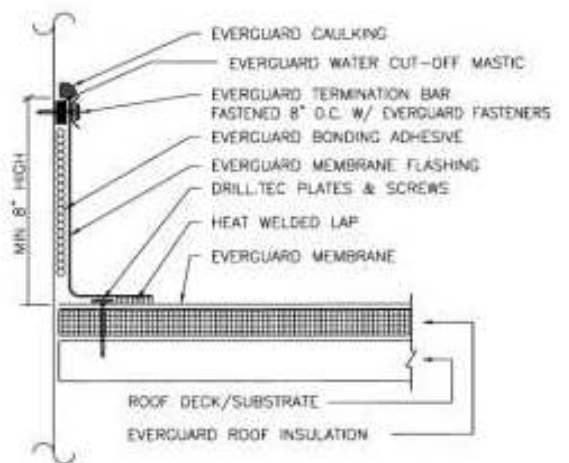


FIGURE 4—WALL FLASHING WITH TERMINATION BAR

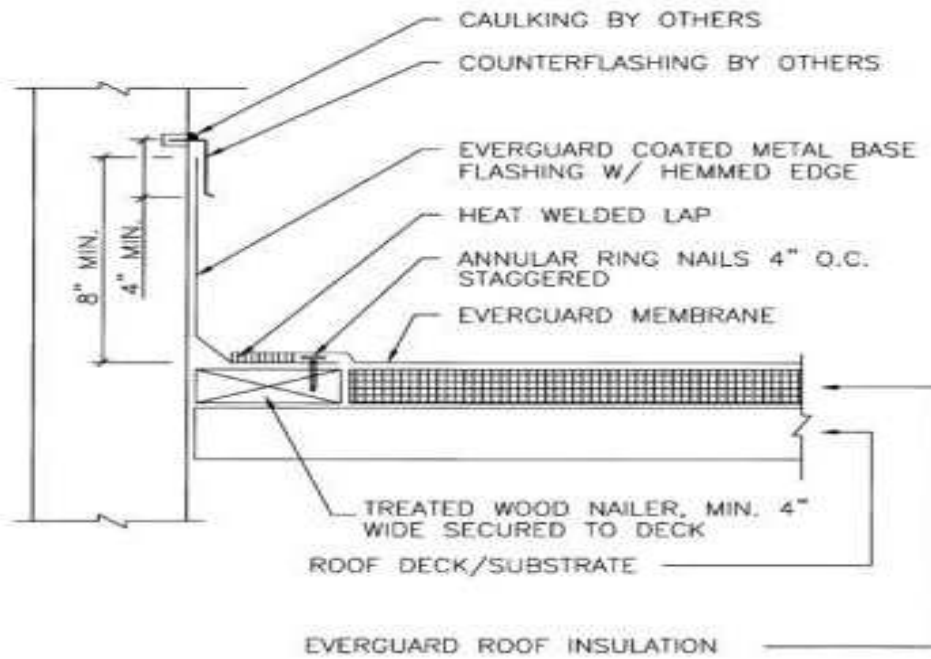
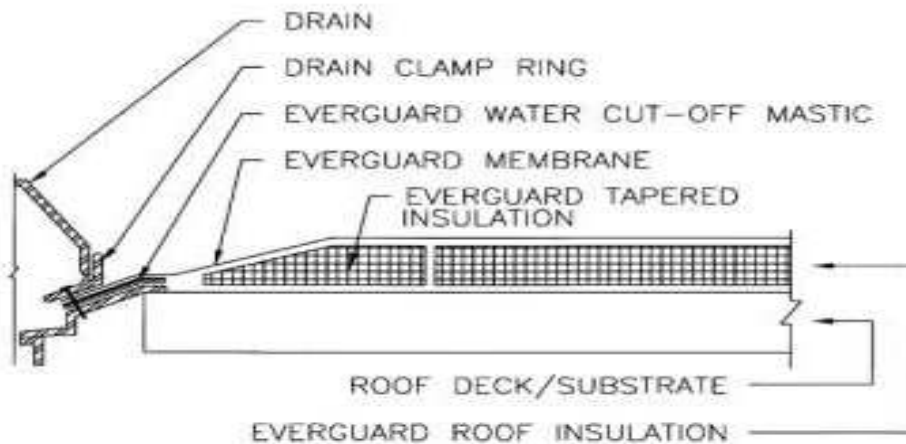


FIGURE 5—COATED METAL WALL FLASHING



NOTES:

1. A FIELD WELD CANNOT PASS WITHIN 12" OF THE CLAMPING RING
2. MEMBRANE MUST EXTEND MINIMUM 1" BEYOND THE BOLT HOLES, THE CLAMPING RING BOLTS MUST PENETRATE THE MEMBRANE
3. TAPERED INSULATION TO CREATE A ROOF SUMP MINIMUM 36"X36" IN SIZE.

FIGURE 6—ROOF DRAIN FLASHING