

# Adhered Roofing Systems (COMEG148FA)

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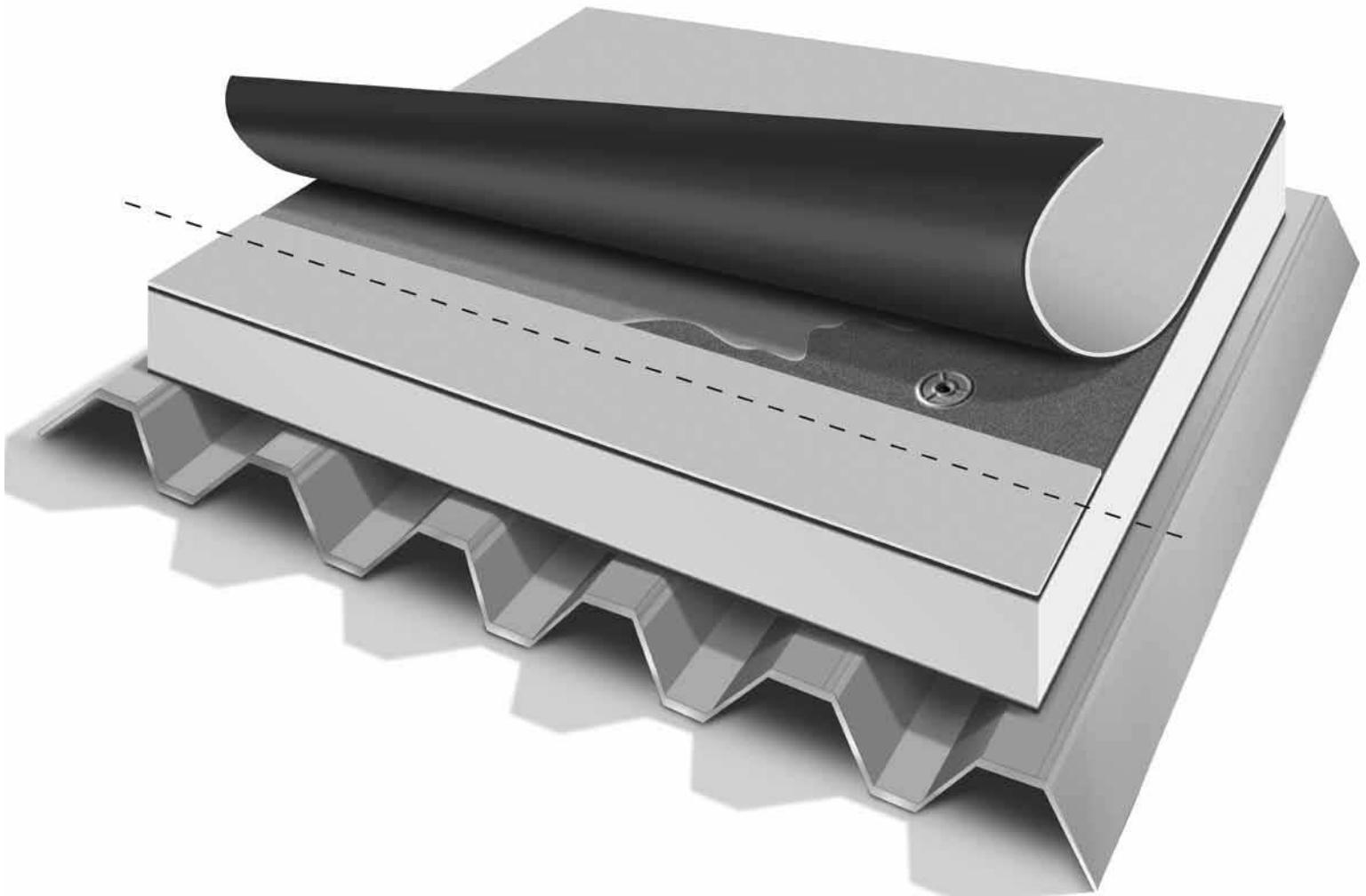
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# **EverGuard®** **TPO/PVC** **Adhered**

## **Roofing System**

**Overview & General  
Requirements Manual**



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**Note:** Refer to [gaf.com](http://gaf.com) for a complete list of Product Data Sheets and Chemical-Resistance Guides.

Thank you for consulting the 2013 Edition of the *EverGuard<sup>®</sup> TPO/PVC Adhered Roofing System Overview & General Requirements Manual*. You can find further information at [gaf.com](http://gaf.com), or contact GAF Technical Services at 1-800-ROOF-411 (1-800-766-3411).

### WHO IS GAF?

Founded in 1886, GAF has grown to become North America's largest manufacturer of commercial and residential roofing.\* Professional roofing contractors have long preferred the rugged, dependable performance that only a GAF roof can offer, and have made it the #1-selling brand in North America.\* Our success in growing the company to nearly \$3 billion in sales has been based on our unique philosophy of helping our customers.

#### For roofing contractors and distributors:

- Helping to build your business and avoid hassles

#### For property owners & architects:

- Helping to assure your best and safest choice in roofing

### WHAT IS IN THIS MANUAL?

#### This Manual contains the following sections:

- Welcome
- Guarantee Program
- Roof Design
- Design & Application Guidelines: Adhered Roofing Systems
- Roofing Details

### WHAT ARE OUR PRODUCTS AND SERVICES?

No one offers a wider range of reliable, proven, cost-effective roofing solutions:

#### COMMERCIAL PRODUCTS

- **EverGuard Extreme<sup>®</sup> TPO Single-Ply Roofing Systems**
- **EverGuard<sup>®</sup> TPO and PVC Single-Ply Roofing Systems**
- **EverGuard<sup>®</sup> Freedom<sup>™</sup> TPO Self-Adhering Roofing Systems**
- **Ruberoid<sup>®</sup> SBS and APP Modified Bitumen Roofing Systems**
- **ROOFMatch<sup>™</sup> SBS and APP Membranes in select colors**

\*Source: 2010 Fredonia Group Study

- **Liberty<sup>™</sup> SBS Self-Adhering Modified Bitumen Roofing Systems**
- **GAFGLAS<sup>®</sup> Fiberglass Built-up Roofing Systems**
- **TOPCOAT<sup>®</sup> Liquid-Applied Membrane Roofing Systems**
- **GardenScapes<sup>™</sup> Roofing...** Hassle-free Garden Roofing System

### RESIDENTIAL PRODUCTS

- **Lifetime Designer Shingles...** Camelot<sup>®</sup>, Camelot II<sup>®</sup>, Country Mansion<sup>®</sup>, Country Mansion<sup>®</sup> II, Slateline<sup>®</sup>, Grand Canyon<sup>®</sup>, Grand Sequoia<sup>®</sup>, Grand Sequoia<sup>®</sup> IR, Sienna<sup>™</sup>, Woodland<sup>®</sup>, and Monaco<sup>®</sup> Shingles
- **Timberline<sup>®</sup> Lifetime Shingles...** Timberline Ultra HD<sup>®</sup>, Timberline HD<sup>®</sup>, Timberline<sup>®</sup> Natural Shadow<sup>®</sup>, Timberline<sup>®</sup> American Harvest<sup>®</sup>, Timberline<sup>®</sup> Cool Series, and Timberline<sup>®</sup> ArmorShield<sup>™</sup> II
- **3-Tab Shingles...** Marquis<sup>®</sup> WeatherMax<sup>®</sup> and Royal Sovereign<sup>®</sup>
- **TruSlate<sup>®</sup> Roofing...** affordable Genuine Slate Roofing System

### ACCESSORY PRODUCTS

- We offer an extensive line of accessory products for our roof systems, including: EverGuard<sup>®</sup> TPO and PVC Prefabricated Accessories; Single-Ply Adhesives, Primers & Sealants; Matrix<sup>™</sup> Coatings and Cements; EnergyGuard<sup>™</sup> Insulations; DRILL•TEC<sup>™</sup> Fasteners; M-WELD<sup>®</sup> Preflashed Accessories; Metalastic<sup>®</sup> Expansion Joint Covers; Lexsuco<sup>®</sup> Roof System Accessories; Cobra<sup>®</sup> and Master Flow<sup>®</sup> Ventilation Products; Timbertex<sup>®</sup> Premium Ridge Cap Shingles; WeatherWatch<sup>®</sup> and StormGuard<sup>®</sup> Leak Barriers; and Shingle-Mate<sup>®</sup> and Deck-Armor<sup>™</sup> Roof Deck Protection.

### SERVICES

- Every GAF roofing product benefits from the substantial resources available only from a multibillion-dollar corporation dedicated to roofing. Our 26 plants mean manufacturing expertise. Our extensive R&D organization means a constant focus on product and process improvement. Over 250 sales and technical personnel mean that GAF is there, in person, to provide you with the service and information you need. GAF is a team of over 3,500 people dedicated to your roofing satisfaction.
- GAF has a network of sales representatives and distributors to supply and service its quality roofing systems throughout North America.

## WELCOME

- Our Technical Helpline is a technical assistance service that allows you to contact us directly to speak with a technical representative about specifications, applications, code approvals, and product information. The Helpline number is 1-800-ROOF-411 (1-800-766-3411).
- Architectural Information Services (AIS) is a specification service that allows you to specify your exact roofing needs and will send you a general specification that outlines your job summary, application method, product description, and detail drawings. The phone number for AIS is 1-800-522-9224.
- Our Tapered Design Group (TDG) is one of the many services available to our customers to help reduce their hassles. We provide tapered insulation take-offs for architects, contractors, and distributors nationwide. Just send your roof plans and specifications to [tdg@gaf.com](mailto:tdg@gaf.com).
- Visit GAF on the web at [gaf.com](http://gaf.com) for extensive product information, specifications, and technical literature.
- Under no circumstances does GAF have any liability for expenses arising out of or associated with the pre-existing presence of asbestos-containing materials or any other allegedly hazardous substances or materials upon the roof to which the new GAF roofing materials are being applied.
- Information contained in this Manual is presented in good faith and, to the best of GAF's knowledge, does not infringe upon any patents, foreign or domestic.
- As a part of its continuing efforts to improve the performance of its products, GAF periodically makes changes to its products and application specifications. The Company reserves the right to change or modify, at its discretion, any of the information, requirements, specifications, or policies contained herein. This Manual supersedes all catalogs and previous manuals.
- GAF is Your Best and Safest Choice!

### A FEW THINGS TO CONSIDER...

- This Manual contains the latest information relating to the application of GAF's adhered single-ply roofing systems and is based on our years of experience in the commercial roofing field. It has been prepared as a general guide to assist architects, engineers, roofing contractors, and owners in the use of our roofing systems.
- GAF manufactures and sells roofing materials and does not practice architecture or engineering. GAF is not responsible for the performance of its products when damage to its products is caused by such things as improper building design, construction flaws, or defects in workmanship.
- The design responsibility remains with the architect, engineer, roofing contractor, or owner, and construction details illustrated and described herein are furnished solely for guidance purposes. These guidelines should not be construed as being all-inclusive, nor should they be considered as a substitute for good application practices.

## GUARANTEE PROGRAM

### GENERAL

GAF offers roof guarantees for a fee for all roofing system specifications published in this Manual when installed by GAF Factory-Certified Low-Slope Roofing Contractors in accordance with the terms and conditions set forth in this Manual, and the procedures for obtaining a guarantee are followed. All GAF insulation, fasteners, pre-flashed details, expansion joint covers, cements, coatings, and accessory products as job appropriate are required for guarantees unless otherwise approved in writing by a Field Services Manager or Director prior to installation.

All guaranteed roofing systems must be flashed in accordance with the GAF flashing requirements and details included in this Manual.

GAF will be the sole judge as to whether or not a roofing guarantee will be issued to cover any proposed or completed roof. The issuance of a guarantee and its effectiveness or the continued liability thereunder is contingent upon payment of GAF's guarantee fee and payment in full to the roofing contractor and materials suppliers.

GAF has no obligation to issue a roofing guarantee on any roof. Any inspection prior to issuance is solely for the benefit of GAF and does not constitute a waiver of any terms or conditions in the guarantee. In the event that a roof system does not conform to GAF's standards and a guarantee is not issued, no portion of the guarantee fee is refundable.

GAF will not accept Notices of Award of Contract that indicate that the owner or architect has the option to accept or reject the guarantee upon completion of the roof.

Specifications not listed in this Manual may also be eligible for GAF guarantees. For further information on guarantee requirements and for approval of modifications to published specifications, consult with GAF at 800-766-3411.

GAF is not responsible for consequential damages in case of roof system failure. GAF has no control over a building's contents, type, quantity, positioning, or protection.

A GAF guarantee cannot be withdrawn once it has been issued, although it may be cancelled subsequently by GAF for violation of its terms and conditions.

### EXTENDED-LENGTH (GREATER THAN 20-YEAR) COMMERCIAL GUARANTEES

#### **EverGuard® TPO Adhered Roof Systems**

The selection of membrane type, thickness, and attachment is the responsibility of the architect, engineer, owner, or roof consultant. GAF EverGuard® roof membranes must be used in roofing systems to be guaranteed by GAF. The following is a list of eligible membranes for adhered systems.

##### **1. EverGuard® 25-year extended-length guarantee\***

- EverGuard® 60 mil TPO membrane (smooth)
- EverGuard® 60 mil TPO membrane (fleece-back)
- EverGuard Extreme® 50 mil TPO membrane (smooth)
- EverGuard Extreme® 50 mil TPO membrane (fleece-back)

\*New construction or complete tear-off only

##### **2. EverGuard® 30-year extended-length guarantee\***

- EverGuard® 80 mil TPO membrane (smooth)
- EverGuard® 80 mil TPO membrane (fleece-back)
- EverGuard Extreme® 60 mil TPO membrane (smooth)
- EverGuard Extreme® 60 mil TPO membrane (fleece-back)
- EverGuard Extreme® 70 mil TPO membrane (smooth)
- EverGuard Extreme® 70 mil TPO membrane (fleece-back)

##### **3. EverGuard® 35-year extended-length guarantee\***

- EverGuard Extreme® 80 mil TPO membrane (smooth)
- EverGuard Extreme® 80 mil TPO membrane (fleece-back)

\*New construction or complete tear-off only

### Roof Insulation

The selection of insulation type, thickness, and configuration is the responsibility of the architect, engineer, owner, or roof consultant. GAF reserves the right to accept or reject any roof insulation as an acceptable substrate for GAF roof systems. GAF EnergyGuard™ insulations must be used in roofing systems to be guaranteed by GAF.

#### **1. For adhered systems, a minimum of two layers of insulation are required for extended-length guarantees. The top insulation layer must be adhered.**

#### **2. For all systems, the top layer may be a cover board, as follows:**

- high-density fiberboard
- DensDeck® Roof Board
- DensDeck® Prime Roof Board
- DensDeck® DuraGuard Roof Board
- SECUROCK® Roof Board
- EnergyGuard™ HD and EnergyGuard™ HD Plus Polyiso

### Additional Requirements

#### **1. Building Height Limitations**

- Buildings greater than 100' (30 m) in height must have a minimum 3' (0.9 m) parapet wall to be eligible for an extended-length Diamond Pledge™ 25-, 30-, or 35-year NDL Roof Guarantee.

#### **2. Construction Type**

- Diamond Pledge™ 25-, 30-, or 35-year NDL Roof Guarantees are available only for new construction or complete tear-off to the deck.

#### **3. WellRoof® Guarantee Extension**

- Any issued guarantee up to 30 years in length is eligible for the GAF WellRoof® Guarantee Extension; maximum guarantee length, including WellRoof® Guarantee Extension, is 35 years.

## GUARANTEE PROGRAM

### Air/Vapor Retarders

For EverGuard® extended-length guarantees, air/vapor retarders are required, as follows:

- a. With mechanically attached installations with openings in the wall that exceed 10% of the total wall area.
- b. With installations of 10' (3 m) wide or greater membranes with side lap mechanical attachment that exceed 6" (150 mm) o.c. [For 10' (3 m) wide sheets, the requirements for an air retarder are dependent upon building height and fastener density. Contact your local GAF Field Services Manager for air retarder requirements.]

### Roof Flashings

1. For EverGuard® extended-length guarantees, separate counter flashing or cap flashing is required; exposed termination bars are not acceptable.

### Roof Edges

1. For EverGuard® extended-length guarantees, use EverGuard Extreme® TPO Cover Tape Heat Weld. This is a hybrid cover tape consisting of 6" (150 mm) of .045 reinforced TPO membrane with 3" (76 mm) butyl tape on half of the back surface.
2. Galvanized-based metal edging is not acceptable for extended guarantee lengths. It may be flashed using EverGuard® TPO Cover Tape after priming both the metal and the TPO membrane for guarantee lengths up to 15 years.

### Flashing Accessories

1. For EverGuard Extreme® extended-length guarantees, regardless of the membrane type, EverGuard Extreme® flashing accessories are required.
2. Unsupported EverGuard Extreme® flashing membrane is available and required on areas where pre-fabricated accessories can not be used or are unavailable.

### SPECIAL CONDITIONS

A guarantee will not be issued to cover less than the entire roof area of a single building.

#### **A GAF roofing system guarantee will not be issued for the following without prior written approval from the Field Services Manager or Director:**

- over any surface or deck not covered in this Manual
- over a cold storage building, unless a ventilated plenum isolates the cold storage area from the roofing system and substrate
- on storage silos, heated tanks, or domed structures
- on structures having conduit or piping between the roof deck and roofing membrane, unless the conduit or piping is installed in channels below the top deck surface
- on roofs that have an inadequate number and spacing of expansion joints or curbs
- on systems constructed with insulation not approved by GAF
- on any structure where there is limited or no access to the roof
- on a roof designed for or used as a water-insulated or spray roof
- on promenade or parking roofs
- on waterproofing applications

- for any structure where high-heat or humidity conditions exist such as, but not limited to, breweries, creameries, laundries, textile mills, pulp and paper plants, swimming pools, shower rooms, and canneries
- when roofing over an existing roof system that contains moisture, that is not adhered to the substrate or roof deck, and/or provides an improperly prepared surface
- on plywood decks without continuous solid end blocking
- on roofs containing sprayed-in-place polyurethane foam
- any unusual condition not specifically approved by GAF
- on any high-temperature condition that allows the roof membrane temperature to exceed 160°F (71°C); or 195°F (90°C) for EverGuard Extreme® roofing systems.

### GAF CERTIFIED CONTRACTOR PROGRAM

GAF does not install roofing systems. GAF does not own roof contracting companies, or have any interest in companies installing roofing systems. Accordingly, GAF shall not be responsible for any roofing contractor's workmanship except as specifically covered under the terms and conditions of the GAF roofing guarantee.

The term "GAF Factory-Certified Low-Slope Roofing Contractor" only identifies a contractor eligible to apply for a GAF roofing guarantee and is not intended to convey any other meaning. GAF Factory-Certified Low-Slope Roofing Contractors are not employees, agents, or representatives of GAF.

GAF will issue a roofing system guarantee only for roofs applied by a GAF Factory-Certified Low-Slope Roofing Contractor. The responsibility for proper application of the roof lies with the Factory-Certified Low-Slope Roofing Contractor alone. It is the responsibility of the building owner and his designated representatives, as the employer of the Factory-Certified Low-Slope Roofing Contractor, to enforce the compliance with specifications and good workmanship practices, and such enforcement is not an obligation of GAF.

### INSPECTIONS

GAF will inspect only those roofs where a guarantee is to be issued or where special inspection services have been agreed to be purchased prior to the start of the roof construction, and the current charge for the guarantee or inspection services has been paid. If an inspection is requested and the job is not ready or the owner's representative is not available, an extra billing will be made at consultation fee rates.

GAF reserves the right to waive inspection of guaranteed roofs when, in its opinion, inspection is not necessary. In such cases, the owner or designer may request a special inspection for which an additional charge may be made.

Any inspections made by GAF are for its own use only and do not constitute a waiver of any of the terms and conditions of the guarantee.

Should a GAF Field Services Representative observe conditions on the job site that do not conform to the requirements of this Manual or standard good roofing practices, such conditions will be brought to the attention of the roofing contractor. GAF, at its sole discretion, has the right to require corrective action as it deems necessary to conform to the requirements of this General Requirements Manual and the requirements for the issuance of the GAF roofing system guarantee.

# ROOF DESIGN

**Provides a quick reference of technical requirements for  
EverGuard® adhered roofing system design**

- General
- Sustainable Design
- Building Utilization
- Tear-off or Re-cover
- Roof Decks
- Parapet Walls
- Roof Drainage
- Expansion Joints
- Area Dividers
- Equipment Mountings
- Fire Resistance
- Wind Performance
- Energy Efficiency
- Water Vapor Transfer

## ROOF DESIGN

### GENERAL

Proper roofing system design and selection requires the consideration of many factors. Although GAF's expertise is in materials manufacturing, and not in engineering, architecture, or specialized roof consulting, our company has decades of extensive experience in the practical aspects of roofing.

Our experience suggests that careful consideration of the following will provide a fundamentally sound basis for design and selection of EverGuard® single-ply roofing systems.

### SUSTAINABLE DESIGN

ENERGY STAR® is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. It is designed to help our nation save energy and money, and to protect the environment through energy-efficient products and practices. Energy-efficient choices can save building owners significantly on their energy bills with similar savings of greenhouse gas emissions, without sacrificing features, style, or comfort. ENERGY STAR® helps consumers, contractors, architects, and property owners make more knowledgeable, energy-efficient choices.

The LEED® (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary standard for developing high-performance, energy-efficient sustainable buildings. The LEED® Certification System is a program that awards building points for satisfying specified green-building criteria and requirements.

Green Globes® is a web-based program for green building guidance and certification that includes an onsite assessment by a third party and is an alternative to the LEED® rating system.

GAF's EverGuard® TPO is the first to be certified by NSF International for the NSF/ANSI 347 *Sustainability Assessment for Single-Ply Roofing Membranes*. This Standard is the evaluation of the sustainability of single-ply roofing membranes. The Standard includes criteria across the product life cycle from raw material extraction through manufacturing, use, and end-of-life management. Go to [www.nsf.org](http://www.nsf.org) for details.

GAF's EverGuard Extreme® TPO Roofing Membrane was engineered with energy efficiency and sustainability in mind. This high-performance, reflective roof membrane is also geared for solar roof installations. The increasing use of building integrated photovoltaics (BIPV) has highlighted the challenges faced by roofing membranes exposed to concentrated heat, sunlight, and UV. GAF scientists have created a new grade of TPO single-ply membrane that is built to handle the extreme demands that new rooftop applications can place on roofing membranes. EverGuard Extreme® TPO uses proprietary stabilizers and UV absorbers to achieve weathering performance far beyond current standards.

- EverGuard Extreme® TPO can be installed up to 10 years prior to the installation of solar overburden.
- Installation of overburden will not affect the membrane performance or warranty coverage of EverGuard Extreme® TPO.
- Please contact GAF before installing any overburden on the roof.

### BUILDING UTILIZATION

Building utilization can have a significant impact on roofing system selection and design. The most common building utilization

considerations are as follows: extremes in internal temperature/humidity; positive internal pressure; rooftop traffic/abuse; rooftop-exhausted contaminants; and the use of the roof as living space.

#### Internal Temperature/Humidity

Extremes in internal temperature/humidity are most often associated with cold storage/freezer buildings, swimming pool facilities, drying kilns, food processing plants, paper/pulp mills, and smelting/blast furnace facilities. What makes these building applications unusual is that the pronounced difference in vapor pressure between the building interior and the exterior can cause a pronounced vapor flow through the roof assembly. This can result in a significant build-up of condensation within the roof assembly, and severe deterioration of both the roof assembly itself and the structural deck.

*Relevant design considerations include:*

- Incorporation of a vapor retarder at deck level to control vapor flow into and through the roof assembly;
- Attention to a vapor-tight seal between the roof and side walls/penetrations;
- Utilization of closed-cell foam insulation and stainless steel fasteners to minimize potential for condensation-related degradation of the roof system;
- Limitation of penetrations through the roof deck;
- Avoidance of roof system attachment that will puncture the vapor retarder.

#### Positive Internal Pressure

Positive internal pressure is most often associated with manufacturing/clean-room facilities, mechanical air-handling rooms, aircraft hangars, distribution centers with multiple overhead doors, and high-rise office/residential towers. In all these instances, positive internal pressures can adversely act on the underside of the roof system.

Conditions where the positive internal pressure is constant, as in the case of clean-room facilities and high-rise towers, may cause the roof system to billow up in a mechanically attached system, i.e., form a mattress effect, and may reduce the overall uplift resistance of the roofing system.

This effect can cause attachment concerns with other types of roof system installations including adhered systems. Conditions where the positive internal pressure is applied suddenly, as in the case of aircraft hangars and distribution centers, may cause failure of the roofing system due to pressure impact.

*Relevant design considerations include:*

- Use of air-impermeable deck construction, such as poured-in-place concrete or insulating cellular concrete over a steel pan;
- Alternatively, installation of an air barrier, such as polyethylene sheeting, at deck level beneath mechanically attached insulation with attachment sufficient to balance positive pressure;
- Attention to an air-tight seal between roof and side walls/penetrations.

## ROOF DESIGN

### Rooftop Traffic/Physical Abuse

Roofing installations that can be expected to experience a high degree of roof traffic due to equipment maintenance, vandalism or other unauthorized access, frequent hailstorms or high winds, and prolonged periods of temperature extremes or rapid fluctuations in temperature will require a more durable roofing system.

*Relevant design considerations include:*

- Use of thicker membrane or multiple-ply system, e.g. GAF Tripotise XL™;
- Installation of EverGuard® TPO or PVC Walkway Roll at high-traffic areas;
- Use of a higher compressive strength insulation substrate;
- Application of a concrete paver or insulated paver overlay for extreme conditions.

### Contamination

Many roofing installations are exposed to oil, grease, and chemical contamination in excess of normal airborne contaminants. These conditions are most often associated with restaurants, food processing plants, chemical and pharmaceutical plants, refineries, machining and manufacturing facilities, and airports. Most roofing materials are degraded by certain families of contaminants, and will become brittle, swell and soften, or dissolve, depending on the material formulation and contaminant type.

Long-term exposure, i.e., 28-day immersion testing of roofing material and specific contaminant, remains the preferred method of determining material resistance. Even then, unforeseen combinations of contaminants, environmental exposure effects, and variation in contaminant concentration prevent an absolute prediction of resistance to contamination in all but the most common situations.

*Relevant design/maintenance considerations include:*

- Isolation of contaminated roof area with expectation of more frequent roof membrane replacement;
- Periodic power washing of roofing membrane with moderate pressure;
- Limitation of rooftop spillage/exhaust of contaminating materials, i.e., grease traps.

Please refer to [www.gaf.com](http://www.gaf.com) for detailed TPO and PVC Chemical-Resistance Charts.

**NOTE:** GAF guarantees on any GAF membrane, including TPO and PVC, do not cover damage due to chemical contamination.

### TEAR-OFF OR RE-COVER

The decision to tear-off/replace or to repair/re-cover an existing roofing system before installing a new roofing system is not always clear-cut.

Although not an exhaustive list, the following additional design elements typically require consideration for any reroofing project:

- Replacement of damaged roof decking or structural components;
- Improvement of roof access;
- Removal of unused rooftop equipment and associated equipment mountings;

- Remounting of rooftop equipment to allow proper roofing and flashing technique;
- Matching of architectural elements such as special perimeter metalwork;
- Repair of deteriorated parapet and penthouse walls;
- Protection of roofing membrane by means of concrete paver overlay or walkway pad system.

### Tear-off/Replace

*Factors that support the tear-off approach include:*

- Two or more existing roofs (building code restriction);
- Structural weight limitation;
- More than 25% of existing roof area is wet;
- Flashing height limitations;
- Need to maximize long-term performance.

The basis for any tear-off project is to provide a sound substrate for the installation of a new roofing system and minimize potential damage from tear-off activities. *At a minimum, attention to the following considerations is recommended.*

- Thoroughly inspect decking, flashing substrates, and wood nailers before installing new materials;
- Plan a tear-off strategy so that roof drainage patterns are never blocked, and so that construction traffic is directed away from new roof areas;
- Protect new roof areas adjacent to tear-off areas from dirt, debris, and damage.

### Re-cover

*Factors that support the re-cover approach include:*

- Need to minimize cost;
- Disposal restrictions;
- Difficult access to the roof.

The basis for any re-cover project is to eliminate defects in the existing roof assembly so that their effect on the new roofing system is minimized. *At a minimum, attention to the following considerations is recommended:*

- Raise all perimeter flashings, penetrations, and equipment to provide required flashing heights;
- Address drainage deficiencies to provide positive drainage;
- Remove and replace all wet roofing materials;
- Concentrate on thorough surface preparation.

### Re-covering Over Coal Tar Pitch Roofing

Coal tar pitch has oils and vapors that can be harmful to various roofing membranes and may discolor white thermoplastic membranes. Coal tar pitch may also “cold flow” through fastener holes into the building. For these reasons, extra care must be taken when re-covering over an existing coal tar pitch roof. Typically,

## ROOF DESIGN

additional insulation and a white surface help to first separate the membrane from the existing coal tar pitch roof and reduce the temperature of the finished assembly, which minimizes the potential for cold flow.

### ROOF DECKS

Most common structural roof deck types are suitable substrates for the installation of an EverGuard® roofing system. It is the responsibility of the engineer, architect, building owner, or roofing contractor to determine the fitness of a deck for a specific roofing system installation.

#### Structural Steel

- Min. 22 gauge (standard FM-approved steel decking is 22 gauge in thickness).
- 24-26 gauge decks require a GAF Field Services Manager's or Director's approval. Thinner-gauge steel decks usually require additional mechanical fasteners to achieve comparable roof attachment performance.
- 18 gauge, 20 gauge, and 22 gauge Grade E high-strength steel decks usually require fewer mechanical fasteners to achieve comparable roof attachment performance.

#### Structural Concrete

- Min. 2,500 psi compressive resistance (98,066 kilogram-force/square centimeter).
- Min. 2" (51 mm) thickness (pre-cast), min. 4" (102 mm) thickness (poured-in-place).
- Cannot be wet or frozen. If the deck is determined to be wet, it must be allowed to dry.
- For insulated decks, wood nailers of equivalent thickness to the roof insulation must be provided at perimeters and projection openings to act as an insulation stop and to provide for the nailing of the flanges of metal flashing.
- Ridges and other irregularities require grinding to provide a smooth and even substrate surface.
- For non-insulated decks, nailers must be flush with deck surfaces.
- When applying insulation directly to the deck in hot asphalt, prime with asphalt/concrete primer, meeting ASTM D41, at a rate of 1 gal/square (3.8 m/liter) and allow the primer to dry prior to the application of the roofing system.

#### Pre-cast Concrete Decks

- These decks are usually manufactured as planks or slabs and constructed of steel-reinforced Portland cement and solid aggregate; often they are made with hollow cores to minimize their weight.
- All deformed panels must be replaced.
- Joints must be filled with a masonry grout to correct imperfections between slabs and feathered to provide a slope not greater than  $\frac{1}{8}$ :12 for adhered insulated assemblies.

- If the joints cannot be grouted and finished smooth, then a leveling course of lightweight insulating concrete (minimum 2" (51 mm) thickness) must be applied. Do not seal joints between the slabs; leave open to permit venting and drying of the roof fill from below.

#### Pre-stressed Concrete Decks

- GAF recommends a minimum 2" (51 mm) cellular lightweight concrete fill be installed over all pre-stressed concrete decks prior to installation of the roof system and/or insulation because variations in camber and thickness of pre-stressed concrete members may make securement of the roof system difficult.
- Provisions must be made for the curing or drying of the fill installed over the top of the pre-stressed deck members. Do not seal joints between the slabs/leave open to permit venting and drying of the roof fill from below.

#### Poured Structural Concrete Decks

- Must be properly cured prior to application of the roofing system; twenty-eight (28) days is normally required for proper curing. Check curing agents for compatibility with roofing materials. Prior to the installation of the roof assemblies, GAF recommends the evaluation of surface moisture and deck's dryness through the use of ASTM D4263 or a hot bitumen test.
- Must be poured over removable forms or must provide for bottom side drying. Poured-in-place structural concrete decks that are poured over non-vented metal decks or pans that remain in place can trap moisture in the deck under the roof system and are not acceptable.
- The underside of the concrete decks, either the vented metal forms or exposed concrete, must remain unobstructed to allow the escape of water vapor. Materials that retard the flow of vapor must not be installed directly below the deck. Foil-faced insulation secured to the bottom of the deck, spray-on fireproofing, or paint, which obstruct the venting of the concrete, are just three examples of unacceptable deck assemblies.

#### Wood Planking

- Min. 1" (25 mm) nominal thickness.
- Tongue & groove or splined edges required.
- All boards must have a bearing on rafters at each end and be securely fastened.
- Lumber should be kiln dried.
- Check compatibility of preservatives or fire retardants used to treat decking with roofing materials.
- Decking should be kept dry and roofed promptly after installation.
- Tape and staple fastening systems may be used on wood decks when they comply with local building codes and agencies.

## ROOF DESIGN

### Plywood/Oriented Strand Board (OSB)

- Min.  $\frac{1}{2}$ " (13 mm) thickness. Standard FM-approved plywood decking is fire-rated at  $\frac{3}{4}$ " (18 mm) thickness.
- Tongue & groove edges or full blocking required.
- Oriented strand board (OSB) decks shall comply with Structural 1 rating.
- Plywood sheathing shall be exterior grade, minimum 4 ply, not less than  $\frac{15}{32}$ " (12 mm) thick.
- Must be installed over joists not greater than 24" (610 mm) o.c.
- Must be installed so that all four sides of each panel bear on, and are secured to, joists and cross blocking; the panels must be secured in accordance with APA—The Engineered Wood Association recommendations. "H" clips are not acceptable.
- Panels must be installed with a  $\frac{1}{8}$ " to  $\frac{1}{4}$ " (3.1 mm to 6.3 mm) gap between panels and must match vertically at joints to within  $\frac{1}{8}$ " (3.1 mm).
- Decking should be kept dry and roofed promptly after installation.
- Tape and staple fastening systems may be used on wood decks when they comply with local building codes and agencies.
- Deck shall be attached with approved fasteners at required spacing. Consult local building codes for specific requirements.

### Gypsum Concrete

- Min. 2" (51 mm) thickness.
- Steel reinforcing mesh and permanent form boards required for poured-in-place monolithic decks.
- Steel-reinforced edges required for pre-cast decking units.
- An average fastener withdrawal resistance as recommended by the fastener manufacturer must be obtained. If proper mechanical attachment cannot be achieved, contact the GAF Technical Hotline at 1-800-ROOF-411 for assistance with installation recommendations.
- If either surface-wet or frozen, a poured gypsum deck is not suitable to receive a roof.

### Cementitious Wood Fiber

- Min. 2" (51 mm) thickness.
- Tongue & groove panel edges required.
- OSB or insulation composite decks for use with fully adhered systems require a GAF Field Services Manager's or Director's approval.
- Should not be installed over high humidity occupancies.
- All structural wood fiber deck panels must be anchored against uplift and lateral movement.

### Insulating Concrete

- Min. 2" (51 mm) thickness.
- Cellular lightweight insulating concrete decks can be installed

over non-slotted, galvanized metal decking designed for cellular lightweight insulating concrete or structural concrete.

- Aggregate lightweight insulating concrete decks must be installed over permanent venting steel forms.
- Insulating concrete installed over structural concrete or existing roof membrane substrates requires a GAF Field Services Manager's or Director's approval.
- Lightweight insulating concrete decks are required to have a minimum compressive strength of 125 psi (9 kg/cm) and a density of 22pcf (208 grams/cubic meter). Individual deck manufacturers' standards apply when their specifications exceed these GAF minimum thicknesses, compressive strengths, and density requirements.
- Where the Mean January Temperature (reference current ASHRAE Fundamentals Handbook) is below 40°F (4.4°C), lightweight insulating concrete decks must be poured and roofed between April 1st and October 31st; this type of deck is unacceptable in Alaska and Northern Canada.
- Lightweight insulating concrete should not be poured during rainy periods; deck areas that have frozen before they have cured must be removed and replaced. Check decks for moisture content and dryness if exposed to precipitation prior to installation of roof membrane.

### Loadmaster Decks

- Roof deck must be installed by a Loadmaster-approved contractor according to Loadmaster specifications.
- Min. 25 gauge steel decking,  $\frac{15}{16}$ " (22 mm) deep with  $\frac{1}{2}$ " thick (13 mm) mineral board top panel.
- Polystyrene or polyisocyanurate insulation is optional.
- Consult a GAF Field Services Manager for reroofing and re-covering requirements.

### PARAPET WALLS

Most common structural wall types are suitable substrates for the installation of EverGuard® membrane flashing.

### Brick/Block Masonry

- Standard-finish brick and concrete block with standard tooled mortar joints.
- Split-face block, textured block and brick, and deeply tooled mortar joints require a cementitious coating or plywood facing to provide a smooth and even substrate surface.

### Structural Concrete

- Steel trowel, wood float, or removable form finish.
- Ridges and other irregularities require grinding to provide a smooth and even substrate surface.

### Stucco/EIFS

- Stucco finish and EIFS systems must be removed to the underlying substrate surface.

## ROOF DESIGN

### Plywood/Oriented Strand Board (OSB)

- Min.  $\frac{1}{2}$ " (13 mm) thickness (exterior-grade).
- Tongue and groove edges or full blocking required.
- Adhesives should only be used with untreated plywood/OSB.

### Sheet Metal

- Min. 24 gauge steel.
- Min. .032" (8 mm) aluminum.
- Corrugated panels require overlay of  $\frac{15}{32}$ " (12 mm) plywood/ oriented strand board or silicone-impregnated gypsum panel.

### Gypsum Panel

- Min.  $\frac{1}{2}$ " (13 mm) thickness.
- Silicone-impregnated fiberglass-faced panels.
- Underlying substrate must allow securement of flashing at prescribed spacing. Mechanical attachment to gypsum panels is not acceptable.
- Use of gypsum panel decks requires GAF Field Services Area Manager's approval.

## ROOF DRAINAGE

Providing positive roof drainage is important. Standing water can result in deck deflection and possible structural damage. In addition, in the event of an opening through the roofing membrane, standing water can significantly worsen damage to the roof system, the building itself, and interior contents by providing a reservoir of water ready to gravitate through the membrane opening. Providing structural slope in the deck assembly, installing a tapered lightweight cellular concrete overlay, installing a tapered insulation system, or adding additional drains are the most common methods of achieving positive drainage.

National building codes generally require a minimum  $\frac{1}{4}:12$  slope to drain in order to provide positive drainage and accommodate deck irregularities. Although existing buildings may or may not be required by code to achieve this degree of roof slope, providing positive slope to drain remains an important design consideration.

In situations where roof edge conditions, window/door height above the roof surface, parapet wall height, weep hole locations, rooftop equipment mountings, or other factors prevent the installation of a full slope-to-drain system, a combination of additional drain locations, tapered saddles, and crickets to direct drainage to drain points should be considered.

## EXPANSION JOINTS

The function of a structural expansion joint is to minimize the effect of stresses and movements on building components and to prevent these stresses from adversely affecting the roof. The design, location, and use of building structural expansion joints must be considered at the time of original building design and are the responsibility of the architect, engineer, and building owner.

### Expansion Joints:

- Must be continuous along the break in the structure and not terminated short of the end of the roof deck.

- Should never be bridged with insulation or roofing membrane.
- Construction ties must be removed in order for expansion joints to function properly.
- Extend expansion joints at least 8" (203 mm) above the roof surface on curbs and use either Metalastic® Flexible Expansion Joint Covers or metal caps or covers. Alternately, a low profile expansion joint can be used; see EverGuard® details for construction.
- Design drainage flow patterns so they are not blocked by any structural expansion joints.
- Where possible, position walkways on roof access points to limit roof traffic over expansion joints; provide protective coverings for expansion joints at locations of anticipated roof traffic.
- EverGuard® Pre-Fab Expansion Joint Covers are available.

## AREA DIVIDERS

Area dividers are not considered structural expansion joints. They can be installed to separate different roofing systems and can be either a curb or low-profile type. Contact the GAF Technical Helpline (1-800-ROOF-411) for recommendations regarding area dividers.

## EQUIPMENT MOUNTINGS

Proper mounting of equipment is an important consideration. In general, rooftop equipment should be mounted in such a way as to provide adequate flashing height for both new and anticipated re-cover roof system applications; sufficient clearance around and beneath the equipment to facilitate roof system installation; and compatibility with roofing and flashing materials so that standard flashing methods can be readily applied.

Alternately, lightweight equipment and gas/conduit lines can be installed on wood blocking or other prefabricated devices that do not penetrate the roofing system. Do NOT use this type of application for heavy equipment or gas conduit line; or where excessive movement can damage the substrate or membrane.

## FIRE RESISTANCE

Resistance by the roofing system to fire applied to the exterior roof surface is important. Typically, a UL Class A or B rating is required by building code. Occasionally, depending on the use of the building, special resistance to fire applied from within the building is required. This is normally expressed in the form of hourly ratings, and usually requires the use of a specialized roof assembly. Refer to current EverGuard® listings in the appropriate UL directory to verify roof assembly requirements for specific fire ratings.

## WIND PERFORMANCE

Ideally, roofing systems should be capable of resisting the forces generated by the maximum anticipated wind speed for a specific building. One widely accepted method for specifying wind performance is to require the appropriate FM 1-60, 1-90, or other rated system as appropriate for a specific building based upon location and exposure.

## ROOF DESIGN

The following are common wind codes and approvals typically used in conjunction with EverGuard® roofing systems:

- **FM Global (Factory Mutual)**

- Testing based on method described in Approval Standards 4450 and 4470.
- Measures resistance to upward pressure applied to the roof system.

- **American Society of Civil Engineers (ASCE) document ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures"**

- A comprehensive analysis of wind forces acting on buildings. Requires detailed calculations to determine actual wind pressures at different regions of the roof.
- Referenced by building codes.

Refer to Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29 for specific installation guidelines.

### ENERGY EFFICIENCY

Thermal transmission standards have been established by building codes for most buildings. Roof insulation installed above the roof deck is a practical means of achieving the necessary energy efficiencies. In addition, the use of white-colored reflective membranes can reduce the heat load on air conditioning equipment, as well as provide a moderating effect on the temperature in proximity to the building.

- **U-Value**

- Thermal Transmittance: The number of BTUs (energy) that pass through a 1-square-foot (0.1 sq. m.) sample of a total material assembly in one hour with a temperature difference between the two surfaces of 1 degree F (-17°C).
- Thermal Transmittance applies to an actual total material assembly, and as such is a quantitative physical property that can be used to represent the overall thermal performance of a system.

- **R-Value**

- Thermal Resistance: The number of degrees difference between two surfaces (energy difference) that is required to obtain an energy flow of 1 BTU through a 1-square-foot (0.1 sq m) sample of a given material thickness in one hour.
- The R-value is the reciprocal of the C-value.
- Thermal Resistance applies to an actual thickness of a material, and as such is a quantitative physical property that can be used for determining insulation requirements.

- **Reflectance**

- A measure of the % of solar energy that is reflected away from a surface.
- Dark materials absorb more heat from the sun and can be up to 70°F (21°C) hotter than a reflective white surface given the same outside temperature and conditions such as wind speed, location, etc.

- **Emittance**

- A measure of the infrared radiation emitted from a roof surface. Unlike reflectance, infrared emissivity may not be affected by dirt or discoloration of the surface of a material.

The following references provide useful information regarding energy efficiency:

- **ASHRAE Fundamentals Handbook**

- Provides detailed design calculations and material energy transfer information utilized by mechanical engineers in the design of heating, ventilation, and air-conditioning systems.
- Suitable for complex energy evaluation considerations such as solar heat gain, exterior shading, total building envelope, building usage, and lighting.

- **NRCA Energy Manual**

- Provides a simplified method for determining the amount of insulation necessary to construct an energy-efficient low-slope roof system.
- Provides a simplified method for determining the energy cost savings resulting from the installation of additional roof insulation.
- Suitable for most roofing-related energy evaluations.

- **DOE Energy Calculator**

- Go to [www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm](http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm) to find the Cool Roof Calculator.
- This tool measures the energy savings for low-slope roofs with non-black roof surfaces.

### WATER VAPOR TRANSFER

Typical single-ply roof assemblies do not include vapor retarders as a standard assembly component. For these applications, there is a natural transfer of water vapor into the roof assembly during a portion of the year, followed by a natural transfer of water vapor out of the roof assembly during the balance of the year. Under normal conditions, this type of cyclical water vapor flow does not cause a significant deterioration of the roof insulation or reduction in insulation thermal performance.

However, for projects where there is a significant difference in vapor pressure between building interior and exterior, the volume of water vapor flow is much greater, and control of water vapor transfer into and through a roof system becomes an important consideration. Without adequate control provisions, the roof insulation can become saturated with water, with a corresponding reduction in insulation thermal performance. Structural deck damage and/or condensation into the building interior may also occur. Vapor flow is referenced in various ways. The following is a description of common terminologies:

- **Permeance**

- The time rate of vapor transmission through a flat material or construction induced by vapor pressure difference between two specific surfaces, under specified temperature and humidity conditions.

## ROOF DESIGN

- Units of permeance are expressed as: (gr.) / (h) (sq.ft.) (in Hg).
- The permeance, or perm rating, of a material is a performance evaluation specific to a sample of material, and not a specific property of the material.

### • Relative Humidity

- Relative humidity is the ratio of the pressure of water vapor present in air to the pressure of fully saturated water vapor at the same temperature.
- Relative humidity is expressed as a percentage.

### • Dew Point Temperature

- The temperature at which air becomes saturated with saturated vapor (100% relative humidity) and condensation begins to form.
- Dew Point Temperature is expressed as °F.

### • Temperature and Relative Humidity

- Vapor flows due to a difference in vapor pressure between two locations, and flows from higher to lower pressure regions.
- Normally, the higher the temperature, the higher the vapor pressure, and this is typically called the "warm side."
- In determining the need for a vapor retarder for most typical conditions, the exterior winter temperature and the interior winter relative humidity are the most critical factors.
- Temperature information is readily available from the National Weather Service.
- Relative humidity information is typically available from the building HVAC design professional or the building operations manager. Relative humidity can also be field measured.

### • Vapor Retarder Location

- A number of basic considerations factor into the need and location of a vapor retarder. Determining the need and location of the vapor retarder is the responsibility of the design professional.
- Vapor retarders are intended to be installed as close to the "warm side" as possible. Normally, this places the vapor retarder directly on the structural deck or directly over a minimal layer of EnergyGuard™ insulation or fire barrier.
- A sufficient amount of EnergyGuard™ insulation must be installed over the vapor retarder to raise the location of the dew point temperature above the level of the vapor retarder.

### • Sealing At Perimeter And Penetrations

- Vapor retarders shall be completely sealed at all perimeter and penetration locations.
- Sealing methods shall be selected in accordance with type of vapor retarder being installed.
- Air leakage at perimeter and penetrations will significantly

reduce the effectiveness of the vapor retarder by allowing moist air to penetrate into the roof assembly, where it can condense and cause roof deterioration.

### • Building Usage

- Normal building usage such as offices, schools, retail, warehousing, etc. will not typically require the use of a vapor retarder except when located in the most northerly climates.
- Building usage such as swimming pools, food processing, paper manufacturing, foundries, etc. that result in increased internal temperatures and humidity conditions will likely require the use of a vapor retarder (except when located in the most southern climates).
- These generalizations are not intended to substitute for actual vapor flow calculations based upon specific building and climactic conditions.

### • The Case For The Use Of A Vapor Retarder

- A vapor retarder can protect the long-term thermal resistance of insulation sandwiched between the vapor retarder and the membrane.
- A vapor retarder provides a good safeguard against vapor migration in case a building's use changes from a "dry" use to a "wet" use.

### • The Case Against The Use Of A Vapor Retarder

- The vapor retarder, together with the roofing membrane, may seal entrapped moisture within the roof system that can eventually destroy the insulation, wrinkle the membrane or, in gaseous form, blister it.
- In the event of a roof leak through the membrane, the vapor retarder will trap the water in the insulation and release it through punctures, breaks, or poor seals in the vapor retarder. This water may move some lateral distance from the roof leak, thus making leak discovery more difficult. A large area of insulation may be saturated before the punctured roof membrane is discovered and repaired.
- A vapor retarder is a disadvantage in summer, when vapor migration is generally downward through the roof. Hot, humid air can infiltrate the roofing "sandwich" through vents, or via diffusion through the roof membrane itself. If this occurs, moisture can condense within the roofing system.

The following resources may provide useful information regarding vapor retarders:

- NRCA Energy Manual
- ASHRAE Fundamentals Handbook

## TPO DESIGN TABLE - NEW CONSTRUCTION OR TEAR-OFF - ADHERED SYSTEMS

Deck	Membrane Attachment		Membrane Type		Insulation/Substrate					Insulation/Substrate Attachment		
	Adhered		Smooth	Fleece (FB)	ISO	Gypsum Board <sup>5</sup>	Wood fiber/Perlite	EPS <sup>2</sup> /XPS <sup>2</sup>	None	Mech Attached	Adhesive <sup>8</sup>	Hot <sup>1</sup>
	Adhesive <sup>7</sup>	Hot										
Steel	X		X		X	X	X <sup>4</sup>	X		X	X	
				X <sup>6</sup>	X	X	X <sup>4</sup>	X		X	X	
		X		X	X	X	X	X		X	X	
Wood	X		X		X	X	X <sup>4</sup>	X	X	X	X	X <sup>3</sup>
				X <sup>6</sup>	X	X	X <sup>4</sup>	X	X	X	X	X <sup>3</sup>
		X		X	X	X	X		X <sup>3</sup>	X	X	X <sup>3</sup>
Structural Concrete & Gypsum	X		X		X	X	X <sup>4</sup>	X		X	X	X
				X <sup>6</sup>	X	X	X <sup>4</sup>	X	X	X	X	X
		X		X	X	X	X		X	X	X	X
Lightweight Insulating Concrete	X		X		X	X	X <sup>4</sup>	X		X	X	X <sup>3</sup>
				X <sup>6</sup>	X	X	X <sup>4</sup>	X	X <sup>6</sup>	X	X	X <sup>3</sup>
		X		X	X	X	X <sup>4</sup>	X	X <sup>3</sup>	X	X	X <sup>3</sup>
Cementitious Wood Fiber	X		X		X	X	X <sup>4</sup>	X		X	X	X <sup>3</sup>
				X <sup>6</sup>	X	X	X <sup>4</sup>	X	X	X	X	X <sup>3</sup>
		X		X	X	X	X	X	X <sup>3</sup>	X	X	X <sup>3</sup>

1. No hot attachment of XPS or EPS.

2. Cover board required.

3. Insulation/membrane can be installed in hot asphalt only when mopping to mechanically attached base sheet.

4. Wood fiber only with bonding adhesives.

5. Glass mat facer required for adhered membranes.

6. Attachment of membrane must be with water-based adhesive.

7. Includes LRF-O, LRF-M, and GAF 2-Part Roofing Adhesive.

8. Includes Olybond<sup>®</sup>, LRF-M, and GAF 2-Part Roofing Adhesive.

## TPO DESIGN TABLE - RE-COVER - ADHERED SYSTEMS

Existing Roofing System Type	Membrane Attachment		Membrane Type		Insulation/Substrate					Insulation/Substrate Attachment		
	Adhered		Smooth	Fleece	ISO	Gypsum Board <sup>7</sup>	Wood fiber <sup>3</sup> / Perlite <sup>3</sup>	EPS <sup>2</sup> /XPS <sup>2</sup>	None	Mech Fast.	Adhesive <sup>9</sup>	Hot <sup>1</sup>
	Adhesive <sup>8</sup>	Hot										
Smooth BUR/MB	X		X		X	X	X <sup>5</sup>	X		X	X	X
				X <sup>8</sup>	X	X	X <sup>5</sup>	X		X	X	X
		X		X	X	X	X	X	X	X	X	X
Single Ply Membrane	X		X		X	X	X <sup>5</sup>	X		X		
				X <sup>8</sup>	X	X	X <sup>5</sup>	X		X		
		X		X	X	X	X	X		X		
Granule Surfaced BUR/MB	X		X		X	X	X <sup>5</sup>	X		X	X	X
				X <sup>8</sup>	X	X	X <sup>5</sup>	X		X	X	X
		X		X	X	X	X	X	X	X	X	X
Gravel Surfaced BUR/MB	X		X		X	X	X <sup>5</sup>	X		X	X	X
				X <sup>8</sup>	X	X	X <sup>5</sup>	X		X	X	X
		X		X	X	X	X	X		X	X	X
Standing Seam Metal <sup>4</sup>	X		X		X	X	X <sup>5</sup>	X		X		
				X <sup>8</sup>	X	X	X <sup>5</sup>	X		X		
		X		X	X	X	X	X		X		

1. No hot attachment of XPS or EPS.

2. Cover board required.

3. Roof moisture scan required for use of perlite/wood fiber in re-cover roof systems.

4. XPS is the only material allowed as flute fill with cover board required.

5. Wood fiber only with bonding adhesives.

6. Glass mat facer required for adhered membranes.

7. Attachment of membrane must be with water-based adhesive.

8. Includes LRF-O, LRF-M, and GAF 2-Part Roofing Adhesive.

9. Includes Olybond<sup>®</sup>, LRF-M, and GAF 2-Part Roofing Adhesive.

## PVC DESIGN TABLE - NEW CONSTRUCTION ON TEAR-OFF - ADHERED SYSTEMS

Deck	Membrane Attachment		Membrane Type		Insulation/Substrate					Insulation/Substrate Attachment		
	Adhered		Smooth	Fleece	ISO	Gypsum Board <sup>4</sup>	Wood fiber/Perlite	EPS <sup>3</sup> /XPS <sup>2</sup>	None	Mech. Attached	Adhesive <sup>8</sup>	Hot <sup>1</sup>
	Adhesive <sup>7</sup>	Hot										
Steel	X		X		X	X	X <sup>6</sup>			X	X	
				X <sup>5</sup>	X	X	X <sup>6</sup>	X		X	X	
		X		X	X	X	X	X		X	X	
Wood	X		X		X	X	X <sup>6</sup>		X	X	X	X <sup>3</sup>
				X <sup>5</sup>	X	X	X <sup>6</sup>	X	X	X	X	X <sup>3</sup>
		X		X	X	X	X		X <sup>3</sup>	X	X	X <sup>3</sup>
Structural Concrete & Gypsum	X		X		X	X	X <sup>6</sup>			X	X	X
				X <sup>5</sup>	X	X	X <sup>6</sup>	X	X	X	X	X
		X		X	X	X	X		X	X	X	X
Lightweight Insulating Concrete	X		X		X	X	X <sup>6</sup>			X	X	X <sup>3</sup>
				X <sup>5</sup>	X	X	X <sup>6</sup>	X	X <sup>5</sup>	X	X	X <sup>3</sup>
		X		X	X	X	X	X	X <sup>3</sup>	X	X	X <sup>3</sup>
Cementitious Wood Fiber	X		X		X	X	X <sup>6</sup>			X	X	X <sup>3</sup>
				X <sup>5</sup>	X	X	X <sup>6</sup>	X	X	X	X	X <sup>3</sup>
		X		X	X	X	X	X	X <sup>3</sup>	X	X	X <sup>3</sup>

1. No hot attachment of XPS or EPS.

2. Cover board required.

3. Insulation/membrane can be installed in hot asphalt only when mopping to mechanically attached base sheet.

4. Glass mat facer required for adhered membrane attachment.

5. Membrane attachment must be with water-based adhesive.

6. Wood fiber insulation only.

7. Includes LRF-O, LRF-M, and GAF 2-Part Roofing Adhesive.

8. Includes Olybond<sup>®</sup>, LRF-M, and GAF 2-Part Roofing Adhesive.

## PVC DESIGN TABLE - RE-COVER - ADHERED SYSTEMS

Deck Type	Membrane Attachment		Membrane Type		Insulation/Substrate				Insulation/Substrate Attachment			
	Adhered		Smooth	Fleece (FB)	ISO	Gypsum Board <sup>4</sup>	Wood fiber <sup>5</sup> / Perlite <sup>5</sup>	EPS <sup>2</sup> / XPS <sup>2</sup>	None	Mech Fast.	Adhesive <sup>9</sup>	Hot <sup>1</sup>
Smooth BUR/MB	Adhesive <sup>8</sup>	Hot			X	X	X <sup>6</sup>			X	X	X
	X			X <sup>7</sup>	X	X	X <sup>6</sup>	X		X	X	X
		X		X	X	X	X	X	X	X	X	X
		X	X		X	X	X <sup>6</sup>			X		
Single Ply Membrane	X		X		X	X	X <sup>6</sup>			X		
		X		X <sup>7</sup>	X	X	X <sup>6</sup>	X		X		
		X		X	X	X	X	X		X		
Granule Surfaced BUR/MB	X		X		X	X	X <sup>6</sup>			X	X	X
		X		X <sup>7</sup>	X	X	X <sup>6</sup>	X		X	X	X
		X		X	X	X	X	X	X	X	X	X
Gravel Surfaced BUR/MB	X		X		X	X	X <sup>6</sup>			X	X	X
		X		X <sup>7</sup>	X	X	X <sup>6</sup>	X		X	X	X
		X		X	X	X	X	X		X	X	X
Standing Seam Metal <sup>3</sup>	X		X		X	X	X <sup>6</sup>			X		
		X		X <sup>7</sup>	X	X	X <sup>6</sup>	X		X		
		X		X	X	X	X	X		X		

1. No hot attachment of XPS or EPS.

2. Cover board required.

3. XPS only as flute fill material with overlay board.

4. Glass mat facer required for adhered membrane attachment.

5. Roof moisture scan required for use of perlite/wood fiber in re-cover roofing systems.

6. Wood fiber insulation only.

7. Attachment of membrane must be with water-based adhesive.

8. Includes LRF-O, LRF-M, and GAF 2-Part Roofing Adhesive.

9. Includes Olybond<sup>®</sup>, LRF-M, and GAF 2-Part Roofing Adhesive.

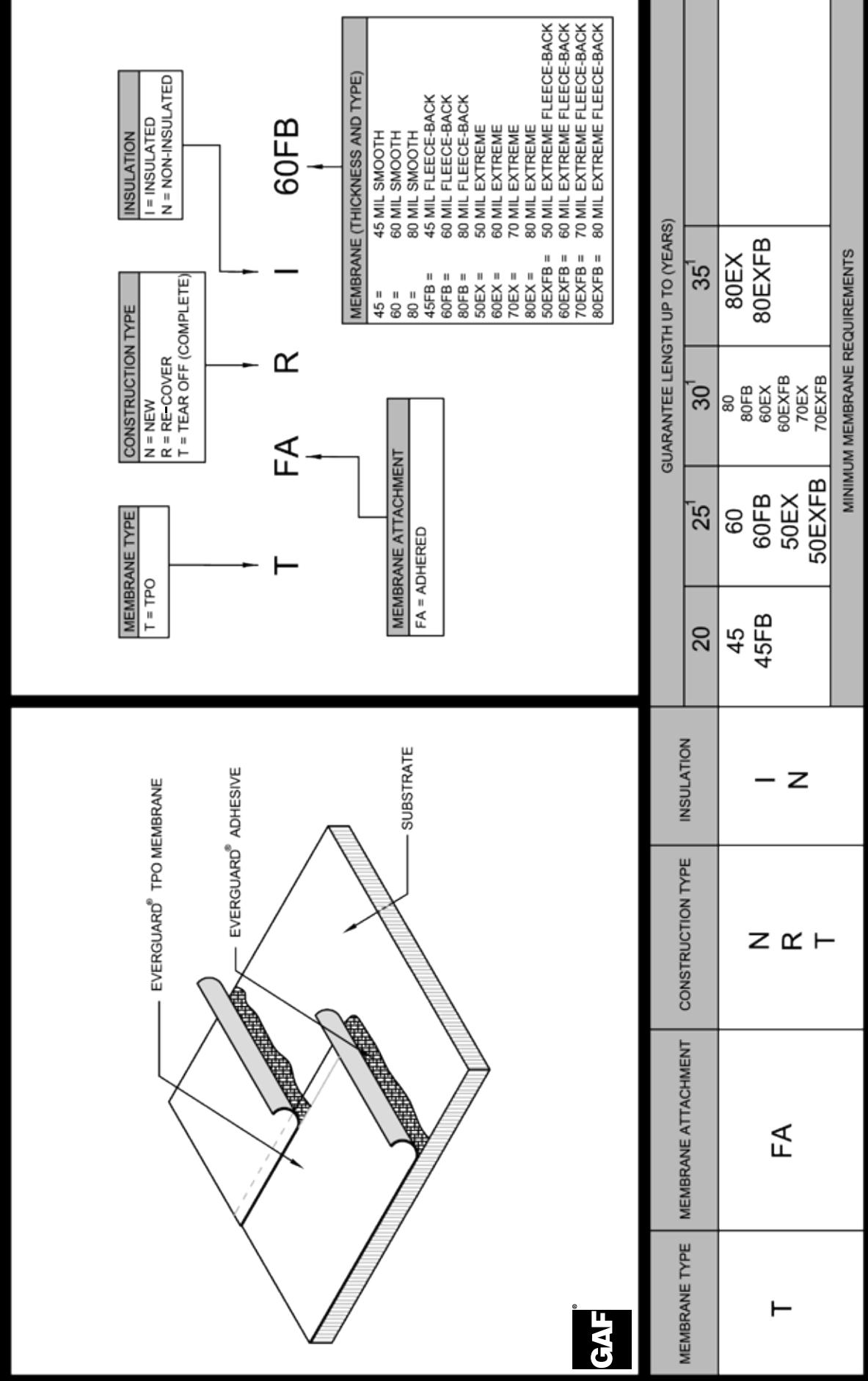
## INSULATION ATTACHMENT TABLE FOR ADHERED SYSTEMS

NUMBER OF FASTENERS								
Insulation Type	Board Size (feet)	Thickness	Standard Attachment Fastners/Board			Attachment Fasteners/Board for 90 psf Uplift Resistance		
			Field	Perimeter	Corner	Field	Perimeter	Corner
Isocyanurate	4x4	1" - 1.4"	8	12	16			
	4x4	1.5" - 1.9"	6	8	12	8	12	16
	4x4	2" minimum	4	6	8	4	6	8
	4x8	1" - 1.4"	16	24	32			
	4x8	1.5" - 1.9"	11	16	22	16	24	32
	4x8	2" minimum	8	12	16	8	12	16
EPS/XPS <sup>1</sup>	4x4	1" - 1.4"	8	12	16			
	4x4	1.5" - 1.9"	6	8	12			
	4x4	2" minimum	4	6	8			
	4x8	1" - 1.4"	16	24	32			
	4x8	1.5" - 1.9"	11	16	22			
	4x8	2" minimum	8	12	16			
Gypsum Board	4x8	1/4" - 5/8"	16	24	32			
	4x8	1/2" minimum	16	24	32	21	32	36
Wood Fiber	4x4	1/2" minimum	6	8	12			
	4x4	1" minimum	4	6	8			
	4x8	1/2" minimum	16	24	32			
TYPE OF INSULATION FASTENER								
Deck	Fastener		Plate			Penetration (minimum)		
Steel – all gauges	DRILL-TEC™ HD (#14) or Standard (#12)		3" Galvalume			3/4" through the deck		
Wood – plank and sheathing	DRILL-TEC™ HD (#14) or Standard (#12)		3" Galvalume			1" thread into/through the deck		
Structural Concrete	DRILL-TEC™ HD (#14) or DRILL-TEC Spike		3" Galvalume			1" thread/shank into the deck		
Insulating Concrete	DRILL-TEC™ HD (#14)		3" Galvalume			3/4" thread through steel form		
Gypsum Concrete	DRILL-TEC™ Polymer Screw		3" Galvalume			1 1/2" thread into the deck		
Cementitious Wood Fiber	DRILL-TEC™ Polymer Screw		3" Galvalume			1 1/2" thread into the deck		

<sup>1</sup> Require a Coverboard.

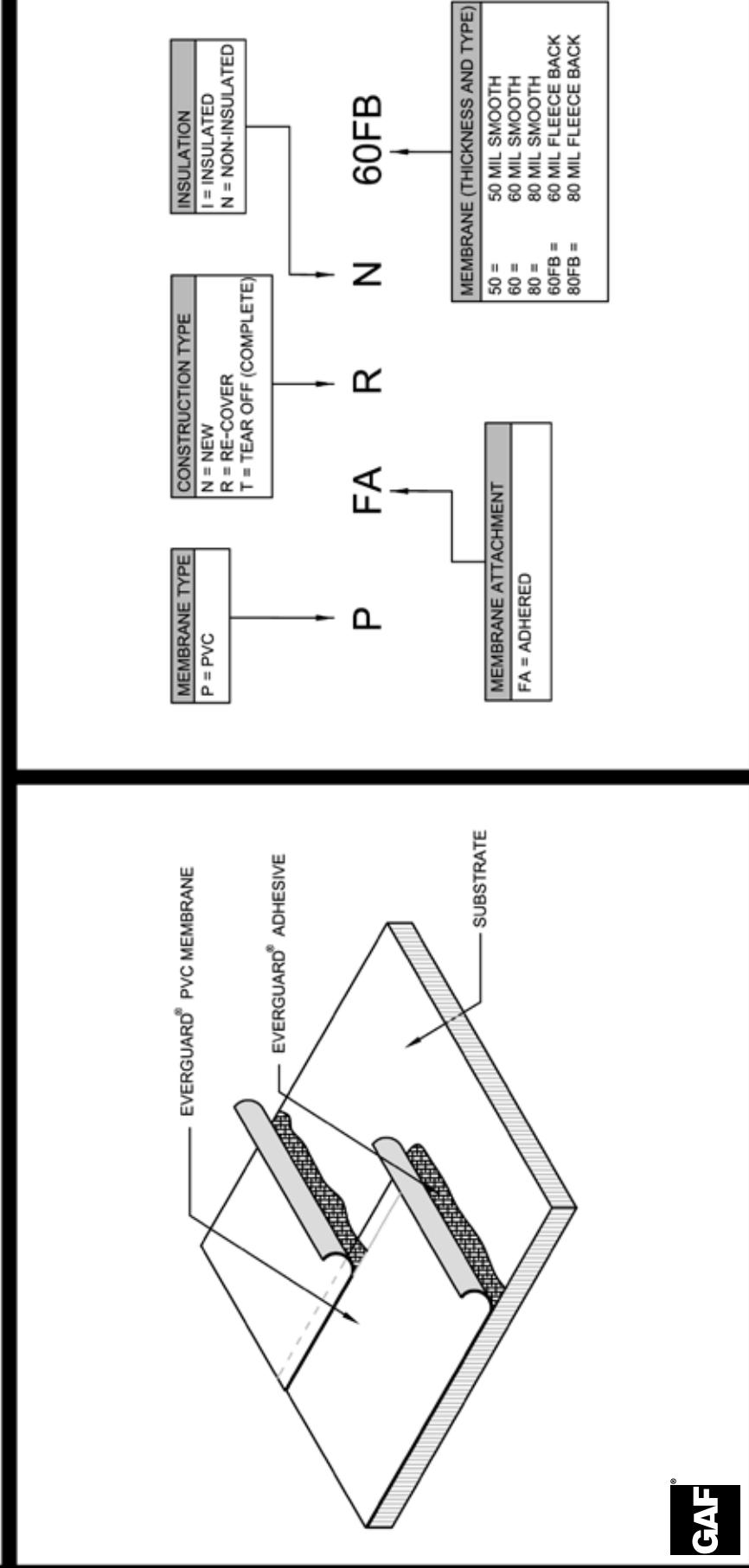
**Note:** Attachment requirements to meet determined uplift resistance are dependent on deck type, specific fastener, etc. Refer to the Everguard® TPO/PVC Membrane Attachment Table in the Everguard® TPO/PVC Mechanically Attached Roofing System Manual for minimum pull-out values and deck requirements.

## INSULATED & NON-INSULATED TPO ADHERED SYSTEMS SPECIFICATION PLATE



1. New & Tear-off only. Minimum 2 layers of insulation. Refer to Guarantee Program section for additional requirements.

## INSULATED & NON-INSULATED PVC ADHERED SYSTEMS SPECIFICATION PLATE



**GAF**

MEMBRANE TYPE	MEMBRANE ATTACHMENT	CONSTRUCTION TYPE	INSULATION	GUARANTEE LENGTH UP TO (YEARS)				MINIMUM MEMBRANE REQUIREMENTS
				12	15	20	80	
P	FA	N R T	I N	50	60 60FB	80 80FB		

## LOW-RISE FOAM (LRF) ADHESIVE SECUREMENT TABLE

Decks For Direct Adhesion To Fleece-Back Membranes Only		Notes
Structural Concrete (New)	✓	28-day cure on new poured decks
Structural Concrete – Reroof (structural concrete deck that had an existing roof and contains residual asphalt)	✓	
Lightweight Structural Concrete	✓	28-day cure on new poured decks.
Lightweight Insulating Concrete	✓	28-day cure on new poured decks. Adhesion test required*
Cellular Lightweight Insulating Concrete Decks	✓	Adhesion test required*
Plywood (CDX) Or Oriented Strand Board (OSB)	✓	
Wood Planking	✓	
Poured Gypsum	✓	Adhesion test required*
Pre-Cast Gypsum	✓	Adhesion test required*
Cementitious Wood Fiber (Tectum)	✓	Adhesion test required*
<b>Asphaltic Base Sheet**</b>		
Unmodified Fiberglass / Asphalt Sand / Smooth Surface Base Sheet	✓	Adhesion test required*
SBS Modified Asphalt Sand / Smooth Surface Base Sheets	✓	Adhesion test required*
APP Modified Asphalt Sand / Smooth Surface Base Sheets	✓	Adhesion test required*
<b>Approved Insulations</b>		
Polyisocyanurate (flat / tapered)	✓	Maximum board size is 4'x 4' (1.2 m x 1.2 m)
High Density Wood Fiber	✓	
DensDeck®	✓	4'x 8' (1.2 m x 2.4 m) boards approved
DensDeck® Prime	✓	4'x 8' (1.2 m x 2.4 m) boards approved
Perlite Insulation	✓	¾" (18 mm) minimum
SECUROCK® (all gypsum/cement-based cover boards)	✓	
Extruded Polystyrene (XPS)	✓	Board must be adhered
Expanded Polystyrene (EPS)	✓	1.5 lb (42 g./cubic cm) density
Mineral Wool	N/A	
Asphaltic Cover Boards	✓	
<b>Direct Re-covery</b>		
Asphalt Built-Up Roofs		
Existing Smooth Surface Built-Up Roof (with no coating)	✓	Adhesion test required*
Existing Smooth Surface Built-Up Roof (with new asphalt glaze coat)	✓	Adhesion test required*
Existing Smooth Surface Built-Up Roof (with any type of coating)	✓	Adhesion test required*
Existing Gravel-Surfaced Built-Up Roof (over existing insulation)	✓	Loose gravel removed + new insulation and adhesion test required*
Existing Mineral-Surfaced Built-Up Roof	✓	Adhesion test required*
Existing Roof Insulation (after removal of existing roof)	✓	Contact GAF Technical Services

SBS Modified Asphalt Roofs			
Smooth SBS Ply – Base or Cap Sheet (with sand surfacing with no granules or coating)	✓	Adhesion test required*	
Smooth SBS Ply – Base or Cap Sheet (with new asphalt glaze coat)	✓	Adhesion test required*	
Existing SBS Modified Bitumen Roofs (with any type of coating)	✓	Adhesion test required*	
Existing Mineral-Surfaced SBS Modified Bitumen Roofs	✓	Adhesion test required*	
APP Modified Asphalt Roofs			
Smooth APP Ply – Base or Cap Sheet (with sand surfacing with no granules or coating; including Grace products)	✓	Adhesion test required*	
Smooth APP Ply – Base or Cap Sheet (with polyethylene surfacing)	✓	Contact GAF Technical Services	
Existing APP Modified Bitumen Roofs (with any type of coating)	✓	Adhesion test required*	
Existing Mineral-Surfaced APP Modified Bitumen Roofs	✓	Adhesion test required*	
Coal Tar Built-Up Roof			
Gravel-Surfaced Coal Tar Pitch Roof	✓	1" ISO min. required Adhesion test required* Contact GAF if using GAF 2-Part Roofing Adhesive	
Single-Ply Roof (TPO/ PVC)***	N/A		
EPDM Roof***	N/A		

**LRF-M (For adhering both membrane & insulation)**

**LRF-O (For adhering membrane only)**

**OlyBond® (For adhering insulation only)**

**GAF 2-Part Roofing Adhesive (For adhering both membrane & insulation)**

Refer to product data sheets for uses and application

✓ (Acceptable) N/A (Not Acceptable)

\* Adhesion test: An adhesion test is required to ensure substrate and adhesion quality.

\*\* Contact GAF Technical Services 800-766-3411 when using LRF in conjunction with a base sheet installation.

\*\*\* The use of low-rise foam adhesives directly over an existing single-ply or EPDM membrane is not acceptable by GAF. LRF-M, OlyBond® and GAF 2-Part Roofing Adhesive can be utilized to attach new insulation / cover board to existing adhered polyiso that has had its facer removed during the removal of an adhered single-ply roof system.

## PERIMETER SECUREMENT TABLE

Building Width	Building Height	Area Width	Adhesive Bead Spacing
<200' (61 m)	0-34' (0-10 m)	5' (1.5 m)	6" (152 mm)
	35'-100' (10-30 m)	10' (3 m)	6" (152 mm)
	>100' (30 m)	<b>Formula:</b> Perimeter area width is throughout the perimeter and corner region. The width of this region is defined as the least of the following two measurements:  0.1 x Building Width or 0.4 x Building Height	<b>Note:</b> The minimum width is 5' (1.5 m)

### Note:

1. FM Global attachment requires the Formula calculation.

2. LRF-M, LRF-O and OlyBond® adhesive ribbons must be applied at a width of 1" (25 mm) wet bead. When using GAF 2-Part Roofing Adhesive, a 2.5" (62 mm) wide, wet continuous bead is required.

# DESIGN & APPLICATION GUIDELINES: ADHERED ROOFING SYSTEMS

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# DESIGN & APPLICATION GUIDELINES: ADHERED ROOFING SYSTEMS

TPO & PVC

## PART 1 – GENERAL

### 1.01 System Description

- A. Adhered heat-welded thermoplastic sheet roof membrane system.
- B. EverGuard® TPO and EverGuard® PVC materials are not compatible with one another. DO NOT mix EverGuard® TPO or PVC membranes, flashings, and flashing accessories together in the same roofing system.

### 1.02 Specification Designations

- A. See Specification Plates in this manual.

### 1.03 Regulatory Requirements & Pre-Job Conference

- A. Conform to all applicable building and jurisdictional codes, including roof assembly wind uplift and fire resistance requirements and slope limitations. GAF recommends at least 1/4:12 of slope with proper grading and placement of drainage outlets.
- B. Follow your local jurisdiction requirements for disposing of used or expired adhesives, sealants and other products subject to disposal regulations.
- C. Potential problems in roofing applications, as well as potential conditions that may be detrimental to installation and performance of the roof system, should be resolved prior to the start of the application. This can best be accomplished by a pre-job meeting with the architect; roofing contractor; general contractor; all other subcontractors whose work will involve the roof system/related systems; and the GAF representative.
- D. The following are common items of discussion at a pre-job conference:
  1. Roof deck conditions.
  2. Flashing and expansion joint details.
  3. Insurance underwriters or building code requirements.
  4. Unusual project conditions.
  5. Protection of the roof, building, building occupants, and contents during and after application.
  6. Application techniques.
  7. Coordination and scheduling of other trades that will be working on the project.
  8. Designation by the roofing contractor of a qualified person responsible for quality control. This person must be on the project full time during application of the roof system, and must not be changed without the approval of GAF.
  9. Scheduling of material shipments, material storage, and rooftop loading.
  10. Submittals of materials, drawings and project documents.

### 1.04 Delivery, Storage and Protection

- A. Deliver products to site in original containers with seals unbroken and labeled with manufacturers' names, product brand names and types.
- B. Store materials in weather-protected environment, clear of the ground and moisture, in accordance with GAF instructions. Store all adhesives, coatings, and sealants/caulks to protect them from freezing. Frozen material must be discarded and replaced. Properly seal all liquid material containers after use.
- C. Outside storage of roofing materials
  1. All materials stored outside must be raised above ground or roof level on pallets and covered with a tarpaulin or other waterproof and "breathable" material. Insulation products should be properly stored and weighted to avoid weather and wind damage.
  2. Factory-installed plastic wrapping is not designed as protective covering for insulation materials and should be removed. Use "breathable" type covers, such as canvas tarpaulins, to allow venting and protection from weather and moisture.
  3. Cover and protect materials at the end of each day's work.
  4. Do not remove any protective tarpaulins until immediately before material will be installed. Extreme heat or cold conditions may require special storage requirements. Reference product data sheets for specific product storage requirements.
- D. Follow GAF directions and requirements for protection of roofing materials prior to and during installation.
- E. Do NOT use materials that are wet or damaged to the extent that they will no longer serve their intended purposes. All roof insulation that has been wet is considered damaged, even if later dried out. Remove all damaged materials from the job site.
- F. When staging materials on the roof during application, ensure the deck and structure are not temporarily overloaded by the weight of construction materials.
- G. At the job site, no more material should be stored than what will be used within two weeks. For periods longer than two weeks, the materials should be properly warehoused; i.e., dry ventilated, on pallets, etc. No more material should be stored on the rooftop than can be used within five days. When prolonged inclement weather threatens, i.e., rainy seasons, no more roofing materials should be supplied to the rooftop than can be used within two days.

### 1.05 Environmental Requirements & Restrictions

- A. Do not apply roofing materials during inclement or threatening weather.
- B. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.
- C. Be aware that high or gusting winds make the installation of some materials more difficult.

# DESIGN & APPLICATION GUIDELINES: ADHERED ROOFING SYSTEMS

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- D. Material installation during periods of high ambient temperature and/or humidity levels (typically above 90°F (32°C) and/or 90% relative humidity) can result in poor installation quality due to condensation on the membrane surface, or excessively fast adhesive drying rates in hot, dry weather. Do not install materials when moisture, in any form, is present on the roof deck or substrate to which the materials are to be applied.
- E. Material installation during periods of low ambient temperatures, typically below 32°F (0°C), can result in poor installation quality. To avoid these problems:
  1. Store accessory materials in a warming box.
  2. Use as soon as possible.
  3. Allow adhesives to properly cure.
  4. Adjust welder settings to ensure proper welds for applicable ambient conditions.

## 1.06 Working Environment

- A. Work should only begin when the contractor has decided to his/her satisfaction that all specifications are workable as specified, and that the contractor can meet project and code requirements.
- B. The contractor should only begin roofing work when the substrates have been prepared as necessary, and are ready to accept the roofing materials installed as specified.
- C. Provide a safe working environment, including, but not limited to, adequate fall protection, restriction of unauthorized access to the work area, and protection of the building and its occupants.
- D. Safe work practices should be followed, including, but not limited to, keeping tools in good operating order; providing adequate ventilation if adhesives are used; and, daily housekeeping to remove debris and other hazards. See section 1.07 for further details on safety.
- E. Protect the building, contents, surrounding area, building occupants and contractor personnel during work. Coordinate all work operations with the building owner and building occupants so that adequate interior protection, as necessary, is provided and disruption to normal building operations is minimized.
- F. Where heavy wheeled or other traffic over the partially completed roofing is unavoidable, provide and use adequate plank or plywood, set over a minimum thickness of rigid board insulation to protect the newly installed roof.
- G. Provide temporary water cut-offs and tie-ins at the end of each work day. Remove all temporary work at the beginning of the next work day.
- H. When tearing off an existing membrane, limit removal to the area that will be completely reroofed that day with the new roofing system.
- I. If conditions are uncovered or created which would be detrimental to the proper conduct of specified work, immediately notify the building owner and GAF of these conditions for consultation on acceptable treatments.

## 1.07 Safety Considerations and Warnings

- A. As with any construction process, safety is a key element. All applicable safety standards and good roofing practices must be followed. Read and understand GAF's Design & Application Guidelines before starting application. Follow all precautions and directions.
- B. Only properly trained and professionally equipped roofing contractors experienced in the installation of each TPO and PVC roofing application should install these systems. Never allow contact between the heated surface of a hot welder or other tool and the applicator's hair, skin or clothing. Always wear protective gear, including but not limited to: hardhats, goggles, heavy-duty gloves, and snug-fitting clothing.
- C. Solvent-containing accessories may be combustible and should always be kept from heat, flame or any source of ignition. Empty containers must be disposed of in posted toxic substance landfills in accordance with local, state and federal regulations.
- D. Thoroughly train all personnel in first aid procedures, and always comply with all OSHA safety standards and fire codes. Also, use extreme caution when working around equipment, such as gas lines or HVAC units, which have electrical or gas connections.

## PART 2 – PRODUCTS

### 2.01 Membrane

- A. EverGuard® TPO (smooth) thermoplastic polyolefin membrane.
- B. EverGuard® TPO Fleece-Back (FB) thermoplastic polyolefin membrane.
- C. EverGuard Extreme® TPO (smooth) thermoplastic polyolefin membrane.
- D. EverGuard Extreme® TPO Fleece-Back (FB) thermoplastic polyolefin membrane.
- E. EverGuard® PVC (smooth) thermoplastic membrane.
- F. EverGuard® PVC Fleece-Back (FB) thermoplastic membrane.

### 2.02 Flashing

- A. EverGuard® membrane flashing should be of the same type and thickness as the roofing membrane. EverGuard® Freedom™ TPO can be used with EverGuard® TPO membrane for flashing in the same thickness as the field membrane.
- B. Caution: Because colored TPO membranes may exhibit different welding characteristics, test welds should be performed to determine best weld speeds and temperatures to ensure a good weld bond.
- C. EverGuard® TPO and PVC FB membranes may be used as optional flashing membranes for all TPO and PVC roof systems, respectively. FB membranes may also be a solution when a contaminated substrate is encountered.

# DESIGN & APPLICATION GUIDELINES: ADHERED ROOFING SYSTEMS

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## 2.03 Flashing Accessories

- A. EverGuard® PVC or TPO pre-formed flashing accessories must be made of the same material as roofing membrane.
- B. For a full listing and descriptions of the latest EverGuard® TPO and EverGuard Extreme® TPO preformed flashing accessories, see the appropriate Product Data Sheets for the specific membranes you are working with.
- C. All EverGuard® accessories must be stored indoors and protected from moisture and extreme temperatures. See specific instructions on packaging for further details.

**Note:** EverGuard Extreme® flashings and accessories are required for use with EverGuard Extreme® membranes.

## 2.04 Fasteners

- A. DRILL-TEC™ membrane fasteners and plates, insulation fasteners and plates, and flashing fasteners and termination bars. Refer to the Insulation Attachment Table and the appropriate Membrane Attachment Table in this manual for the correct type, length, and diameter of fastener.
- B. Use fasteners that are suitable for the deck type, and ensure the deck is of the required thickness and condition to ensure reliable installation and performance.
- C. Fasteners used in flashings should be dictated by the substrate.

## 2.05 Adhesives, Sealants, Primers, and Cleaners

- A. Adhesives
  - 1. Solvent-based
    - a. EverGuard® TPO Bonding Adhesive for TPO smooth membranes and insulation.
    - b. EverGuard® PVC (Low VOC) Bonding Adhesive for PVC smooth membranes and FB membranes.
    - c. EverGuard® TPO Low VOC Bonding Adhesive for TPO smooth membranes.
  - 2. Water-based
    - a. EverGuard® WB 181 Water-Based Bonding Adhesive for smooth TPO membranes, TPO FB membranes, and PVC FB membranes.
  - 3. EverGuard® Low-Rise Foam (LRF) Adhesives:
    - a. LRF-M (membrane and insulation)
    - b. LRF-O (membrane only)
    - c. OlyBond® (insulation only)
    - d. GAF 2-Part Roofing Adhesive (membrane and insulation)
  - 4. Hot Asphalt
    - a. Use ASTM D312, Type III or Type IV asphalt.
    - b. Apply asphalt at the rate of 25 lbs. (11.3 kilograms) per 100 sq. ft. (9.2 sq. m.) over the entire surface to which the board is to be adhered.
    - c. If the substrate surface is rough or porous, such as an existing flood coat and gravel surfacing, additional asphalt may be required. Ensure existing gravel and dirt is vacuumed, power-broomed or power-washed away.

d. Apply asphalt at its EVT temperature to obtain a proper bond, typically within the range of 425°F (218°C) to 475°F (246°C).

- e. Walk in the boards after installation to ensure a proper bond.
- f. Maximum board size is 4' x 4' (1.2 m x 1.2 m).
- g. Hot asphalt application requires priming of concrete and gypsum decks and existing asphaltic roofing systems.
- h. Hot asphalt may be used only to adhere EverGuard® FB membranes.

## B. Sealants

- 1. EverGuard® Two-Part, urethane-based and EverGuard® One-Part Pourable Sealants for use in sealant (pitch) pans.
- 2. TOPCOAT® FlexSeal™ Caulk Grade, a white, solvent-based synthetic elastomeric sealant for use behind termination bars, stainless steel clamps, drain bowls, and other areas between the substrate and membrane. FlexSeal™ is also available in a low-viscosity version called FlexSeal™ LV.
- 3. EverGuard® TPO Cut Edge Sealant.

## C. Primers

- 1. EverGuard® TPO Primer.
- 2. GAF Asphalt Primer for use with EverGuard® FB membranes.

## D. Cleaners

- 1. EverGuard® CleanWeld™ Conditioner (a low VOC cleaner).
- 2. EverGuard® TPO Seam Cleaner.

## 2.06 Traffic Protection

- A. EverGuard® TPO Walkway Roll. This product is designed to be heat-welded to the top of GAF TPO roofing membranes. The Walkway Roll is available in standard gray or "safety" yellow with a "diamond tread" pattern, and comes in 34.25" x 50' (870 mm x 15.2 m) rolls. The EverGuard® TPO Walkway Roll features a 2" (51 mm) welding strip (smooth border) along each longitudinal edge that is compatible with hand- or automatic welders.
- B. EverGuard® PVC Walkway Pads. This product heat-welds directly to GAF EverGuard® PVC roofing membranes. The Walkway Pad is available in standard gray with a "herringbone" traction surface, and comes in 30" x 36" (762 mm x 914 mm) pads.

## 2.07 Insulation

- A. The selection of insulation type, thickness, and configuration is the responsibility of the architect, engineer, owner or roof consultant. GAF reserves the right to accept or reject any roof insulation as an acceptable substrate for GAF roof systems. GAF EnergyGuard™ insulations must be used in roofing systems to be guaranteed by GAF.
- B. EnergyGuard™ foam insulations of the types listed below are acceptable. The actual minimum thickness of insulation will depend on flute spacing. Refer to specific Product Data Sheets for further information. Board size can be 4' x 4' or 4' x 8' (1.2 m x 1.2 m or 1.2 m x 2.4 m) panels for mechanical attachment, and 4' x 4' (1.2 m x 1.2 m) for adhered attachment and tapered panels.

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1. EnergyGuard™ Polyisocyanurate Insulation with glass-based facer meeting or exceeding the requirements of ASTM C1289 (min. 16 psi [1.1 kg/cm] compressive strength).
2. EnergyGuard™ Extruded Polystyrene Insulation meeting or exceeding the requirements of ASTM C578, Type II nominal 1.5 pound (42 gram/cubic cm) density and minimum 15 psi (1.0 kg/cm) compressive strength. (Requires cover board.)
3. EnergyGuard™ Expanded Polystyrene Insulation with plastic facer meeting or exceeding the requirements for ASTM C578, Type II nominal 1.5 pound (42 gram/cubic cm) density and minimum 15 psi (1.0 kg/cm) compressive strength. (Requires cover board.)

C. The following additional insulations are acceptable for use in roofing systems to be guaranteed by GAF:

## Perlite

(ASTM C728/FS HH-1-529) Perlite may be used as a base insulation and cannot be used with bonding adhesives.

EnergyGuard™ Perlite Roof Insulation

EnergyGuard™ Perlite Re-cover Board

EnergyGuard™ Perlite Roof Insulation (tapered)

EnergyGuard™ Tapered Edge Strip

## Fiber Board

(ASTM C208/FS LLL-1-535b, Class C)

Blue Ridge Structodek® High Density Fiberboard Roof Insulation. Wood fiber board is appropriate for use with bonding adhesives and low-rise foam adhesives.

## Polyisocyanurate

(ASTM C1289 Type II, Class 1/FS HH-1-972, Class 1)

EnergyGuard™ Polyiso Insulation, as above.

EnergyGuard™ Tapered Polyiso Insulation

## Perlite/Polyisocyanurate/Wood Fiber Composites

(FS HH-1-1972, Gen./FS HH-1-1972, 3)

## EnergyGuard™ Composite Board Polyiso Insulation

**EnergyGuard™ Tapered Composite Board Insulation**

D. For Insulation/Guarantee Requirements for EverGuard® extended-length guarantees, refer to page 4 of this manual.

**Note:** EnergyGuard™ Tapered Composite Board is manufactured in various areas with either a perlite or wood fiber top layer. Contact your nearest GAF sales office for additional information.

## 2.08 High Traffic Applications

- A. EnergyGuard™ foam insulation of the following types in a minimum 1" (25 mm) thickness. However, actual thickness will be dependent on flute spacing. Board size can be 4' x 4' or 4' x 8' (1.2 m x 1.2 m or 1.2 m x 2.4 m) panels for mechanical attachment, and 4' x 4' (1.2 m x 1.2 m) for adhered attachment and tapered panels.
  1. EnergyGuard™ Polyisocyanurate Insulation with glass-based facer meeting or exceeding the requirements of ASTM C1289 (min. 25 psi [1.8 kg/cm] compressive strength).
  2. EnergyGuard™ Extruded Polystyrene Insulation (XPS) meeting or exceeding the requirements of ASTM D578, Type IV (min. 25 psi [1.8 kg/cm] compressive strength). (Requires cover board.)
  3. EnergyGuard™ Expanded Polystyrene Insulation (EPS) with plastic facer meeting or exceeding the requirements of ASTM D578, Type IX (min. 25 psi [1.8 kg/cm] compressive strength). (Requires cover board.)

## 2.09 Cover/Re-cover Boards

- A. EnergyGuard™ Perlite Insulation, minimum 1/2" (13 mm), ASTM C728. (To be used only with fleece-back membrane applied in hot asphalt.)
- B. Blue Ridge Structodek® High Density Fiberboard Roof Insulation, minimum 1/2" (13 mm), meeting or exceeding the requirements of ASTM C208, Class E.
- C. EnergyGuard™ Foam Re-Cover Board of the following types: board size can be 4' x 4' or 4' x 8' (1.2 m x 1.2 m or 1.2 m x 2.4 m) panels for mechanical attachment and 4' x 4' (1.2 m x 1.2 m) for adhered attachment and tapered systems.
  1. EnergyGuard™ HD 1/2" (13 mm) Polyisocyanurate Insulation Re-Cover Board with glass-based facer meeting or exceeding the requirements of ASTM C1289 ( $\geq 80$  psi [5.6 kg/cm] compressive strength).
  2. EnergyGuard™ HD PLUS 1/2" (13 mm) Polyisocyanurate Insulation Re-Cover Board with glass-based facer meeting or exceeding the requirements of ASTM C1289 ( $\geq 110$  psi [7.7 kg/cm] compressive strength).
- D. SECUROCK® Roof Board is available in 1/4" (6.3 mm), 3/8" (9.5 mm), and 5/8" (16 mm) thicknesses. It can be used as a fire barrier, an overlay board, or as a re-cover board.
- E. DensDeck®, DensDeck® Prime™, and DensDeck® DuraGuard™ Roof Boards (ASTM C1177) are available in 1/4" (6 mm), 1/2" (13 mm), and 5/8" (16 mm) thicknesses.

**Note:** Roof boards sold and distributed by GAF are acceptable for use in various roof systems as overlay and re-cover boards. Refer to individual GAF Roof System Specification sections for limitations on the use of these insulation materials.

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## 2.10 Base Sheets

The use of the following base sheets may also be appropriate with hot-asphalt applications of fleece-back membranes:

- A. GAFGLAS® Stratavent® Eliminator™ Nailable Base Sheet
- B. GAFGLAS® #80 Ultima™ Base Sheet
- C. GAFGLAS® #75 Base Sheet
- D. GAFGLAS® Stratavent® Eliminator™ Perforated Base Sheet

## 2.11 Other Accessories

A. Subject to compliance with requirements, provide the following products not available from GAF:

- 1. Wood Nailers: New wood nailers must be #2 or better quality lumber. Do NOT use asphaltic or creosote-treated lumber.
- 2. Roofing Nails: Galvanized or non-ferrous type and size as required to suit application.
- 3. Temporary Sealant: Polyurethane foam sealant or similar as required to provide temporary watertight sealing of roofing.
- 4. Air/Vapor Barrier: Polyethylene sheeting, min. 6 mil. for TPO only when covered with mechanically attached insulation.
- 5. Fire Barrier: Water-resistant gypsum board, min.  $\frac{1}{4}$ " (6.3 mm) thick.

# PART 3 – EXECUTION

## 3.01 Site Conditions

- A. Obtain verification that the building structure can accommodate the added weight of the new roofing system.
- B. Confirm the adequacy of the new roofing system to provide positive slope to drain. Eliminate ponding areas by the addition of drainage locations or by providing additional pitch to the roof surface.
- C. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.
- D. All defects in the roof deck or substrate must be corrected by the responsible parties before new roofing work commences. Verify that the deck surface is dry, sound, clean and smooth, free of depressions, waves, or projections.
- E. Protect building surfaces against damage and contamination from roofing work.
- F. Where work must continue over completed roof areas, protect the finished roofing system from damage.
- G. Deck preparation is the sole responsibility of the building owner or roofing contractor. All defects in the roof deck or substrate must be corrected before roofing work commences.

H. In addition, for EverGuard Extreme® TPO Roof Systems, buildings greater than 100' (30.5 m) in height must have a minimum 3' (914 mm) parapet wall to be eligible for an extended length Diamond Pledge™ 25-, 30-, or 35-year NDL Roof Guarantee. This is also a requirement for standard EverGuard® TPO membranes with an extended-length guarantee.

## 3.02 Preparation of Roofing Area – New and Tear-off Applications

- A. Remove all existing roofing materials to the roof decking, including flashings, metal edgings, drain leads, pipe boots, and pitch pockets, and clean substrate surfaces of all asphalt and adhesive contaminants.
- B. Confirm the quality and condition of the roof decking by visual inspection. Fastener pull-out testing must be conducted by the roof fastener or low rise foam manufacturer, as applicable.
- C. Remove abandoned equipment and equipment supports.
- D. Confirm that height of equipment supports will allow the installation of full-height flashings.
- E. Air Barriers – EverGuard® extended-length TPO Roof Systems
  - 1. EverGuard® TPO Roof Systems require an air retarder where large wall openings greater than 10% of a total wall area can be open during a wind storm, including opening due to storm damage. Refer to Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29 for specific installation procedures.
- F. For extended-length guarantees, a new roof construction or tear-off is required. For tear-offs, remove all existing roofing materials to the roof deck. This includes flashings, metal edgings, drain leads, pipe boots, and pitch pockets.

## 3.03 Preparation of Roofing Area – Re-cover Applications

- A. Remove all stone ballast, loose gravel, and debris from the roof surface.
- B. Remove blisters and ridges from the roof membrane.
- C. When re-covering over an existing single-ply roof, that roof must be first cut into maximum 10' x 10' (3 m x 3 m) areas first, before the application of new slip sheet and/or membrane. PVC must be separated from existing PVC roofs. This includes roofs that have active sealants, including asphalt cement or other non-compatible materials. This can be accomplished by installing a slip sheet, insulation, cover board, or fleece-back PVC or TPO membrane.
- D. Remove all existing flashings, including metal edgings, drain leads, pipe boots, and pitch pockets, and clean substrate surfaces of all asphalt and adhesive contaminants. Dry-hung wall flashings are an option if the wall/curb flashings are in good condition and tightly adhered to the substrate. New TPO and PVC flashing materials may be installed over these to a height of 24" (610 mm) without adhesives; in addition, new PVC flashing materials must be installed over a layer of 3 oz (85 gr) polymat or insulation board.

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- E. The existing roof surface must be free of visible moisture, such as ponding water, ice, or snow.
- F. It is strongly recommended that the building owner have a moisture survey performed to ascertain the condition and suitability of the existing roofing materials to receive a re-cover system. A survey is required if perlite or wood fiber insulation is used in a re-cover system. GAF will not be responsible for damage to the roofing system resulting from moisture in the existing roofing system. Remove and replace all existing roofing materials that contain moisture.
- G. Confirm quality and condition of roof decking by visual inspection if possible, and by fastener pull-out testing. Remove and replace all deteriorated decking.
- H. Test cuts
  - 1. There is no substitute for quality materials and workmanship. Should cuts be required for testing purposes, take cuts before the membrane is installed so that proper and adequate repairs can be accomplished.
  - 2. Take test cuts to verify the existing roof construction and condition. Three test cuts should be made for roofs under 100 squares (929 sq. m) and one test cut per 100 squares (929 sq. m) above the minimum amount.
  - 3. GAF will not comment on the results of any test cut that cannot be shown to be statistically representative of the roofing system.
  - 4. The party requesting test cuts from roof must assume all responsibility for any detrimental effects of said test cuts.
- I. Remove abandoned equipment and equipment supports.
- J. Raise equipment supports to allow the installation of full-height flashings.
- K. Re-cover installation over coal tar pitch roofs requires that the existing loose gravel be broomed (do not spud); if high spots remain, use a thicker insulation board to provide a smooth substrate for the EverGuard® membrane. Re-cover with EverGuard® TPO membranes over coal tar pitch roofs require the installation of a minimum 1" (25 mm) re-cover board prior to the installation of the membrane. Do not use EPS/XPS over coal tar pitch roofs. A minimum 1.5" (38 mm) re-cover board is required for PVC applications.
- L. Surface preparation over Coal Tar Pitch (CTP)
  - 1. CTP must be cleaned mechanically (not by hand) with vacuuming, power washing or power brooming equipment.
  - 2. When using LRF-M, OlyBond®, or GAF 2-Part Roofing Adhesive, a pull-out test must be completed and the adhesive bead spacing pattern must be approved by a GAF Field Services Manager. Contact GAF Technical Services for compatibility and surface preparation instructions over CTP or gravel-surfaced BUR.
- M. Surface preparation over Smooth-Surface BUR
  - 1. When adhering EverGuard® fleece-back membrane to a smooth-surface built-up roof (BUR) – with or without coatings – a pull-out test must be completed first. When using low rise foam adhesives, contact the appropriate low rise foam adhesive manufacturer for pull-out tests and submit the results to GAF Technical Services.
  - 2. All asphaltic surfaces must be clean, dry, and acceptable for use with GAF Asphalt Primer.

## 3.04 Wood Nailer Installation

### A. Acceptable Material

- 1. Solid Blocking: Non-pressure treated wood as required, #2 Grade or better, nominal 1 1/4" (30 mm) x 4" (102 mm) with a minimum thickness of 3 1/2" (88 mm).

- 2. Shim Material: Plywood, 1/2" (13 mm) x width to match solid blocking.

### B. Existing Nailers

Verify the condition of existing roof nailers and anchor to resist 250 lb. per ft. (550 kg) load applied in any direction.

- 1. DRILL-TEC™ HD screws 18" (457 mm) o.c. attachment to structural wood, steel decks with a 1" (25 mm) thread embedment.

- 2. DRILL-TEC™ spikes or HD screws 18" (457 mm) o.c. attachment to concrete decks. Min. 1" (25 mm) shank or thread penetration.

- 3. Wood nailers attached to gypsum, concrete, cellular concrete and cementitious wood fiber must be fastened 12" (305 mm) o.c., through the naler into the substrate with substrate-approved DRILL-TEC™ fasteners.

- 4. Three anchors per length of wood naler minimum.

### C. New Nailers

Anchor to resist 250 lb. per ft. (550 kg) load applied in any direction.

- 1. DRILL-TEC™ HD screws 18" (457 mm) o.c. attachment to structural wood and steel decks with a 1" (25 mm) thread embedment.

- 2. DRILL-TEC spikes or HD screws 18" (457 mm) o.c. attachment to concrete decks. Min. 1" (25 mm) shank or thread penetration.

- 3. Wood nailers attached to gypsum, concrete, cellular concrete and cementitious wood fiber must be fastened 12" (305 mm) o.c., through the naler into the substrate with substrate-approved DRILL-TEC™ fasteners.

- 4. Three anchors per length of wood naler minimum.

### D. Shim Material

Secure simultaneously with overlying solid wood naler.

- 1. Shim material must be continuous. Do NOT use spaced shims.

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E. Slippage of mop-applied systems may occur when roof slope exceeds 1/2:12. On slopes greater than 1/2:12, use Type IV asphalt only. If roof slope is greater than 1/2:12 but less than 2:12, use wood nailers at the eave, at the ridge, and at intermediate spacing of no more than 16 ft. (4.9 m). If roof slope is 2:12 to 3:12, use wood nailers at the eave, at the ridge, and at intermediate spacing of no more than 8 ft. (2.4 m). Maximum roof slope is 3:12. Nailers installed on slopes between 1/2:12 to 3:12 serve as insulation stops and should be of the same thickness as the insulation.

## 3.05 Gypsum Board Installation

### A. General

1. Gypsum fire barrier board must typically be installed when required by design professional or code authority to address code or approval requirements. For EverGuard® adhered systems, SECUROCK® Roof Board or DensDeck® Prime Roof Boards must be specified for a GAF guarantee.

### B. Placement

1. Butt gypsum boards together with a 1/4" (6.3 mm) maximum space between adjoining boards. Fit gypsum boards around penetrations and perimeter with a 1/4" (6.3 mm) maximum space between board and penetration.
2. Install gypsum boards in pieces a minimum of 2' x 2' (610 mm x 610 mm) in size.
3. Gypsum boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over flute surface for bearing support.
4. Do NOT use gypsum boards that are wet, warped or buckled; they must be discarded. Insulation boards that are broken, cracked, or crushed must not be installed unless the damaged area is first removed and discarded.
5. Remove and replace gypsum boards that become wet or damaged after installation.
6. Install no more gypsum board than can be properly covered by the end of each day with roofing membrane.

### C. Securement

#### 1. Mechanical Attachment

- a. Use appropriate type and length of DRILL-TEC™ fastener for structural deck type. See Insulation Attachment Table in this manual.
- b. Install required number of fasteners per board size, and type of roofing system installed. Refer to the construction details in this manual.
- c. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
- d. Install fastener so as to firmly imbed the plate to the insulation surface without over-driving.
- e. Additional fasteners must be installed in corner/perimeter roof areas for all EverGuard® systems.

### 2. Hot Asphalt

- a. Use ASTM D-312, Type III or Type IV asphalt.
- b. Apply asphalt at the rate of 25 lbs. (11.3 kilograms) per 100 sq. ft. (9.2 sq. m) +/- 20 percent over the entire surface to which the board is to be adhered.
- c. If the substrate surface is rough or porous, such as an existing flood coat and gravel surfacing, additional asphalt may be required. Ensure existing gravel and dirt is vacuumed, power-broomed or power-washed away.
- d. Apply asphalt at its EVT temperature (+/- 25°F, 13.9°C) to obtain a proper bond, typically within the range of 425°F (218°C) to 475°F (246°C).
- e. Walk in the boards after installation to ensure a proper bond.
- f. Maximum board size is 4' x 4' (1.2 m x 1.2 m).
- g. Hot asphalt application requires priming of concrete and gypsum decks and existing asphaltic roofing systems.

### 3. Foam Adhesive

When installing crickets, saddles or cut tapered insulation panels, it may be advantageous to use GAF OlyBond®, GAF 2-Part Roofing Adhesive, or LRF-M adhesive in lieu of mechanical attachment.

- a. Depending on foam adhesive type, apply adhesive in minimum 1" (25 mm) wide, wet continuous bead, according to the manufacturer's instructions. When using GAF 2-Part Roofing Adhesive, a 2.5" (62 mm) wide, wet continuous bead is required. Application temperature restrictions for these products are 40°F (22°C) and rising.
- b. For buildings up to 34 ft. (10 m) in height or less and 200 ft. (60 m) wide or less, a 5 ft. (1.5 m) perimeter with 6" (152 mm) bead spacing is required. For buildings from 34 ft. (10 m) to 100 ft. (30 m) in height and 200 ft. (60 m) wide or less, a 10 ft. (3 m) perimeter with 6" (152 mm) bead spacing is required. For buildings taller or wider than the dimensions above, refer to GAF's Low-Rise Foam (LRF) Adhesive Securement Table in this manual.
- c. Apply the proper grade adhesive based on current air and surface temperatures.
- d. Walk in the boards after installation to ensure a proper bond.
- e. Maximum board size: 4' x 4' (1.2 m x 1.2 m) for polyiso insulation only.
- f. Maximum board size for SECUROCK® Roof Board, DensDeck®, or 1/2" (12 mm) gypsum board can be 4' x 8' (1.2 m x 2.4 m).

**Note:** For more information on low rise adhesives, refer to GAF's Low-Rise Foam (LRF) Adhesive Securement Table in this manual.

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## 3.06 Air/Vapor Retarder Installation

### A. General

1. Air/vapor retarder components must typically be installed when required by design professional to address internal building air pressure or humidity conditions.
2. Designers should consider requiring air retarders:
  - a. On all air porous decks, with openings in the walls or area directly below the roof deck that exceeds 10% of the total wall area.
  - b. When the internal pressurization of the building is in excess of 5 lbs. per sq. ft. (239 Pa).
  - c. When the building height exceeds 100 ft. (30.5 m).
  - d. When buildings have large openings & overhangs.
  - e. In conditions where positive internal pressure is applied suddenly, as may be the case at aircraft hangers or distribution centers – otherwise, the roofing system may fail due to pressure impact.
3. Refer to FM Global Loss Prevention Data Sheets 1-28 and 1-29 for specific installation procedures for all roofs with large openings.
4. For roofs to be guaranteed by GAF:
  - a. Air retarders are required for all extended-length guarantees on buildings where large wall openings greater than 10% of the total wall area can be open during a windstorm, including opening due to storm damage.

### B. Air/Vapor Retarder Application - Loose-Applied

1. Install the air/vapor retarder components loose-applied to the deck or fire-barrier board so that wrinkles and buckles are not formed.
2. Overlap air/vapor retarder components per applicable installation recommendations of the supplier. If minimum 6 mil polyethylene is used, overlap a minimum of 6" (152 mm).
3. Seal perimeter and penetration areas with foam sealant.
4. Seal all perimeter nailers with adhered roof membrane placed over the nailer and covering the exterior face of the nailer by 1" (25 mm).
5. Install insulation boards over the air/vapor retarder and mechanically attach the boards to the deck.

### C. Air/Vapor Retarder Application - Adhered

1. Apply compatible adhesive to the structural deck or fire-barrier board per air vapor retarder manufacturer's recommendations.
2. Install the air/vapor retarder components into the adhesive that is applied to the deck or fire-barrier board so that wrinkles and buckles are not formed. Broom air/vapor retarder components to ensure embedment into the adhesive.
3. Overlap air/vapor retarder sheet a minimum of 6" (152 mm) for side and end laps. Adhere laps together with compatible adhesive.
4. Seal perimeter and penetration areas with foam sealant.
5. Install insulation boards over the air/vapor barrier and mechanically attach the boards to the deck or adhere the boards to the air/vapor retarder with compatible adhesive to achieve the desired roof system uplift resistance.

## 3.07 Base Sheet Installation

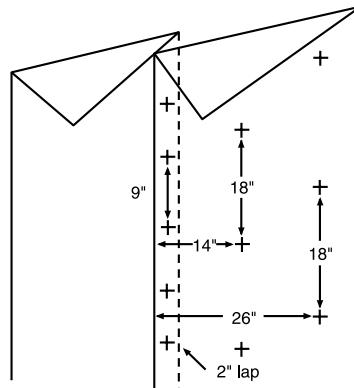
### A. General

1. Fiberglass base sheet shall typically be installed over all nailable substrates other than gravel-surfaced built-up roofing whenever insulation, re-cover board, or fire barrier board is installed in hot asphalt.
2. Nailable base sheet shall be applied over substrates that are not suitable for asphalt adhesion.
3. Install base sheet so that wrinkles or buckles are not formed.
4. Overlap the base sheet a minimum of 2" (51 mm) for side laps and 6" (152 mm) for end laps.

### B. Mechanical Securement- Nailable Base Sheet

1. Secure venting nailable base sheet through existing substrate to the deck. Use appropriate type and length of fastener for structural deck type, and install required number of fasteners in accordance with Figure 1.

Figure 1



2. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
3. Install fasteners such that the fastener plate is pulled flush with the venting base sheet surface and lies flat to the deck surface.

## 3.08 Re-cover Board/Insulation Installation

### A. General

1. Refer to section 2.09 of this manual for specific GAF requirements on cover/re-cover boards.
2. Install insulation board and re-cover board as required in accordance with the Design Table in this manual.
3. The use of an overlay board is required for all membrane applications adhered in hot asphalt over polystyrene insulations. The overlay board must either have all joints taped prior to installation of the roofing membrane, or a layer of red rosin sheathing paper must be installed between the layers of insulation. Roof tape, if required over insulation joints, shall be laid evenly, smoothly, and embedded in a uniform coating of hot steep asphalt with 4" (100 mm) end laps. Care must be taken to ensure smooth application of tape, and full embedment of the tape in the asphalt.

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- a. Perlite is only acceptable as a re-cover board when the membrane is installed in hot asphalt.
- b. Application of the asphalt and tape may be made by either "back mopping" the tape and pressing the tape into place, or by using a taping machine (small felt layer), which will apply asphalt to the tape in a continuous operation.

## B. Placement

1. Butt insulation boards together with a  $\frac{1}{4}$ " (6.3 mm) maximum space between adjoining boards. Fit insulation boards around penetrations and perimeter with a  $\frac{1}{4}$ " (6.3 mm) size maximum space between board and penetration. Do not kick insulation boards into place.
2. Install insulation boards in pieces a minimum of 2' x 2' (610 mm x 610 mm) in size. Every piece must be properly secured to the substrate.
3. Insulation boards installed in multiple layers must have the joints between boards staggered in all directions a minimum of 6" (152 mm) between layers.
4. Insulation boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over flute surface for bearing support.
5. Install tapered insulation to provide a sump area with a minimum area of 36" x 36" (914 mm x 914 mm) where applicable.
6. Do NOT install insulation boards that are wet, warped, or buckled; they must be discarded. Insulation boards that are broken, cracked, or crushed must not be installed unless the damaged area is first removed and discarded.
7. Remove and replace insulation boards that become wet or damaged after installation.
8. Install no more insulation than can be properly covered by the end of each day with roofing membrane.
9. EPS, XPS or polyiso insulation may be used to fill in flutes of steel decking when used in conjunction with a cover board.

## C. Securement

### 1. Mechanical Attachment of Insulation

- a. Use appropriate type and length of DRILL-TEC™ fastener for structural deck type. See Insulation Attachment Table in this manual.
- b. Install required number of fasteners per insulation type, board size, and type of roofing system installed.
- c. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
- d. Install fastener so as to firmly imbed the plate to the insulation surface without over-driving.
- e. Use fastener of correct length as required by the Insulation Attachment Table in this manual.

## 3.09 Adhered Securement

### A. Hot Asphalt

1. Use ASTM D-312, Type III or Type IV asphalt.

2. Apply asphalt at the rate of 25 lbs. (11.3 kilograms) per 100 sq. ft. (9.2 sq. m) over the entire surface to which the board is to be adhered.
3. Asphalt application rates of up to 60 lbs. (27 kg) per 100 sq. ft. (9.2 sq. m) may be required if the substrate surface is rough or porous, such as an existing flood coat and gravel surfacing. Ensure existing gravel and dirt is vacuumed, power-broomed, or power-washed away.
4. Apply asphalt at its EVT temperature to obtain a proper bond, typically within the range of 425°F (218°C) to 475°F (246°C).
5. Walk in the boards after installation to ensure a proper bond.
6. Maximum board size is 4' x 4' (1.2 m x 1.2 m).
7. Hot asphalt application requires priming of concrete and gypsum decks and existing asphaltic roofing systems.

### B. Adhered Securement – Foam

1. Ribbon-adhere insulation with LRF adhesive with the ribbons spaced 12" (305 mm) o.c. maximum for the field of the roof, and 6" (152 mm) o.c. maximum for perimeters and corners. Adhesive must be applied at a width of 1" (25 mm) wet ribbon. For further details, refer to GAF's Low-Rise Foam (LRF) Adhesive Securement Table in this manual. When using GAF 2-Part Roofing Adhesive, a 2.5" (62 mm) wide, wet continuous ribbon is required.
2. Adhesive ribbons must be evenly spaced at the rate required for the specification.
3. Apply adhesive when the air and surface temperatures are 40°F (22°C) and rising.
4. Additional adhesive ribbons must be installed in perimeter and corner roof areas, according to GAF specifications. A 6" (152 mm) o.c. ribbon spacing is required in perimeter areas for all standard GAF guarantees. Section 3.05 C 3 b. defines perimeter areas based on building heights.
5. Walk in the insulation boards after installation to ensure a proper bond.
6. Maximum board size is 4' x 4' (1.2 m x 1.2 m) for polyiso only.

### C. Crickets and Saddles

1. When installing crickets, saddles, or cut tapered insulation panels, it may be advantageous to use GAF OlyBond®, GAF 2-Part Roofing Adhesive, or LRF-M Adhesive in lieu of mechanical attachment. See Section 3.05 C 3. Foam Adhesive for more information.

## 3.10 Membrane Installation

Substrates must be inspected and accepted by the contractor as suitable to receive and hold roof membrane materials.

**Note:** EverGuard Extreme® has a light gray backer sheet to distinguish it from regular TPO membrane. It is the contractor's responsibility to install EverGuard Extreme® where specified on the roof; i.e., under highly reflective glass or metal, or wherever the high temperature performance of the membrane is required.

### A. Placement

1. Place roof membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent securement.

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2. Full-width rolls can be installed throughout the field and perimeter of the roof.
3. Overlap roof membrane a minimum of 3" (76 mm) for side and end laps of adhered systems that utilize smooth reinforced membrane. Membranes are provided with lap lines along the side laps; the red line is for adhered and ballasted systems overlap. PVC does not have an adhered line.
4. Best practice is to install membrane so that the side laps run across the roof slope lapped toward drainage points. Butt ends of fleece-back membrane, if possible.
5. All exposed sheet corners must be rounded a minimum of 1" (25 mm).
6. All cut edges of reinforced TPO membrane must be sealed with EverGuard® TPO Cut Edge Sealant.
7. Overlap roof membrane a minimum of 3" (76 mm) for end laps of EverGuard® PVC and TPO membranes. End laps for EverGuard® fleece-back membranes are made by butting adjacent sheets and heat welding an 8" (203 mm) wide EverGuard® TPO reinforced membrane flashing strip over the joints. For PVC membranes, cut a flashing strip of smooth PVC membrane of the same thickness as the field sheet.

#### B. Supplemental Securement

1. Roof membrane must be mechanically secured at the perimeter, at the base of internal walls and curbs, and at all penetrations with DRILL-TEC™ Membrane Fasteners and Plates at a 12" (305 mm) o.c. maximum spacing. Membrane may be heat welded to coated metal flanges.
- Note:** a minimum of 4 fasteners per penetration is required.
2. Alternatively, membrane may be extended vertically 3" (76 mm) up walls and curbs and secured to the wall/curb substrate within 2" (51 mm) of the plane of the roof with DRILL-TEC™ Membrane Fasteners and inverted Termination Bar at a 12" (305 mm) o.c. maximum spacing. This detail is required to be used for all pressurized buildings.
3. Mechanically attach membrane with screws and plates to the roof deck at locations of deck angle changes in excess of 1" in 12" (25 mm in 305 mm).
4. Fasteners must be installed to achieve the proper embedment depth. Install fasteners vertical to the deck, or horizontal to the wall/curb without lean or tilt.
5. Install fasteners so that the plate is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate/termination bar to move (under-driving), but will not cause wrinkling of the membrane (over-driving).
6. Alternately, utilization of Roof Transition Anchor (R.T.A.) Strip may be installed as the method of supplemental securement per detail for a non-penetrating base attachment detail on adhered TPO systems.

#### C. Cold Bonding Adhesive—Smooth Reinforced Membrane

1. When using EverGuard® TPO and PVC bonding adhesives, use any one of the following substrates: polyisocyanurate insulation (w/o foil facer), high density wood fiber board, gypsum, cured structural concrete absent of curing and sealing compound, untreated OSB, untreated CDX plywood, Type X gypsum board, and dry, sound masonry absent of curing or sealing compounds. For best results use a 3/8" (9.5 mm) solvent-resistant nap roller, brush, or squeegee. When using a roller, avoid taking the roller head out of the bucket, dropping it in one place, and beginning to roll. Instead, remove the roller filled with adhesive and drop the roller on three areas to be glued, and then connect the adhesive drop areas. This will avoid an excess amount of adhesive in one place, and it will flash off faster and more uniformly. When spraying bonding adhesive, refer to GAF adhesive product data sheets for viscosity. Contact spray equipment manufacturer for proper nozzle tip sizes and flow rates.
2. Application of bonding adhesive
  - a. Apply bonding adhesive to both the substrate surface and the underside of the roof membrane.
  - b. GAF EverGuard® Low VOC Bonding Adhesive is designed for smooth TPO membranes only and features a coverage rate of 500-600 sq. ft. (47-56 sq. m) per five-gallon (19 liter) bucket. This adhesive features a fast-drying solvent system, which is typically 10-20 minutes at typical application temperatures.
  - c. EverGuard® Solvent-Based Bonding Adhesive for TPO and PVC smooth membranes only features a coverage rate of about 120 sq. ft./gal. (11.2 sq. m/liters). This will cover both surfaces, yielding 60 sq. ft. (5.6 sq. m) of finished, mated surface per gallon for standard solvent-based bonding adhesives.
  - d. EverGuard® WB 181 Water-Based Bonding Adhesive for EverGuard® TPO smooth membranes are applied at a rate of 200 sq. ft./gal. (7.4 sq. m/liter). Covering both surfaces will yield 100 sq. ft. (9.2 sq. m) of finished, mated surface area per gallon.
3. Apply the adhesive only when the adhesive, substrate, membrane, and outside temperatures are above 40°F (4.4°C) and rising. Application temperatures above 50°F (10°C) are recommended to allow easier adhesive application. Water-based adhesives are approved for use with smooth and fleece-back TPO and fleece-back PVC membranes only.
4. Please note that solvent-based adhesive must be allowed to dry until tacky to the touch before mating membrane. Water-based adhesive must be allowed to flash off completely. Typically, the sheet must be installed within one hour of applying the water-based adhesive. However, this may vary depending on ambient temperature conditions.
5. Heat-weld all laps in EverGuard® smooth reinforced flashing membrane in accordance with heat-welding guidelines.
6. Porous substrates may require double application of adhesive.

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7. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
8. Adhere approximately one half of the membrane sheet at a time. One half of the sheet's length must be folded back in turn to allow for adhesive application.
9. For solvent-based adhesives, mate membrane to the substrate coated with adhesive once the bonding adhesive has flashed off and is tacky to the touch. Water-based adhesives must be allowed to flash off completely; install membrane within one hour of drying, depending on ambient temperature conditions.
10. Broom membrane to ensure complete bonding between adhesive and membrane.

D. Water-Based Bonding Adhesive – Fleece-Back Membrane

1. Use WB 181 for substrate surface applied with a solvent resistant roller, brush, squeeze or spray equipment. When using EverGuard® TPO WB 181, use any one of the following substrates: polyisocyanurate insulation (w/o foil facer); high density wood fiber board; gypsum roof board; cured structural concrete absent of curing and sealing compound; untreated OSB; untreated CDX plywood; Type X gypsum board, and dry, sound masonry absent of curing or sealing compounds.
2. Adhere membrane sheets with WB 181 at the rate of 120 sq. ft. per gallon (11.2 sq. m/liter) or 600 sq. ft. (56 sq. m) for a 5 gallon (19 liter) bucket. For fleece-back membranes, all of the water-based adhesive goes on the substrate and the sheet is installed in the adhesive wet. This will give you a coverage rate of 1 five gallon bucket for 600 sq. ft. (56 sq. m). Porous substrates may require a double application of adhesive.
3. Roll membrane into adhesive as soon as practical. Do not allow to dry or string.
4. Broom or roll membrane to ensure complete bonding between adhesive and membrane.

E. Low Rise Foam (LRF) Adhesive - Fleece-back Membrane

1. Use LRF adhesives for all fleece-back membrane attachments at prescribed bead spacing. LRF adhesive packaged in cartridges can be applied using a manual hand applicator; battery powered applicator; or, pneumatic powered applicator. LRF adhesive packaged in five-gallon (20 liter) box sets (parts A and B) must be applied using Cyclone or Cyclone II cart for LRF-M adhesive. An OMG PaceCart® or PaceCart 2® must be used for LRF-O adhesives. For more information on LRF application equipment, contact LRF foam manufacturers.
2. Use appropriate LRF adhesives for substrate surface. Do not apply to wet or damp surfaces. When using LRF adhesives, use any one of the following substrates: polyisocyanurate insulation (w/o foil facer), high density wood fiber board, gypsum, cured structural concrete absent of curing and sealing compound, untreated OSB, untreated CDX plywood, Type X gypsum board, and dry, sound masonry absent of curing or sealing compounds. Adhering fleece-back TPO directly to perlite is not recommended. However, perlite can be used as a base/fill layer underneath an appropriate substrate in fleece-back applications.
3. Ribbon-adhere fleece-back membrane sheets with LRF adhesive at ribbons spaced 12" (305 mm) o.c. maximum for the field of the roof, and 6" (152 mm) o.c. ribbons for perimeters and corners. Adhesive ribbons must be applied at a width of 1" (25 mm) wet bead. When using GAF 2-Part Roofing Adhesive, a 2.5" (62 mm) wide, wet continuous bead is required.
4. Cartridge application coverage rate is approximately 1 to 1.5 sq. (100 to 150 sq. ft. or 9.2 m to 14 m) per cartridge. The coverage rates of box sets or cylinder canister sets is 16 to 20 squares (1600 to 2,000 or 147 to 184 sq. m). Rates will vary depending on the substrate.
5. The GAF 2-Part Roofing Adhesive may be used for applying fleece-back membrane in a "spatter pattern." Use of a spatter nozzle is required. For adhering fleece-back membranes, a 3.75 lbs/sq. (18.3 kg/m<sup>2</sup>) thickness is required for full coverage on substrates. The spatter pattern should yield a heavily textured, even coating of approximately  $\frac{1}{4}$ " (6.2 mm) to  $\frac{1}{2}$ " (12 mm) nominal thickness height on the peaks of the spattered adhesive. Minimum ambient and surface temperature must be 40°F (4°C) and rising for all low-rise foam adhesives.
6. Unroll fleece-back TPO sheets in place and fold back sheets in the long dimension to allow adhering of membrane, one half of sheet at a time. Apply adhesive at prescribed rate to the substrate and ALLOW TO FOAM. Close membrane into wet adhesive and roll into place with a segmented, 150 lb. (68 kg) roller. Repeat for other half of sheet. If adhesive contaminates the weld area, immediately clean area with EverGuard® TPO Cleaner or acetone for PVC membrane. See Section G.7 below for more detailed instructions on cleaning up spills.
7. Alternatively, align a full roll of membrane with the factory-applied red line on the previously installed sheet. Roll out the roll approximately 20' (6.1 m) checking to see that the edge of the new roll is straight with the red marked line. Pick up the tail end of the previously rolled-out membrane and pull back over top of the roll of EverGuard® TPO Membrane. Install the LRF to the substrate per application specification. Pull the sheet back to its original position, and roll into place. Make sure that the red line is followed when re-installing the sheet.

**Note:** For further information on low rise adhesives, refer to GAF's Low-Rise Foam (LRF) Adhesive Securement Table in this manual.

F. Hot Asphalt - Fleece-Back Membrane

1. Use appropriate asphalt grade for deck slope, either Type III or Type IV.
2. Adhere membrane sheets with hot asphalt at the rate of 25 lbs. (11.3 kilograms) per 100 sq. ft. (9.2 sq. m). Apply asphalt to substrate surface only. A greater quantity of asphalt may be required based upon the substrate surface condition.
3. Prevent seam contamination by keeping the asphalt application 4" (102 mm) back from the seam area.
4. Roll membrane into asphalt immediately.
5. Broom membrane to ensure complete bonding between asphalt and membrane.
6. For roofs with a slope over 1 $\frac{1}{2}$ :12, contact your GAF Field Services Manager for review prior to installation.

G. Membrane Surface Preparation for Seaming

1. Membrane must be clean of dirt and contaminants, and free from dew, rain, and other sources of moisture. Factory-fresh membrane typically will not require cleaning prior to automatic welding, provided that welding is performed immediately after placement and securing of the membrane.

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2. Membrane that has been exposed for more than 12 hours or has become contaminated will require additional cleaning methods.
3. Light Contamination - Membrane that has been exposed overnight or up to a few days to airborne debris, foot traffic, or dew or light precipitation can usually be cleaned with a white cloth moistened with EverGuard® TPO Cleaner or EverGuard® CleanWeld™ Conditioner (a low-VOC cleaner) or acetone for PVC. Be sure to wait for solvent to flash off prior to welding.
4. Dirt-Based Contamination - Membrane that is dirt encrusted will require the use of a low-residue cleaner, such as Formula 409® and a mildly abrasive scrubbing pad to remove the dirt. This must be followed by cleaning with a white cloth moistened with EverGuard® TPO Cleaner or EverGuard® CleanWeld™ Conditioner (a low-VOC cleaner) or acetone for PVC. Be sure to wait for solvent to flash off prior to welding.
5. Exposure-Based Contamination - Membrane that is weathered or oxidized will require the use of EverGuard® TPO Cleaner or EverGuard® CleanWeld™ Conditioner (a low-VOC cleaner) or acetone for PVC and a mildly abrasive scrubbing pad to remove the weathered/oxidized top surface layer. This must be followed by cleaning with a white cloth moistened with EverGuard® TPO Cleaner or acetone for PVC. Unexposed membrane left in inventory for a year or more may need to be cleaned as instructed above. Be sure to wait for solvent to flash off prior to welding.
6. Chemical-Based Contamination - Membrane that is contaminated with bonding adhesive, asphalt, flashing cement, grease, oil, and most other contaminants usually cannot be cleaned sufficiently to allow an adequate heat-weld to the membrane surface. These membranes should be removed and replaced.
7. If GAF OlyBond®, GAF 2-Part Roofing Adhesive, or LRF-M Adhesive is accidentally spilled on the surface of the finished roof, use the following procedure to remove the adhesive:
  - a. Carefully scrap off the adhesive without rupturing the underlying roof membrane.
  - b. After removal of the adhesive, cover the affected area with either EverGuard® smooth- or fleece-back TPO membrane.
  - c. Weld the smooth edges per specification, or strip in the fleece-back membrane. Use a minimum 6" (152 mm) reinforced smoothed membrane half on the sheet and half on the roof.
  - d. Finish off the process by adding EverGuard® Cut Edge Sealant as needed.

H. Field Seaming

1. Fabricate field seams using a current-generation automatic hot air welding machine and a 10,000 watt voltage-controlled generator at minimum. In addition, fabricate detail seams with automated hot air welders where possible. Outdated welding equipment and inadequate or fluctuating electrical power are the most common causes of poor seam welds.
2. Equipment Settings - The correct speed and temperature settings for automatic welders are determined by preparing test welds at various settings. The welds are tested by application of pressure causing the seam to peel apart. A satisfactory weld will fail by exposing the scrim reinforcement called a "film tearing bond." A deficient weld fails by separating between the two layers of the membrane.
3. Adjustments to Equipment Settings - Many factors will affect the settings: for example, thicker membranes, lower air temperatures, and overcast skies will generally require a slower speed than would be required with thinner membranes, higher air temperatures, and sunny skies. The slower speed provides additional heat energy to compensate for heat-draining conditions. The test weld procedure should be conducted at the beginning of every work period (i.e., morning and afternoon) using bag-fresh material and following a significant change in weather (i.e., air temperature, wind speed, cloud cover.)
4. Membrane laps must be heat-welded together. All welds must be continuous, without voids or partial welds. Welds must be free of burns and scorch marks.
5. The weld width must be a minimum 1" (2.5 mm) to a maximum 1.5" (38 mm) in width for automatic machine welding (robotic welders) for standard GAF guarantees. A minimum welding width of 1.5" (38 mm) is required to comply with FM Global, Miami-Dade County (Florida) and other specifications. In addition, the field seams of all TPO membranes should be made using a robotic welder in the field of the roof.
6. All TPO cut edges must be sealed with EverGuard® TPO Cut Edge Sealant.

### I. Cautions and Warnings:

1. Any attempt to run a robotic welder at a speed greater than 16' (5 m) per minute may result in defective seam welds.
2. Setting the speed of the welder too fast can also pose potential problems with the ability of the operator to maintain control of the welder. This is particularly true in reroofing or over uneven substrates.
3. Robotic welders running too fast may not allow the operator to monitor the 1.5" (38 mm) minimum weld and ensure that critical T-joint areas have been correctly creased.
4. The operator must keep in mind the relationship between ambient temperature and robotic welding speed in order to achieve a spec weld.
5. Increasing the speed of the robotic welder can also compromise the appearance of a non-bonded system.

### 3.11 Flashing Installation

Refer to the construction details at the end of this manual, which depict flashing requirements for typically encountered conditions. Install flashing materials as shown in the construction details.

#### A. General

1. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
2. All coated metal and membrane flashing corners must be reinforced with pre-formed corners or non-reinforced membrane.
3. All flashing membranes and accessories are to be heat-welded to achieve a minimum 2" (51 mm) wide using a hand welder. The weld width must be a minimum 1" (2.5 mm) to a maximum 1.5" (38 mm) in width for automatic machine welding (robotic welders) for standard GAF guarantees. When using robotic welders, refer to section 3.10. H. 5.

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4. All cut edges of reinforced TPO membrane must be sealed with EverGuard® TPO Cut Edge Sealant.
5. When using bonding adhesive, be sure to use adhesive specific to membrane and ambient weather conditions.
6. Minimum flashing height is 8" (203 mm).
7. The maximum distance from the wall that horizontal mechanical attachment is installed is 6" (152 mm). When you must go past 6" (152 mm), move the attachment to the vertical substrate.
8. Installation of EverGuard® PVC flashing membrane over asphalt-based substrates must have a slip sheet or approved insulation boards, metal, wood, etc., under the PVC flashing membrane.
9. For existing granulated modified bitumen flashings, a separator sheet must be installed for dry-hung flashings. In adhered applications, a barrier board must also be installed.

**Note:** EverGuard Extreme® flashings and accessories are required for use with EverGuard Extreme® membranes.

### B. EverGuard® Coated Metal Flashings

1. Coated metal flashing allows much of the metal-work used in typical roofing applications to benefit from the security of heat-welded membrane seaming, with a corresponding reduction in required metal work maintenance during the life of the roofing system.
2. EverGuard® coated metal must be formed in accordance with construction details and SMACNA guidelines.
3. Coated metal sections used for roof edging, base flashing, and coping must be butted together with a 1/4" (6.3 mm) gap to allow for expansion and contraction. Heat weld a 6" (152 mm) wide non-reinforced membrane strip to both sides of the joint, with approximately 1" (25 mm) on either side of the joint. A 2" (51 mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
4. EverGuard® coated metal used for sealant pans and scupper inserts, and corners of roof edging, base flashing and coping must be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. PVC and TPO coated metal flashings must be stripped in using 6" (152 mm) non-reinforced membranes.
5. Provide a 1/2" (13 mm) hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
6. EverGuard® coated metal base flashings must be provided with min. 4" (102 mm) wide flanges screwed to wood nailers. Coated metal base flashings must be formed with a 1" (25 mm) cant.
7. In addition, provide a 1/2" (13 mm) hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.

8. EverGuard® coated metal flashings are attached to wood nailers or otherwise mechanically attached to the roof deck, or to the wall or curb substrate, in accordance with construction detail requirements.

9. When installing coated metal on walls or curbs that completely cover the existing flashing, the flashing does not need to be removed provided that it is in good condition and tightly adhered.

### C. Adhered Reinforced Membrane Flashings - Smooth Surface

1. The thickness of the flashing membrane must be the same as the thickness of the roofing membrane.
2. When using EverGuard® TPO or PVC adhesives, use any one of the following substrates: polyisocyanurate insulation (without foil facer); high density wood fiber board; gypsum roof board; cured structural concrete absent of curing and sealing compound; untreated OSB; untreated CDX plywood; Type X gypsum board, and dry, sound masonry absent of curing or sealing compounds.
3. Refer to Section 3.10 C. 2. for detailed information on the application of bonding adhesive for flashings.
4. For extended-length guarantees, separate counter flashing is required; exposed termination bars are not acceptable.
5. Alternatively, the Freedom™ System can be used for flashings. Consult the Freedom™ specifications manual for installation instructions.
6. Also available are Corner Curb Wraps, consisting of a pre-formed combination corner and flashing pieces that are 12" (305 mm) in height and can be ordered in various lengths. These pre-fabricated corners can be configured to fit 13.5" x 13.5" (338 mm x 338 mm); 19.5" x 19.5" (500 mm x 500 mm); 25.5" x 25.5" (638 mm x 638 mm); and, 31.5" x 31.5" (800 mm x 800 mm) curb flashings.
7. Never use any TPO Primer or TOPCOAT® Surface Seal SB Primer to prime walls to accept adhesives; only use the adhesive you are using for a primer to prime the walls.

### D. Loose Reinforced Membrane Flashing

1. For 20-year guarantees or longer, a counter flashing must be used. Exposed termination bars are not acceptable.
2. Carefully position the EverGuard® smooth or fleece-back flashing membrane prior to application to avoid wrinkles and buckles.
3. All laps in EverGuard® smooth flashing membrane must be heat-welded in accordance with heat-welding guidelines.
4. Maximum flashing height is 24" (610 mm) with incremental attachment.

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### E. Non-reinforced Membrane Flashings

1. Non-reinforced membrane can be used as a field-fabricated penetration/reinforcement flashing only where pre-formed corners and pipe boots cannot be properly installed.
2. Penetration flashings constructed of non-reinforced membrane is typically installed in two sections, a vertical piece that extends up the penetration, and a horizontal piece that extends up to the roofing membrane. The two pieces are overlapped and heat-welded together.
3. The non-reinforced vertical membrane flashing may be adhered to the penetration surface. Vertical surfaces should always be clean, dry and sound to permit vertical flashing.
4. Refer to Section 3.10. C. 2. for detailed information on the application of bonding adhesive for non-reinforced membrane flashings.
5. For pipe penetrations, the use of adhesive is optional. Finish the penetration with TOPCOAT® FlexSeal™ Caulk Grade sealant between the pipe and the membrane; install clamping band, and TOPCOAT® FlexSeal™ Caulk Grade.
6. T-Joint Cover Patches
  - a. T-Joint Cover Patches are to be minimum 4" (102 mm) in size and made of non-reinforced membrane material. They must be completely hot air welded over the T-joint at the intersection of the three pieces of reinforced membrane. During installation, care must be taken to "crease-in" the unsupported membrane at the three step-off locations.
  - b. Prefabricated or field fabricated non-reinforced membranes that match the membrane being used in the field of the roof are acceptable for T-Joints.
  - c. T-Joint Cover Patches must be made from TPO non-reinforced membrane, EverGuard Extreme® TPO non-reinforced membrane, or PVC non-reinforced membrane.
  - d. T-Joint Cover Patches are required on 60, 70 and 80 mil TPO membranes, and on 80 mil PVC membrane only.

### F. Roof Edging

1. Roof edge flashing is applicable for both gravel stop/drip edge conditions, as well as exterior edges of parapet walls. For guarantees up to 20 years or longer, use EverGuard® Cover Tape Heat Weld (HW), EverGuard® TPO Coated Metal, or any of the EverGuard® pre-fabricated extruded aluminum fascia systems. For extended-length guarantees, use EverGuard Extreme® TPO Cover Tape HW, EverGuard® TPO Coated Metal, or EverGuard® pre-fabricated extruded aluminum fascia systems only.
2. Flash roof edges with minimum 3" (76 mm) wide flange nailed 4" (102 mm) o.c. (or DRILL-TEC™ screws 12" (30.5 mm) o.c.) into wood nailers. Then heat weld 8" (203 mm) with TPO utility flashing strip or 8" (203 mm) PVC utility flashing strip to metal flanges and field membrane.
3. Metal roof edging must be provided with a continuous metal hook strip to secure the lower fascia edge. Secure the continuous hook strip to the building a minimum of 12" (305 mm) o.c.

4. Alternatively, flash roof edges with a two-piece snap-on fascia system, adhering roof membrane to metal cant with bonding adhesive and face nailing the membrane 8" (203 mm) o.c. prior to installing the snap-on fascia.

5. Galvanized-based metal edging may be flashed using EverGuard® TPO Cover Tape. EverGuard® TPO Cover Tape is a 6" (152 mm) wide, non-reinforced TPO membrane backed with a butyl tape adhesive. Clean the entire surface to be covered, including metal and roof membrane with soap and water and dry entire area. Wipe area to be primed with a damp wipe of EverGuard® TPO Cleaner or EverGuard® CleanWeld™ Conditioner (a low-VOC cleaner).
6. Prime surfaces mating with the butyl tape with EverGuard® TPO Primer, keeping primer only on the surface receiving the tape. After primer has flashed off, pull release paper on the back of the tape, exposing the butyl adhesive, and mate the two surfaces. Roll the tape portion of the cover strip at a 45 degree angle to ensure a good bond. Seal all end laps, miters, and T-joint intersections with EverGuard® TPO Cut Edge Sealant 6" (152 mm) past the intersection in all directions.

7. For 20-year guarantees or longer, use EverGuard® TPO Cover Tape Heat Weld (HW). This is a hybrid cover tape consisting of 6" (152 mm) of .045 reinforced TPO membrane with 3" (76 mm) butyl tape on half of the back surface. Refer to Step 6 (above) and follow procedures for the butyl tape preparation and installation. Then heat-weld the cover tape to the field membrane with a 2" (51 mm) hand weld or 1.5" (38 mm) auto weld, to all membrane-to-membrane surfaces.

**Note:** Any overlap ends must be stripped in with flashing detail membrane and welded completely to finish the detail. For cut edges, EverGuard® TPO Cut Edge Sealant must be installed on the cut edge of the non-butyl side of the membrane.

8. Flash roof edge scuppers with a scupper insert of coated metal or EverGuard® pre-fabricated coated metal scupper that is mechanically attached to the roof edge and integrated as part of the metal edging.

### G. Parapet and Building Walls

1. There are three options for flashing parapet and building walls: adhered membrane flashings, metal flashings, and loose-hung flashings.
2. Secure membrane flashing at the top edge with a termination bar. Apply TOPCOAT® FlexSeal™ Caulk Grade sealant between the wall surface and membrane flashing underneath all termination bars. Exposed termination bars must be mechanically fastened 6" (152 mm) o.c.; termination bars that are counter-flashed must be fastened 12" (305 mm) o.c.
3. Roof membrane must be mechanically attached along the base of walls that are flashed with membrane flashing with screws and plates/termination bar at a fastener spacing in accordance with in-lap attachment requirements, with a 12" (305 mm) o.c. maximum spacing.
4. Metal counter-flashings with adhered or dry hung membrane wall flashings are required on 20-year guarantees or longer. All termination bars, either exposed or covered, must be sealed with TOPCOAT® FlexSeal™ Caulk Grade sealant.

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5. Flash wall scuppers with a scupper insert of coated metal that is mechanically attached to the wall and integrated as part of the wall flashing. Refer to scupper section (3.11 M) for other detail options.
6. Maximum flashing height without intermediate fastening:
  - 24" (610 mm) Loose-Applied Flashing
  - 54" - (1.4 m) Adhered Flashing
7. Metal cap flashings must have continuous cleats or be face-fastened 12" (305 mm) o.c. on both the inside and outside of the walls.
8. In addition, EverGuard Extreme® TPO Roof Systems on buildings greater than 100' (305 m) in height must have a minimum 3' (914 mm) parapet wall to be eligible for an extended-length Diamond Pledge™ 25- or 30- or 35-year guarantee. This is also a requirement for standard 60 mil EverGuard® TPO with an extended-length guarantee.
9. DensGlass® Gold Gypsum Board is NOT to be used as a substrate for adhered attachment on parapet walls, according to the manufacturer.
10. Use fire-treated plywood/wood for parapet walls only if covered with an approved gypsum board for (fully) adhered or Freedom™ materials.

### H. Round and Square Tube Penetrations

1. Four options are available for penetration flashings. These are stepped pipe boots; split pipe boots; square tube wraps; and, field fabrication with unsupported membrane and target.
2. All flashings require the installation of a stainless steel draw band around the top of the flashing. Seal the top edge with TOPCOAT® FlexSeal™ Caulk Grade sealant and add draw band with TOPCOAT® FlexSeal™ Caulk Grade sealant.
3. Roof membrane must be mechanically attached at the base of each penetration with screws and plates a maximum of 12" (305 mm) o.c., with a minimum of four fasteners per penetration.

### I. Irregularly Shaped Penetrations

1. Flash irregularly shaped penetrations with flanged sealant pans formed of coated metal, secured to the deck through the roof membrane with screws 12" (305 mm) o.c. or a minimum of 4 fasteners per penetration.
2. Strip in metal flanges and the vertical pop riveted seam with 8" (203 mm) wide membrane flashing strips heat welded to both the roof membrane and the metal flanges.
3. Fill sealant pans with EverGuard® Two-Part Pourable Sealant. Fill sealant pans with non-shrink quick-set grout, and top off sealant pans with a 2" (51 mm) minimum thickness of EverGuard® Two-Part Pourable Sealant. When using TOPCOAT® FlexSeal™ Caulk Grade sealant, after priming, increase the grout to within 1/2" (13 mm) from the top of the pocket, and install the FlexSeal™ to the very top or overfill the pocket.
4. Pre-formed sealant pans/vent boots made of PVC and TPO are also available.
  - a. For PVC: Installation of pre-formed PVC sealant pans require the flange of the PVC sealant pan to be fastened with a

minimum of 4 fasteners per penetration. A PVC membrane target is installed around the base of the sealant pan over the flanges of the PVC sealant pan and heat welded to the flanges. Install the fasteners near the outside edge of the flanges to allow for proper heat welding of the target. The outside edge of the target membrane is heat welded to the field membrane.

- b. For TPO: Installation of pre-formed TPO sealant pans requires field membrane securement around the penetration. A minimum of four (4) system-appropriate screws and plates are required around the penetration. A membrane target must be installed prior to the installation of the TPO sealant pan if the location of the plates does not allow for a continuous 2" (51 mm) weld of the TPO sealant pan flange. Properly heat-weld the flange of TPO sealant pan to the field/target membrane.
- c. If the sealant pan is cut to install around the penetration, the cut must be stripped-in with a minimum 4" (102 mm) wide non-reinforced membrane. The non-reinforced strip-in membrane must extend a minimum of 2" (51 mm) beyond the outside edge of the sealant pan flange and be fully welded.
- d. Prior to filling the TPO sealant pan, the inside vertical pan sides must be primed with GAF TPO primer. Fill the base of the pans with non-shrink grout and top off with a minimum 2" (51 mm) thickness of GAF Two-Part Pourable Sealer. When using TOPCOAT® FlexSeal™ Caulk Grade sealant, after priming, increase the grout to within 1/2" (13 mm) from the top of the pocket, and install the FlexSeal™ to the very top or overfill the pocket.
- e. Reinforced targets must be sealed as the particular roof system requires with EverGuard® TPO Cut Edge Sealant.

### J. Curbs

1. Flashings can be applied in two different ways; either with adhesive applied to the membrane and substrate, or loose applied up to 24" (610 mm) high. EverGuard® Coated Metal flashings must be fastened at 4" (102 mm) o.c.
2. Secure membrane flashing at the top edge with a termination bar, flat stock or counter flashing. Apply TOPCOAT® FlexSeal™ Caulk Grade sealant between the curb surface and membrane flashing. Exposed termination bars must be mechanically fastened 6" (152 mm) o.c.; termination bars that are counter flashed must be fastened 12" (305 mm) o.c. If wood is present at the top of the curb, install ring shanks 12" (305 mm) o.c. after wrapping the membrane to the inside of the curb. This can be used in lieu of the termination bar if nailed on the top or preferably the back side of the wood.
3. Roof membrane must be mechanically attached along the base of curbs and ducts that are flashed with membrane flashing with screws and plates/termination bar at 12" (305 mm) o.c.
4. Metal counter flashing may be needed for extended guarantee lengths. All termination bars must be sealed with TOPCOAT® FlexSeal™ Caulk Grade sealant.

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### K. Expansion Joints

1. Install expansion joint covers at all flat type and raised, curb-type expansion joints. There are currently three types of expansion joints approved for EverGuard® Systems. There are two prefabricated expansion joints - one each for TPO and PVC. TPO and PVC can also be field fabricated to meet expansion joint needs. For PVC, any prefabricated expansion joint metal nailing strips must be fastened to wood nailers, curbs or secured to walls with appropriate nails or EverGuard® DRILL-TEC™ fasteners.
2. Roof membrane must be mechanically attached along the base of raised curb expansion joints with screws and plates a minimum of 12" (305 mm) o.c.
3. Expansion joint bellows must be twice the width of the expansion joint opening to allow for sufficient expansion and contraction.
4. Metal nailing strip must be set in TOPCOAT® FlexSeal™ Caulk Grade sealant and secured with fasteners and neoprene washers fastened 6" (152 mm) o.c.

### L. Roof Drains

1. Roof drains must be fitted with compression clamping rings and strainer baskets. Both traditional cast iron and aluminum drains, as well as retrofit-type cast aluminum and molded plastic drains, are acceptable.
2. Roof drains must be provided with a min. 36" x 36" (914 mm x 914 mm) sumped area, if possible. Slope of tapered insulation within the sumped area must not exceed 4" in 12" (102 mm in 305 mm).
3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a 1/2" (13 mm) membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.
4. For cast iron and aluminum drains, the roofing membrane must be set in a full bed of TOPCOAT® FlexSeal™ Caulk Grade sealant on the drain flange prior to securing with the compression clamping ring. Typical TOPCOAT® FlexSeal™ Caulk Grade sealant application rate is one 10.5 oz. (298 gr.) cartridge per drain.
5. For fleece-back roof membrane applications, the fleece-back membrane is cut just short of the drain flange. A separate smooth reinforced membrane drain flashing sheet is heat welded to the roofing membrane and set into the drain above in a full bed of TOPCOAT® FlexSeal™ Caulk Grade sealant and secured as above.
6. Do NOT locate lap seams within the sump area. If lap seams must be located within the sump area, a separate smooth reinforced membrane drain flashing a minimum of 12" (305 mm) larger than the sump area must be installed. The membrane flashing must be heat welded to the roof membrane. Alternately, if the seam does not run under the clamping ring, it can be covered with a 6" (152 mm) wide reinforced membrane strip heat welded to the membrane.
7. Tighten the drain compression clamping ring in place.

### M. Scuppers

1. Coated metal roof edge scuppers must be provided with a min. 4" (102 mm) wide flange nailed to wood nailers, with hemmed edges and secured with continuous clips in accordance with the gravel stop assembly.
2. Coated metal wall scuppers must be provided with 4" (102 mm) wide flanges, with additional corner pieces pop-riveted to the flanges to create a continuous flange. All flange corners must be rounded.
3. Install wall scuppers over the roof and flashing membrane and secure to the roof deck/wall with DRILL-TEC™ fasteners 6" (152 mm) o.c., a minimum of 2 fasteners per side.
4. All corners must be reinforced with EverGuard® PVC or EverGuard® TPO Universal Corners or field fabricated from EverGuard® non-reinforced materials.
5. Strip in scupper with flashing membrane target sheet.
6. Alternately, a wall scupper box may be field flashed using non-reinforced flashing membrane heat welded to membrane on the wall face and roof deck. Fully adhere to the scupper box and terminate on the outside wall face with a termination bar and TOPCOAT® FlexSeal™ Caulk Grade sealant.
7. EverGuard® TPO has prefabricated scuppers in standard and custom sizes available. Consult your Territory Manager or local distributor for details.

### N. Heater Stacks

1. Field-fabricated two-piece membrane flashings of EverGuard® non-reinforced flashing are typically installed at heater stacks. EverGuard® TPO and PVC have cone-type prefabricated pipe flashing that may work in these applications. If not, then field fabricated membrane flashings, such as EverGuard® Detailing Membranes, may be used. The temperature of any heater stack that comes into contact with the EverGuard® membrane or flashings should not exceed 160°F (71°C) or 195°F (90°C) for EverGuard Extreme® roofing systems.
2. Heat stacks must be equipped with either cone-shaped or vertical tube-type flashing sleeves so that the membrane flashing is not directly in contact with the heater stack.
3. Mechanically attach the roof membrane to the structural deck with DRILL-TEC™ screws and plates around the penetration base prior to flashing installation.
4. All stack flashings must be secured at their top edge by a stainless steel clamping band over TOPCOAT® FlexSeal™ Caulk Grade sealant. The detail should then be sealed with TOPCOAT® FlexSeal™ Caulk Grade sealant.
5. Field-fabricated membrane flashings may be adhered to the flashing sleeve with EverGuard® adhesives.

### O. Drain Inserts

1. EverGuard® PVC roofing membrane is typically terminated at PVC drain inserts by heat welding the membrane to the PVC coated drain flange (if available), or by securing the membrane between the drain flange and the clamping ring.
  - a. EverGuard® TPO drain inserts have an integral TPO target membrane for welding to the field membrane.

# DESIGN & APPLICATION GUIDELINES: ADHERED ROOFING SYSTEMS

TPO & PVC

2. Drain inserts must only be used in the event the original drain is damaged and cannot be repaired without complete replacement of the drain.
3. All drains must be provided with a drain sump of a 36" (914 mm) x 36" (914 mm) minimum dimension, if possible. Fasteners must be installed 12" (305 mm) o.c. or a minimum of 4 (four) per penetration. If a drain sump is not possible, tapered insulation should be used to create positive drainage.
4. The drain insert is installed on top of the roofing membrane and is secured to the roof deck 6" (152 mm) o.c. with DRILL-TEC™ screws.
5. A separate reinforced membrane drain flashing sheet is heat welded to the roofing membrane. The drain flashing sheet is heat welded to a compatible drain flange.
6. Install the drain clamping ring if applicable.
7. All drains must be provided with a strainer basket.
8. Roof drains must be open and functioning
9. Cleaning the length of the retrofit drain pipe is required so that the retrofit drain will seal to the pipe. Failure to clear this section of drain line can prevent the sealing of the drain and degrade the performance of the drain seal.

## P. Wood Support Blocking

1. Wood support blocking, typically 4" (102 mm) x 4" (102 mm), is usually installed under light-duty or temporary roof-mounted equipment, such as electrical conduit, small gas lines, condensation and drain lines.
2. Install wood support blocking over a protective layer of EverGuard® TPO walkway roll. Place wood blocking on oversized slip sheet, fold two sides vertically, and fasten with roofing nails into the blocking.

## Q. Satellite Dish Support Bases

1. Install satellite dish support bases over a protective layer of TPO/PVC membrane.
2. Lightning Suppression Clips
1. Secure lightning suppression clips to the roof surface by means of 2" (51 mm) wide EverGuard® PVC or EverGuard® TPO Flashing membrane strips heat welded to the roof membrane.

## 3.12 Traffic Protection

- A. EverGuard® TPO walkway roll must be installed at all roof access locations, including ladders, hatchways, stairs and doors. Install walkway roll at other designated locations, including roof-mounted equipment work locations and areas of repeated rooftop traffic.
- B. Walkway roll must be spaced 6" (152 mm) to allow for drainage.
- C. Heat weld EverGuard® TPO walkway roll to the roof membrane surface continuously around the walkway roll perimeter.
- D. EverGuard® TPO walkway roll may also be installed with TPO primer and 3" (76 mm) seam tape. First, roll or brush the TPO primer on the back of the TPO roll along the edges and down the middle of length of the roll. Clean and prime the roof membrane where the roll will be installed. Install tape to the back of the roll where cleaned (edges and middle) and roll in with a silicone hand roller. Remove the release paper and install the taped rolls directly onto the roof membrane. Secure the rolls by rolling into place.

## 3.13 Temporary Closures

- A. The roofing installation must be made watertight at the end of each day's activity to prevent water infiltration into the completed roofing system installation.
- B. Complete all flashings and terminations as the roofing installation progresses.
- C. At the edge of the completed roofing system installation, extend the roofing membrane a minimum of 6" (152 mm) beyond the edge. Seal the roofing membrane to the surrounding deck or substrate surface with hot asphalt or foam sealant.
- D. Remove all temporary night seal materials prior to continuing with the roof installation and dispose of properly.

## 3.14 Field Quality Control

- A. Inspect completed roof sections on a daily basis. It is the contractor's responsibility to probe all heat-welded seams and perform an adequate number of seam cuts to ascertain seam consistency.
- B. Immediately correct all defects, irregularities, and deficiencies identified during inspections. All voids that are found must be patched over per specifications. Do NOT re-weld seam voids more than 24 hours after initial welding of the seam.
- C. Remedial work must be performed with like materials and in a manner consistent with the balance of the roofing installation so as to minimize the number of repair patches.
- D. Excessive patchwork will require replacement of the entire affected membrane section from lap to lap.

## 3.15 Cleaning

- A. Remove bonding adhesive, bituminous markings and other contaminants from finished surfaces. In areas where finished surfaces are soiled by asphalt or any other source of soiling caused by work of this or other sections, consult manufacturer of surfaces for cleaning advice and conform to those instructions.
- B. Cut out and remove any sheet membrane contaminated with solvent-based adhesive, bituminous markings, and other contaminants from finished surface. Repair sheet damage by first cleaning the area with an all-purpose cleaner, then rinse off soapy residue. Reactivate membrane using the appropriate EverGuard® cleaner, wiping with a damp (not saturated) rag. Complete repair by installing a patch of like material to specific system requirements.

## 3.16 Maintenance

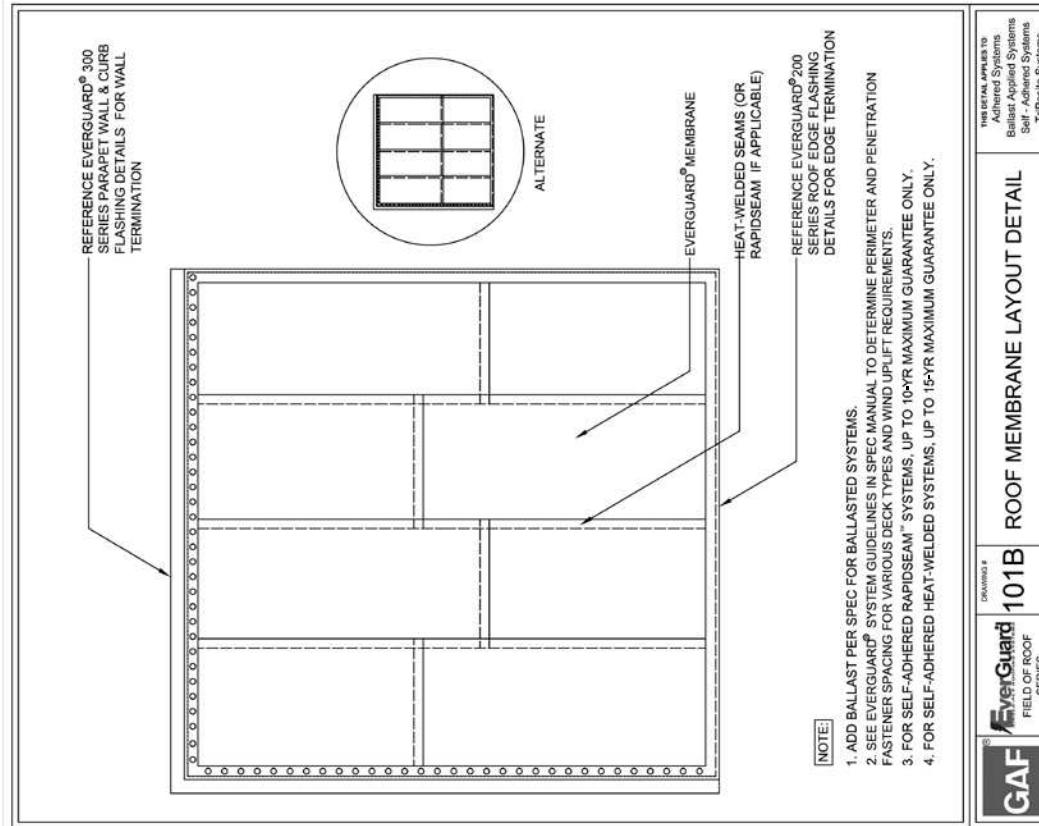
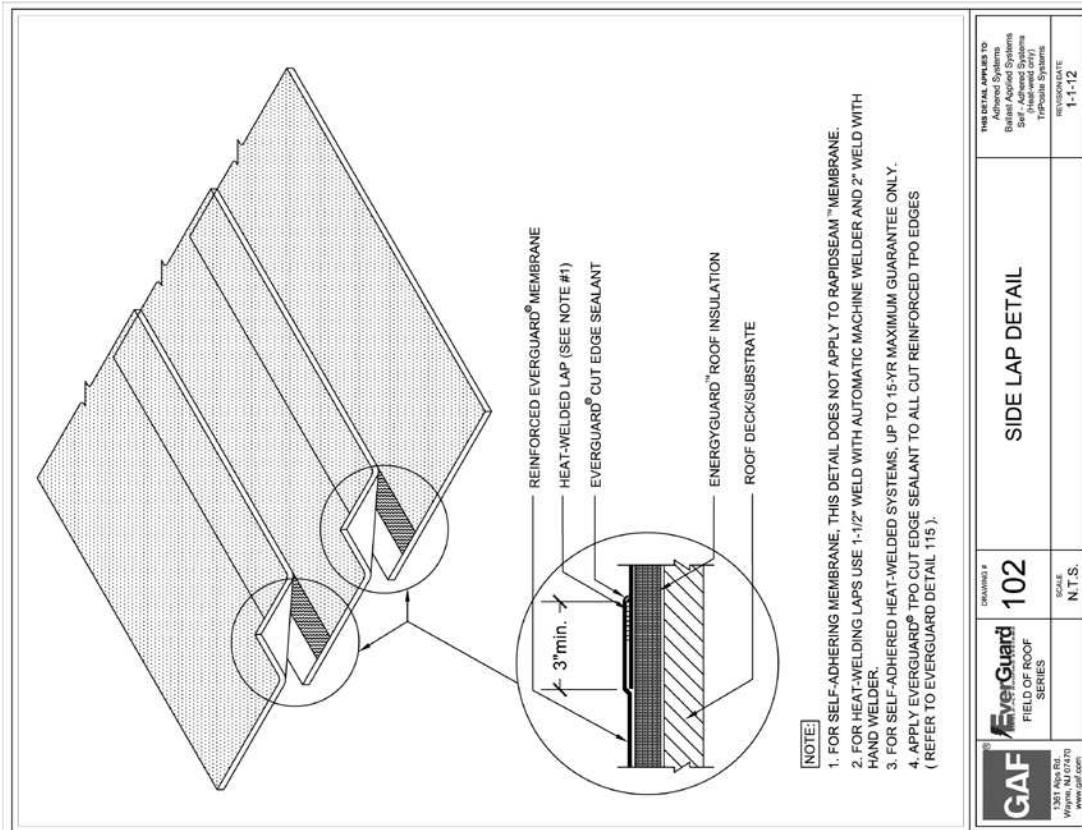
- A. Upon completion of the roofing system, the owner should establish a semi-yearly inspection and maintenance program in accordance with standard good roofing practice and guarantee requirements.
- B. Repair cuts, punctures and other membrane damage by cleaning membrane (see section 3.10 G), followed by heat welding a membrane repair patch of sufficient size to extend a minimum of 2" (51 mm) beyond the damaged area. If heat welding to the top surface of the existing membrane is ineffective, the patch must be heat welded to the underside of the existing sheet after proper preparation.
- C. Any damage to adhered membrane areas or at locations of mechanical attachment, including insulation, must be repaired so that the repaired area remains adhered or mechanically attached.

# ROOFING DETAILS

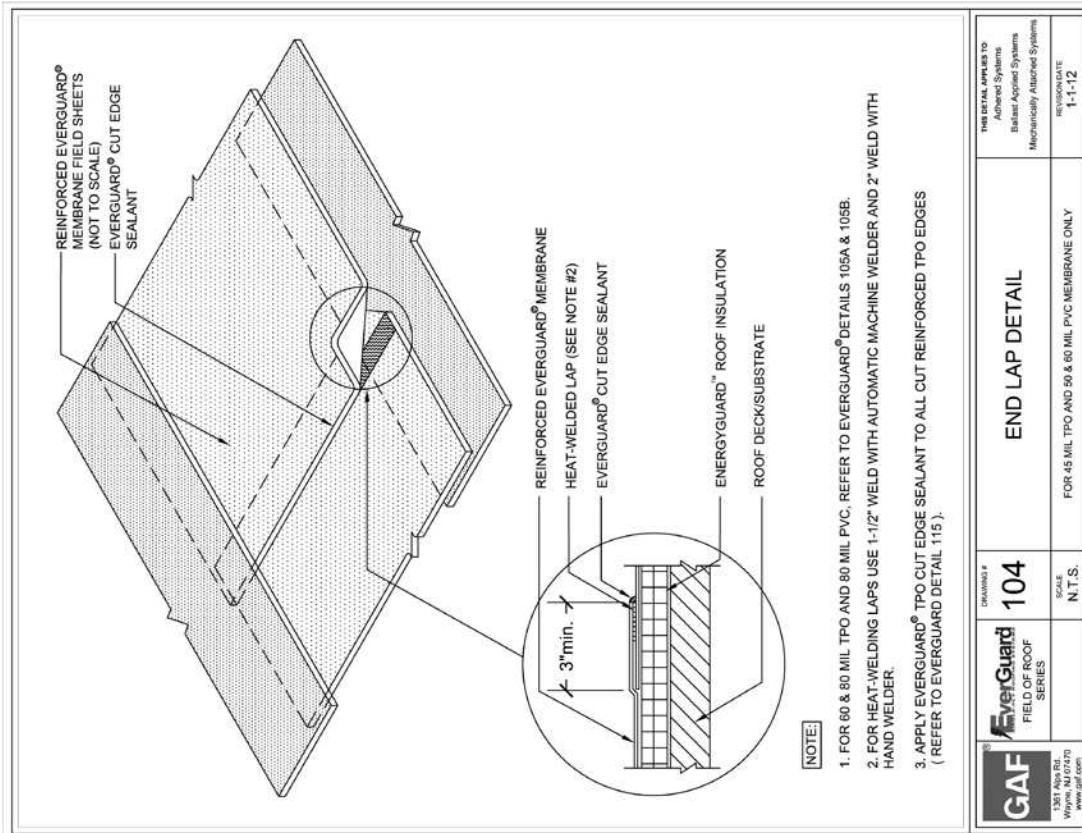
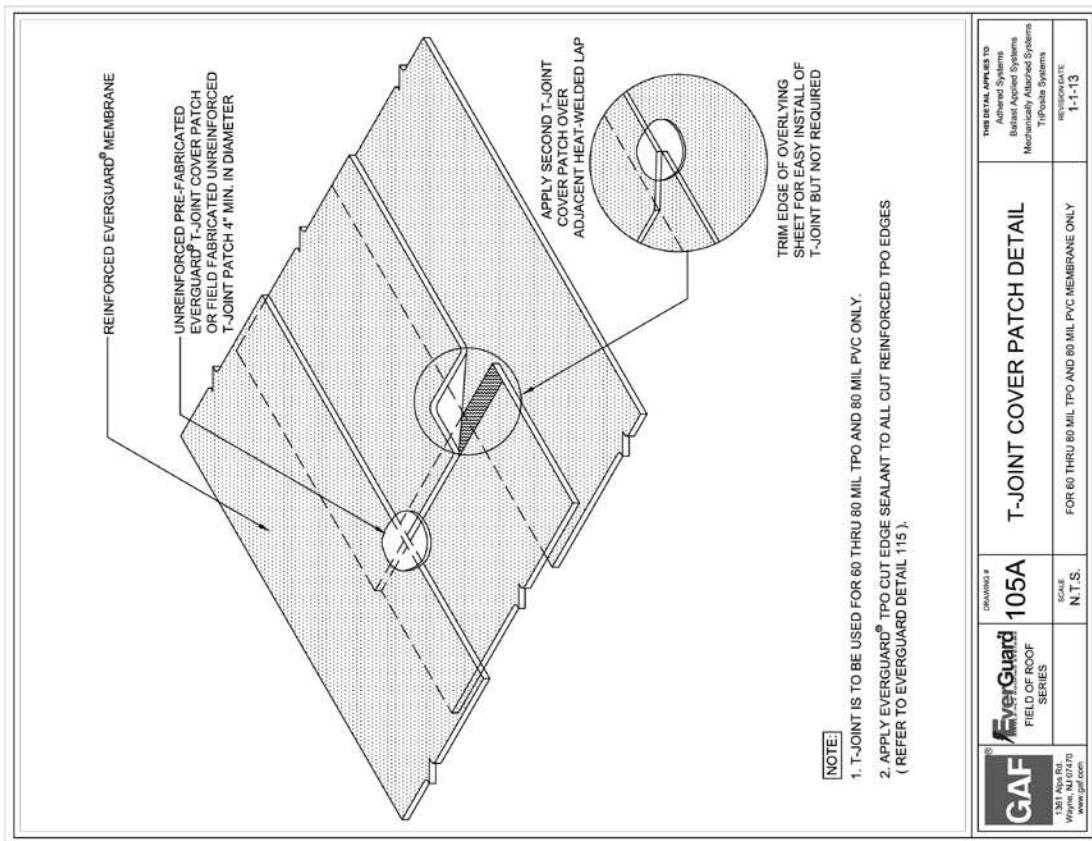
DETAIL NAME	DETAIL NUMBER	PAGE
ROOF MEMBRANE LAYOUT	101B	42
SIDE LAP	102	42
END LAP	104	43
T-JOINT COVER PATCH	105A	43
ROOF AREA ZONE LAYOUT	106	44
COATED METAL ROOF EDGE	202	44
SNAP-ON FASCIA ROOF EDGE - OPTION 1	205	45
SNAP-ON FASCIA ROOF EDGE - OPTION 2	206	45
GUTTER WITH COATED METAL EDGE	211	46
WALL/CURB FLASHING WITH TERMINATION BAR	302	46
WALL FLASHING WITH COATED METAL EDGE	304	47
ALTERNATE WALL BASE TERMINATION	307	47
PARAPET WALL WITH METAL EDGE AND TPO COVER TAPE	316	48
TERMINATION DETAIL 1-3	318A	48
COUNTERFLASHING RE-ROOF	319	49
SCUPPER - PREMANUFACTURED	324	49
CORNER CURB WRAP DETAIL	325	50
R.T.A. STRIP - ALTERNATE BASE TIE-IN	326D	50
INSIDE CORNER REINFORCEMENT-PREFORMED CORNER	327A	51
OUTSIDE CORNER REINFORCEMENT-PREFORMED CORNER	329A	51
FACTORY FABRICATED EXPANSION JOINT DETAIL-FLAT TYPE	401A	52
TERMINATION AT R.T.U. WITH WELDED LAP	503A	52
TERMINATION AT R.T.U. WITH COUNTERFLASHING	503B	53
PREMOLDED VENT BOOT FLASHING	506A	53
DRAIN-STANDARD ROOF DRAIN FLASHING	513	54
POURABLE SEALER POCKET	525	54
SQUARE TUBE WRAP	527	55
HEAT WELDED WALKWAY INSTALLATION	604	55

**NOTE:** REFER TO GAF.COM FOR A COMPLETE LIST OF ACCEPTABLE GAF ROOFING DETAILS.

## ROOFING DETAILS



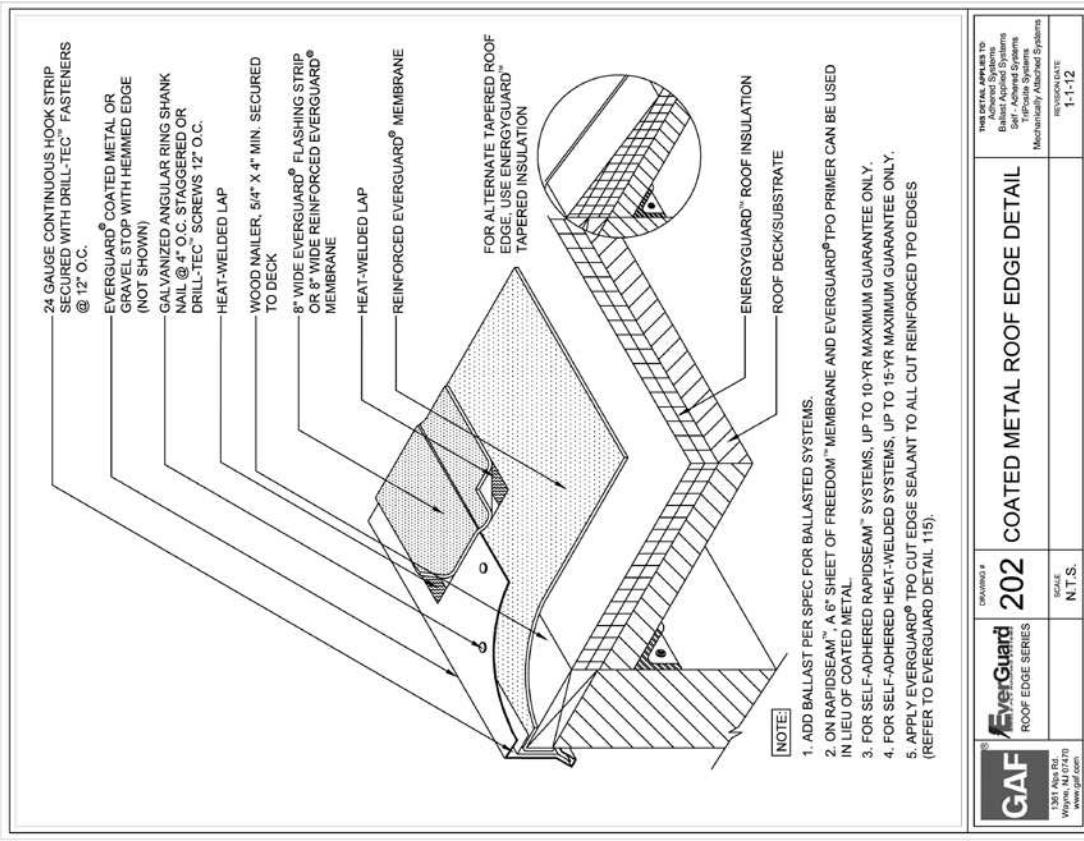
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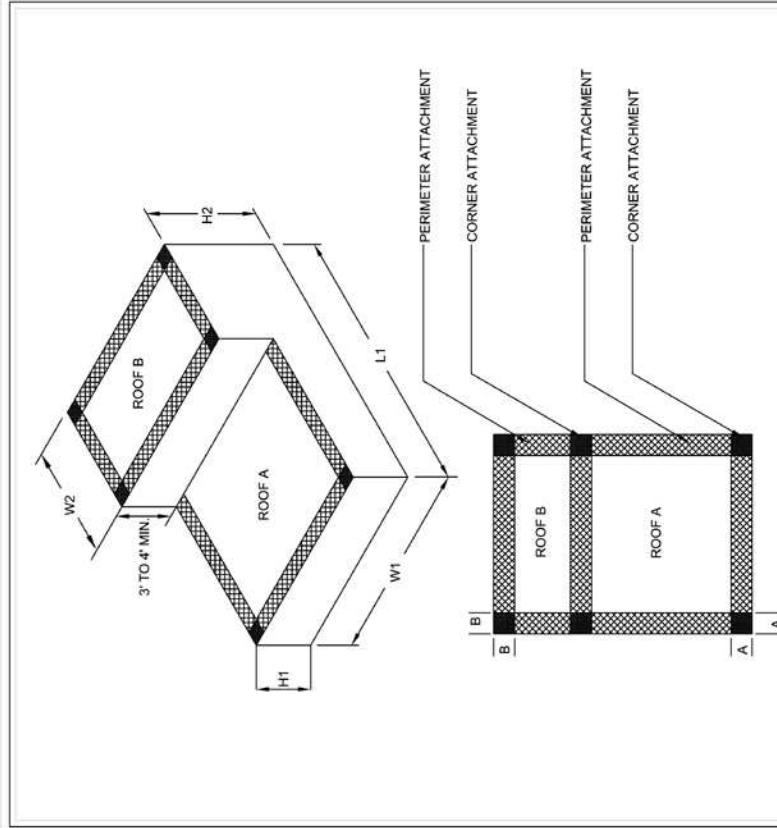
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Adhered Systems Balast Applied Systems Mechanically Attached Systems		
TPO/Rubber Systems		
REVISON DATE		
1-1-13		

THIS DETAIL APPLIES TO		
Adhered Systems Balast Applied Systems Mechanically Attached Systems		
TPO/Rubber Systems		
REVISON DATE		
1-1-12		

## ROOFING DETAILS

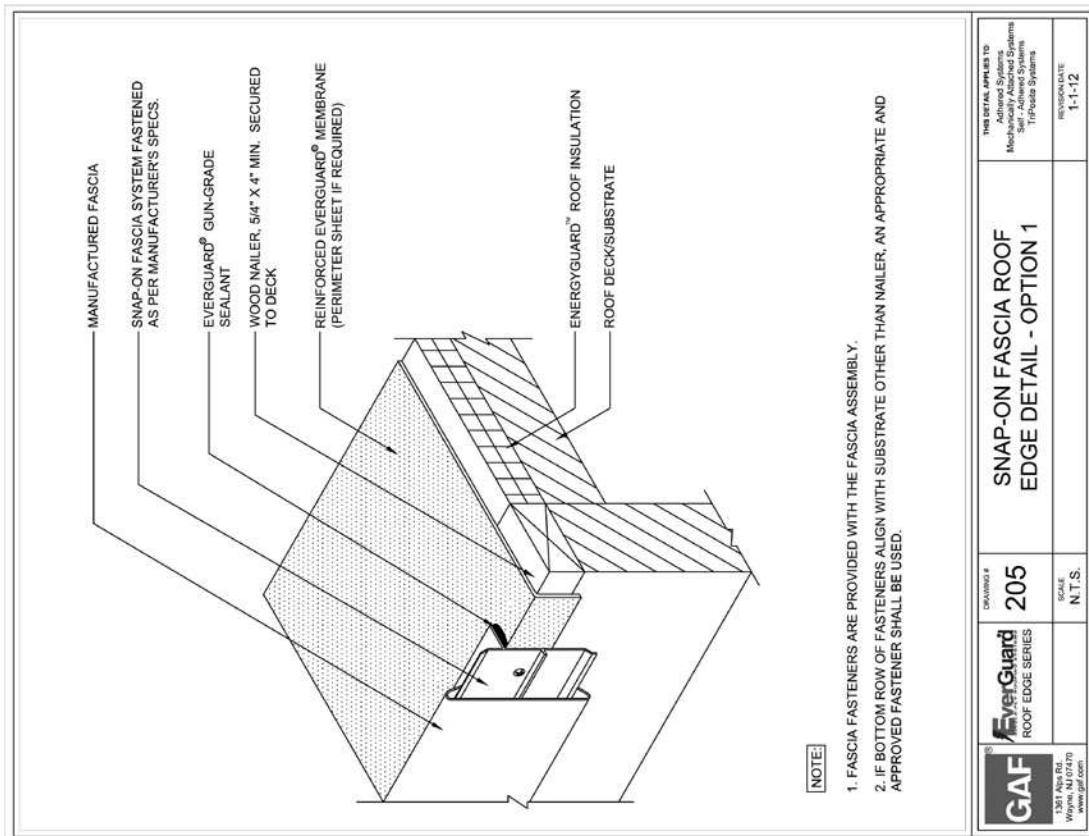
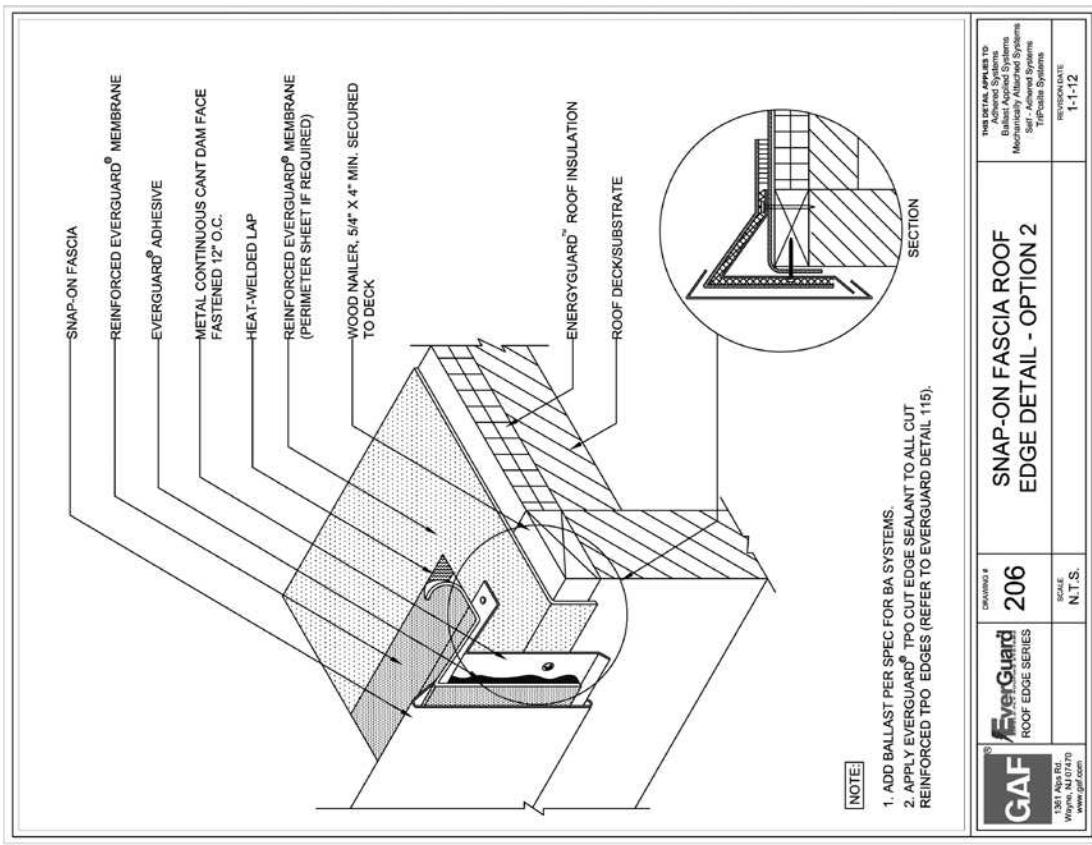


DRAWING #		DESCRIPTION	
<b>GAF</b> EverGuard FIELD OF ROOF SERIES	<b>106</b>	<b>ROOF AREA ZONE LAYOUT DETAIL</b>	1301 Asia Rd. Wayne, NJ 07470 www.gaf.com



DRAWING #		DESCRIPTION	
<b>GAF</b> EverGuard ROOF EDGE SERIES	<b>202</b>	<b>COATED METAL ROOF EDGE DETAIL</b>	1301 Asia Rd. Wayne, NJ 07470 www.gaf.com

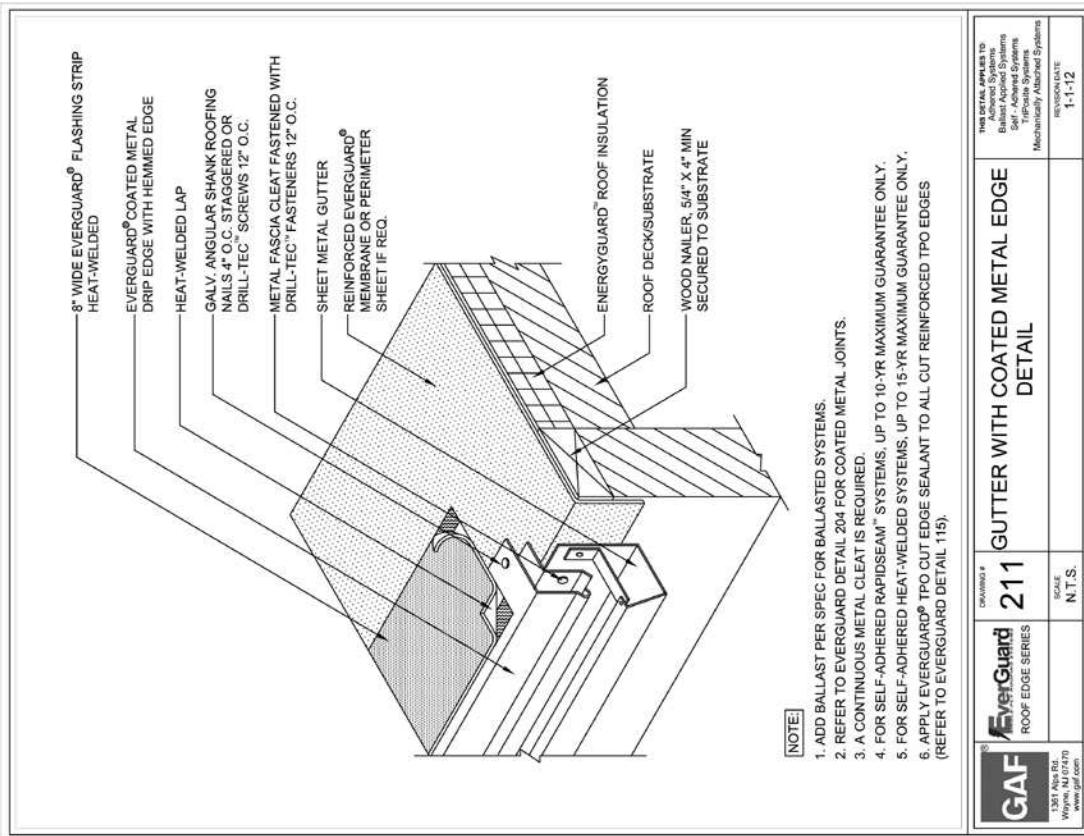
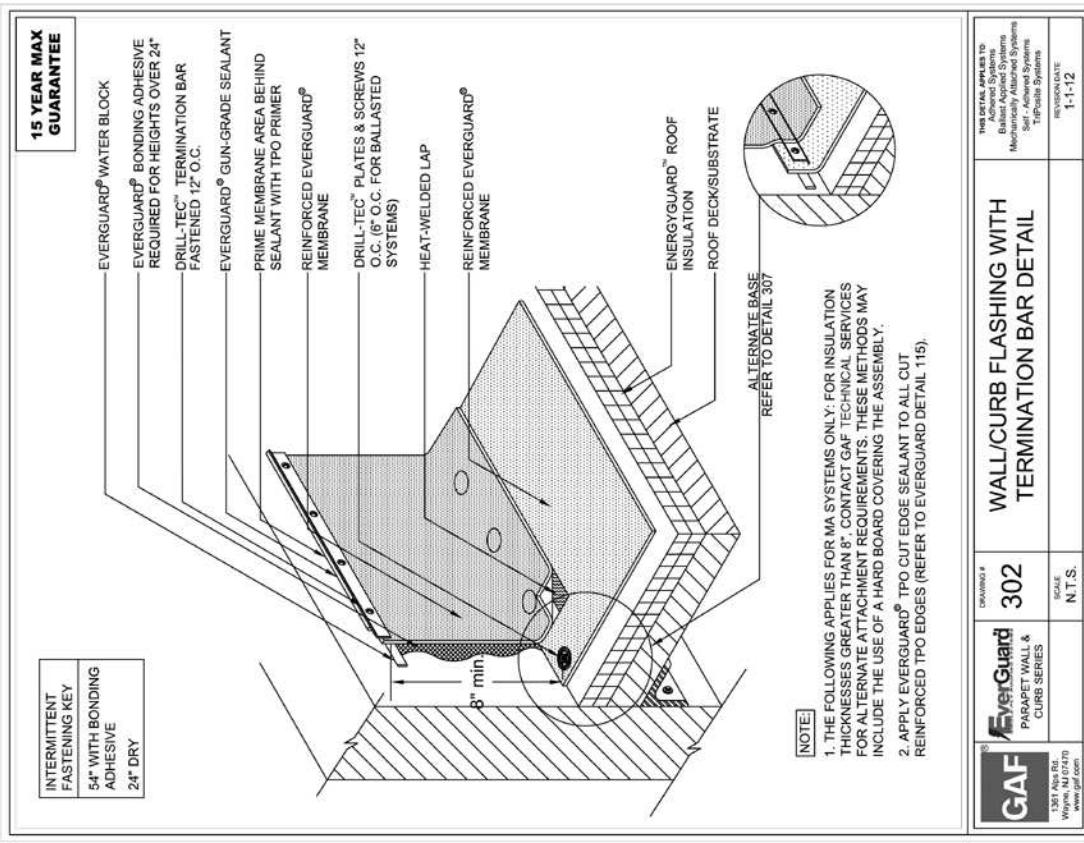
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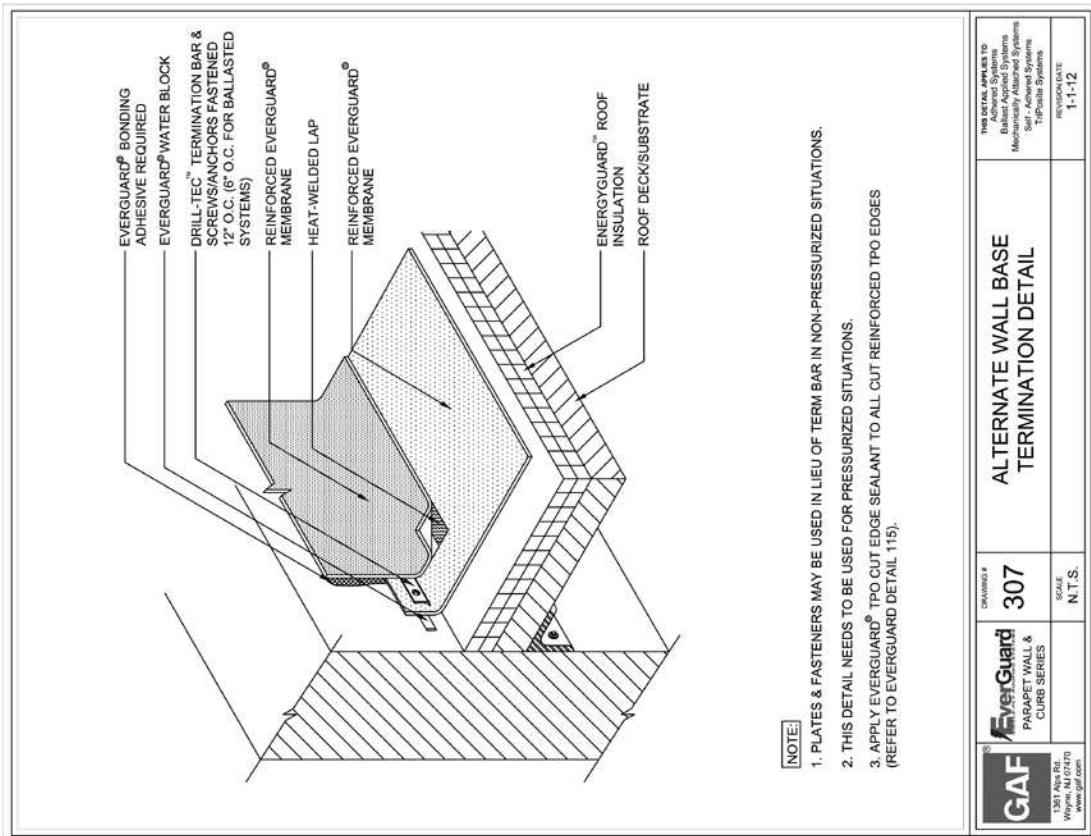
 <b>GAF</b> 1361 Alpa Rd. Wayne, NJ 07470 <a href="http://www.gaf.com">www.gaf.com</a>	DRAWING #	<b>SNAP-ON FASCIA ROOF EDGE DETAIL - OPTION 1</b>	
		SCALE N.T.S.	REVISION DATE 1-1-12

<small>THIS DETAIL APPLIES TO Adhered Systems Mechanically Attached Systems Self-Attached Systems T-Edge Systems</small>	<b>SNAP-ON FASCIA ROOF EDGE DETAIL - OPTION 2</b>	
	 <b>GAF</b> 1361 Alpa Rd. Wayne, NJ 07470 <a href="http://www.gaf.com">www.gaf.com</a>	DRAWING # <b>206</b> ROOF EDGE SERIES 1361 Alpa Rd. Wayne, NJ 07470 <a href="http://www.gaf.com">www.gaf.com</a>

## ROOFING DETAILS



## ROOFING DETAILS

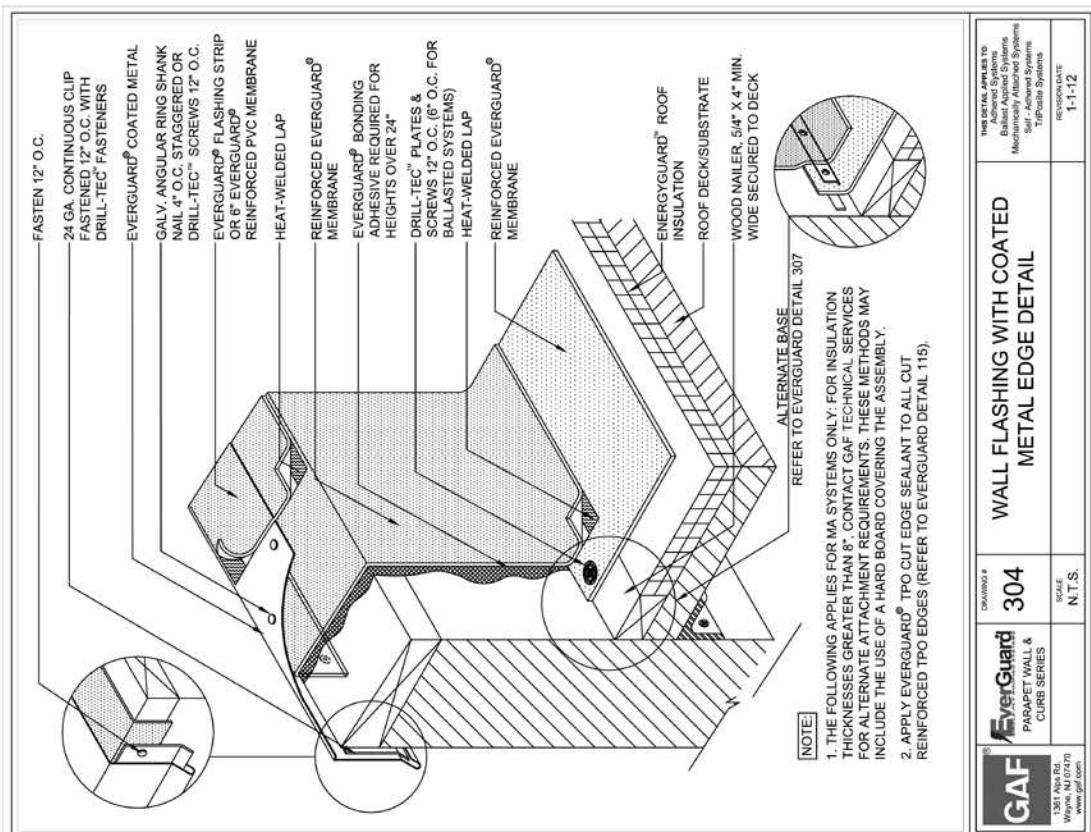


**NOTE:**

1. PLATES & FASTENERS MAY BE USED IN LIEU OF TERM BAR IN NON-PRESSURIZED SITUATIONS.
2. THIS DETAIL NEEDS TO BE USED FOR PRESSURIZED SITUATIONS.
3. APPLY EVERGUARD® TPO CUT EDGE SEALANT TO ALL CUT REINFORCED TPO EDGES (REFER TO EVERGUARD DETAIL 115).

DRAWING #		ALTERNATE WALL BASE TERMINATION DETAIL	
<b>GAF</b> EverGuard PARAPET WALL & CURB SERIES	<b>304</b>	WALL FLASHING WITH COATED METAL EDGE DETAIL	1381 Asia Rd. Wayne, NJ 07470 www.gaf.com

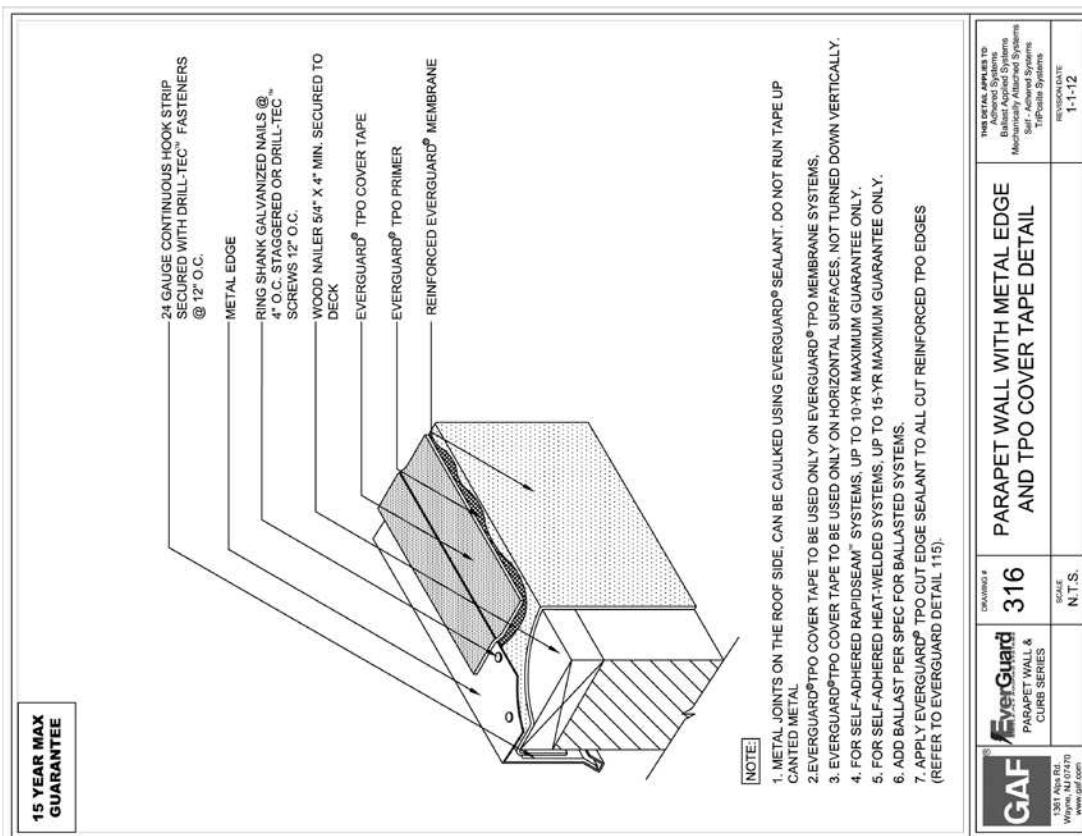
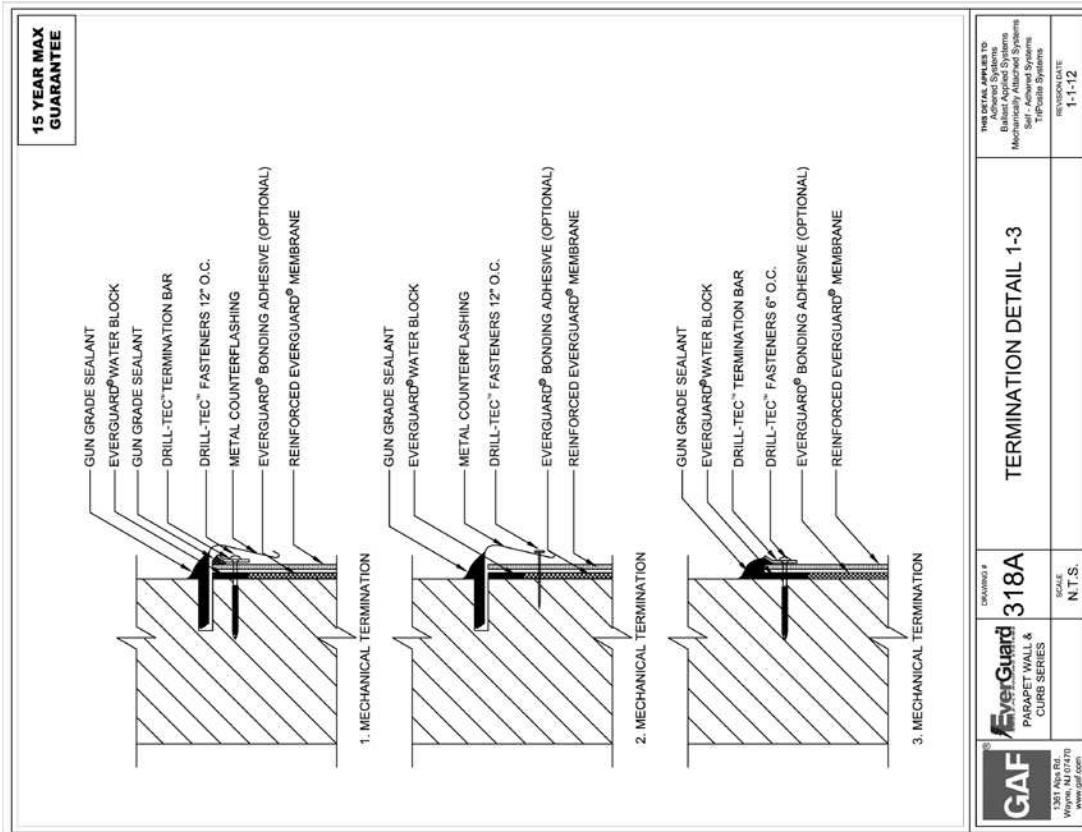
<small>THIS DETAIL APPLIES TO Ballast And Systems Mechanically Attached Systems Self- Anchored Systems Tie-Down Systems REVISION DATE 1-1-12</small>	<small>EverGuard PARAPET WALL &amp; CURB SERIES</small>	<small>307</small>	<small>ALTERNATE WALL BASE TERMINATION DETAIL</small>
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**NOTE:**  
REFER TO EVERGUARD DETAIL 307

1. THE FOLLOWING APPLIES FOR MA SYSTEMS ONLY. FOR INSULATION THICKNESSES GREATER THAN 8", CONTACT GAF TECHNICAL SERVICES FOR ALTERNATE ATTACHMENT REQUIREMENTS. THESE METHODS MAY INCLUDE THE USE OF A HARD BOARD COVERING THE ASSEMBLY.
2. APPLY EVERGUARD® TPO CUT EDGE SEALANT TO ALL CUT REINFORCED TPO EDGES (REFER TO EVERGUARD DETAIL 115).

## ROOFING DETAILS



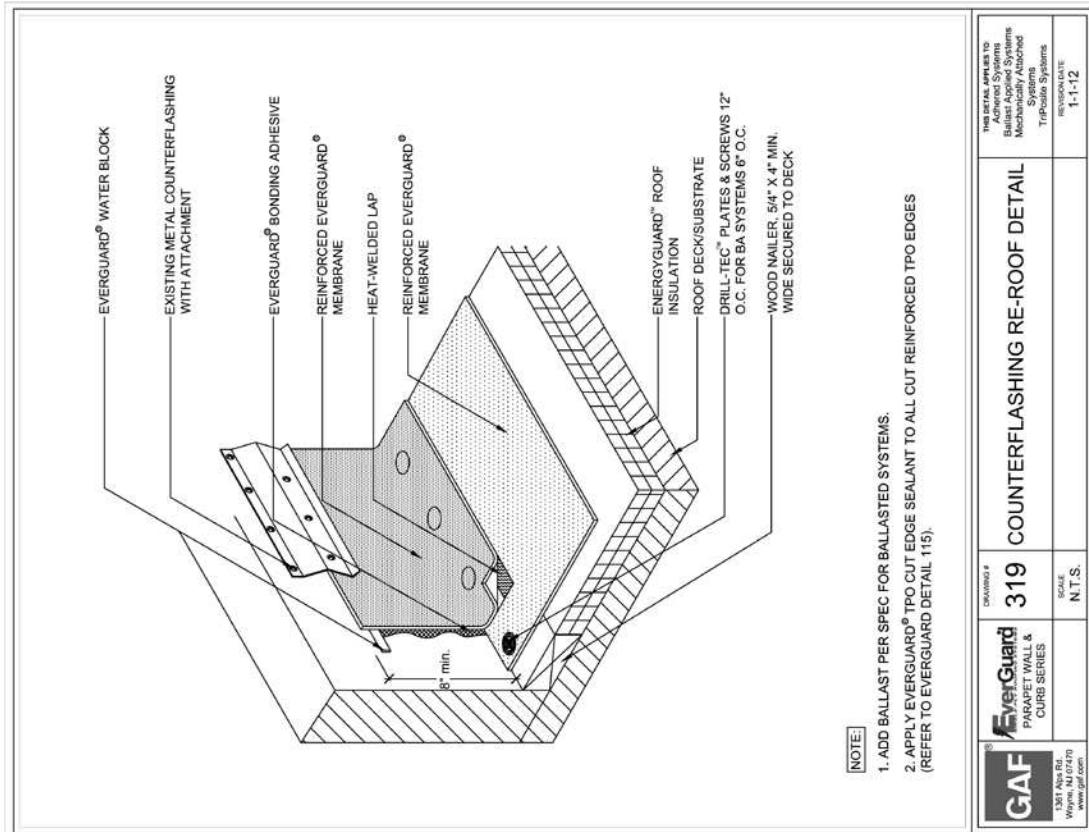
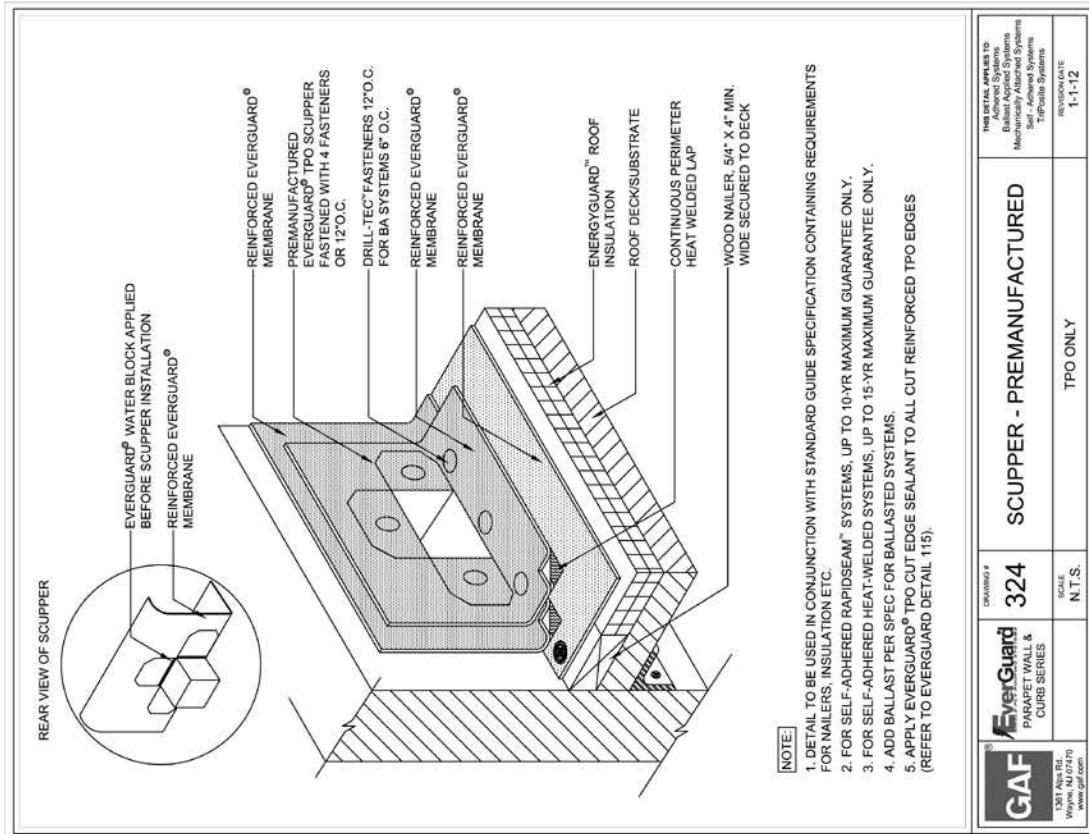
DRAWING #		TERMINATION DETAIL 1-3	
<b>GAF</b> everGuard PARAPET WALL & CURB SERIES	<b>316</b>	<b>318A</b>	<b>TERMINATION DETAIL 1-3</b>

THIS DETAIL APPLIES TO  
Adhered Systems  
Ballasted Systems  
Metal Deck Systems  
Self-Adhered Systems  
TPO/CPE Systems

1301 Asia Rd  
Wayne, NJ 07470  
www.gaf.com

PRINTED DATE: 1-1-12

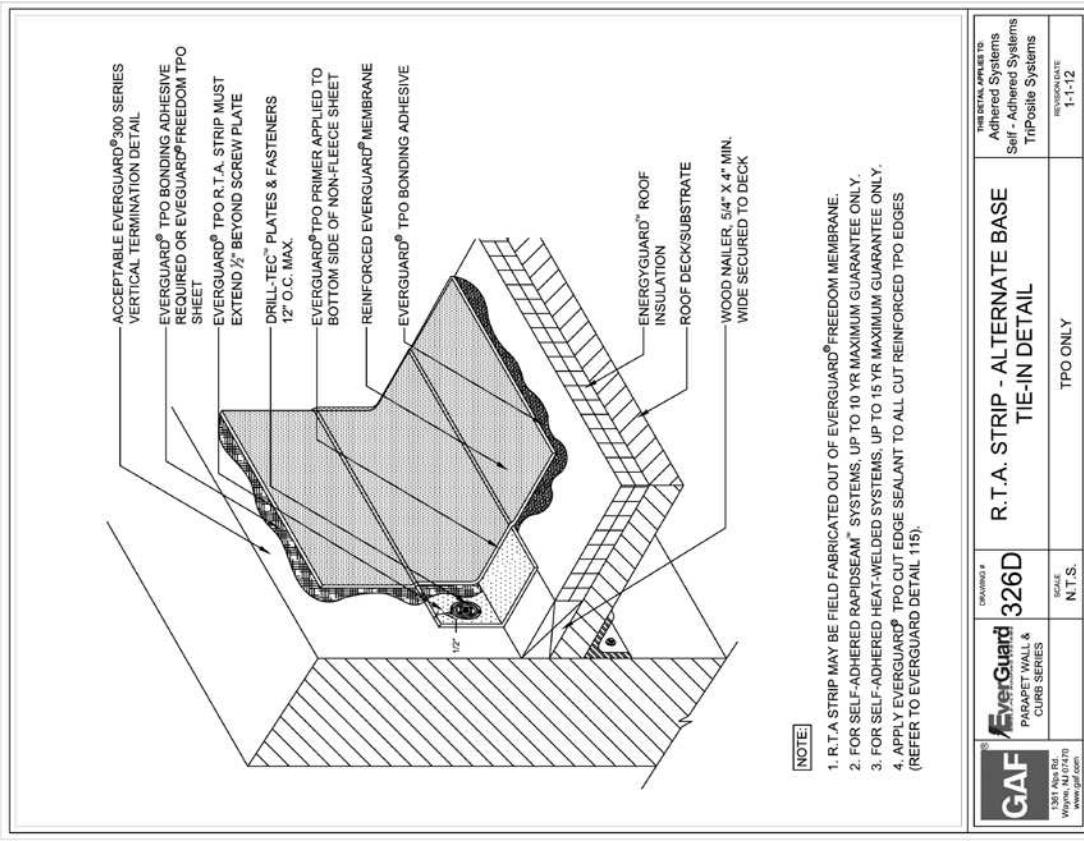
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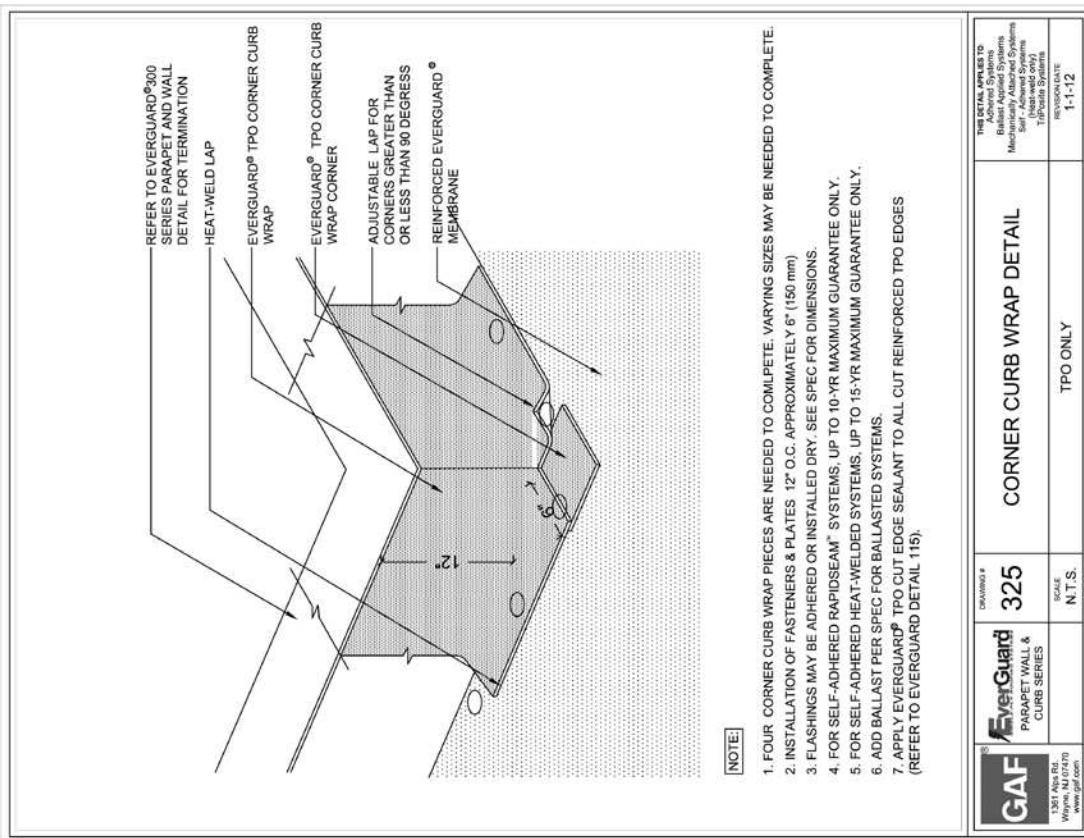
GAF		DRAWING #	DESCRIPTION	NOTES	
EverGuard	319	324	COUNTERFLASHING RE-ROOF DETAIL	SCUPPER - PREMANUFACTURED	1-1-12

GAF		DRAWING #	DESCRIPTION	NOTES	
EverGuard	324	324	SCUPPER - PREMANUFACTURED	TPO ONLY	1-1-12

## ROOFING DETAILS

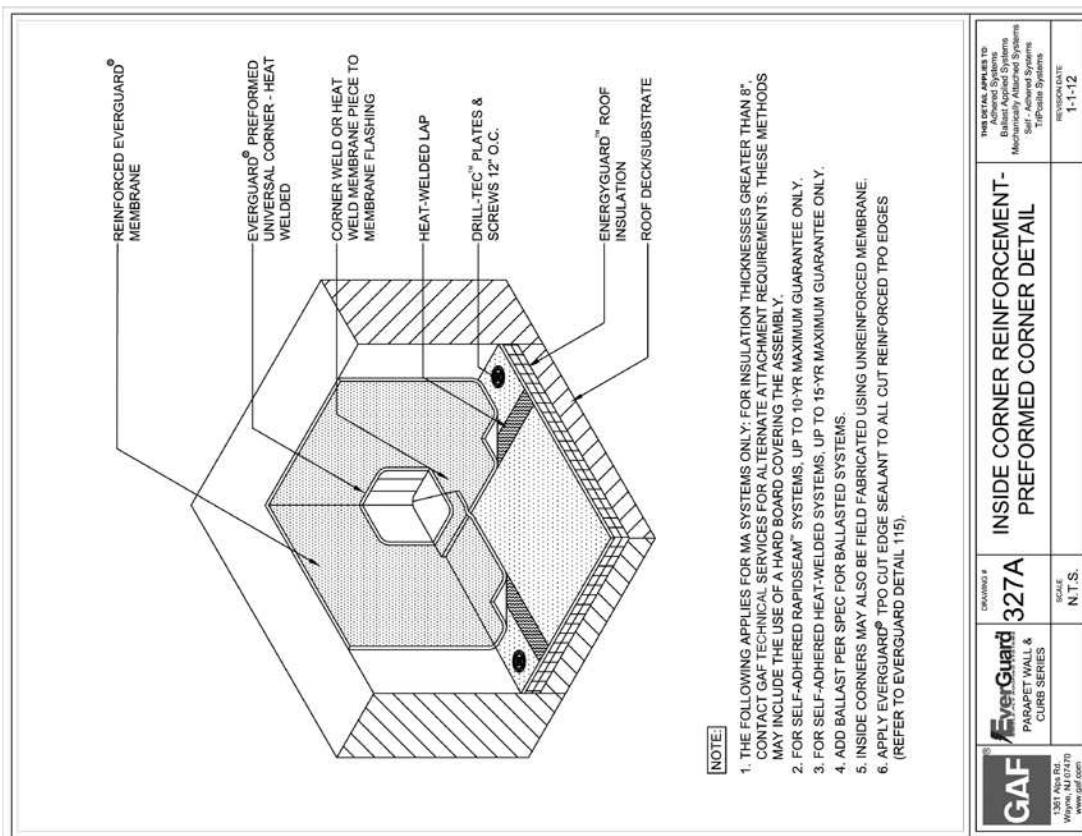
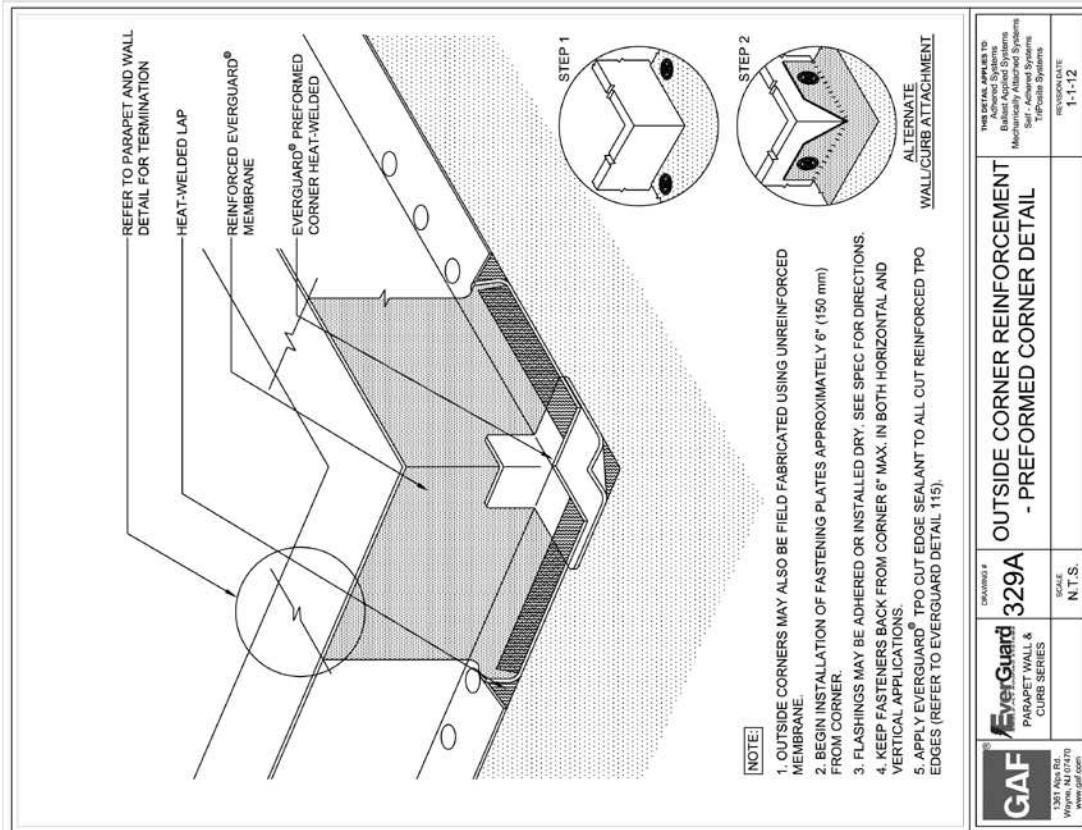


DRAWING #		R.T.A. STRIP - ALTERNATE BASE TIE-IN DETAIL		DRAWING #	
326D		R.T.A. STRIP - ALTERNATE BASE TIE-IN DETAIL		326D	
<b>GAF</b> EverGuard PARAPET WALL & CURB SERIES	1301 Asia Rd. Wayne, NJ 07470 www.gaf.com	TPO ONLY	TPO ONLY	<b>GAF</b> EverGuard PARAPET WALL & CURB SERIES	1301 Asia Rd. Wayne, NJ 07470 www.gaf.com
SCALE N.T.S.		SCALE N.T.S.	SCALE N.T.S.	SCALE N.T.S.	SCALE N.T.S.

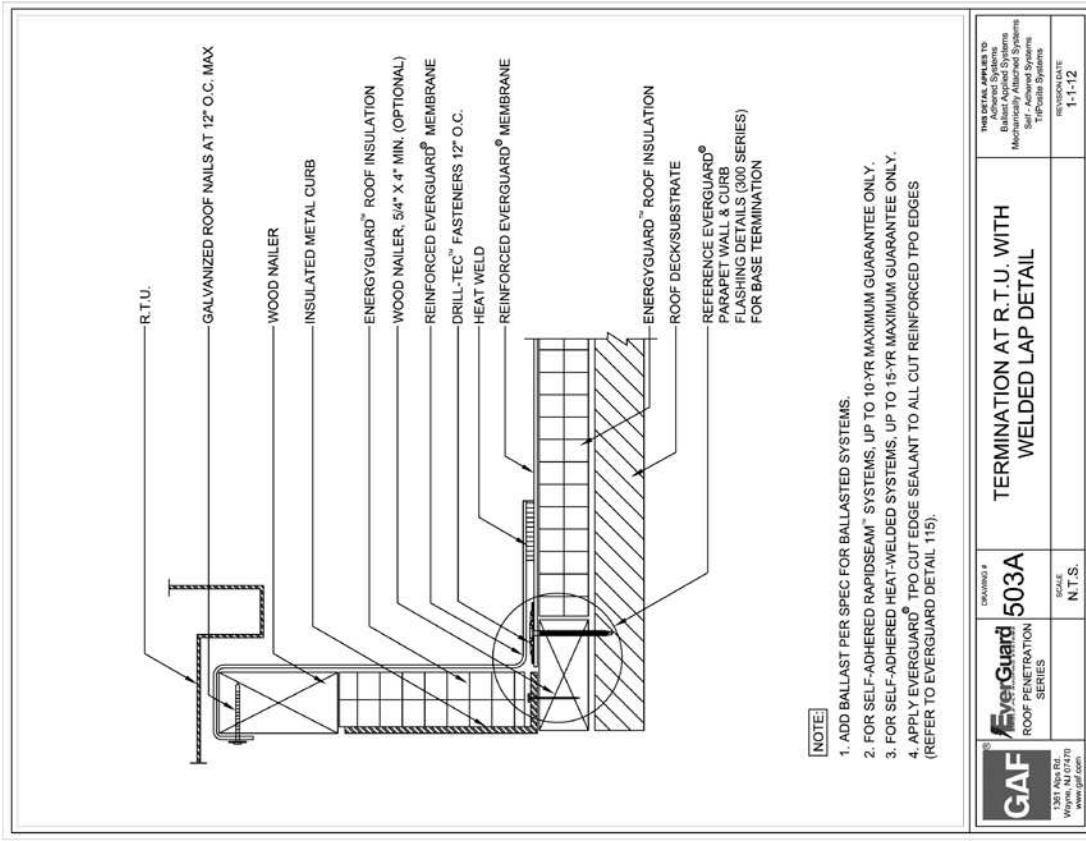


DRAWING #		CORNER CURB WRAP DETAIL		DRAWING #	
325		CORNER CURB WRAP DETAIL		325	
<b>GAF</b> EverGuard PARAPET WALL & CURB SERIES	1301 Asia Rd. Wayne, NJ 07470 www.gaf.com	TPO ONLY	TPO ONLY	<b>GAF</b> EverGuard PARAPET WALL & CURB SERIES	1301 Asia Rd. Wayne, NJ 07470 www.gaf.com
SCALE N.T.S.		SCALE N.T.S.	SCALE N.T.S.	SCALE N.T.S.	SCALE N.T.S.

## ROOFING DETAILS



## ROOFING DETAILS

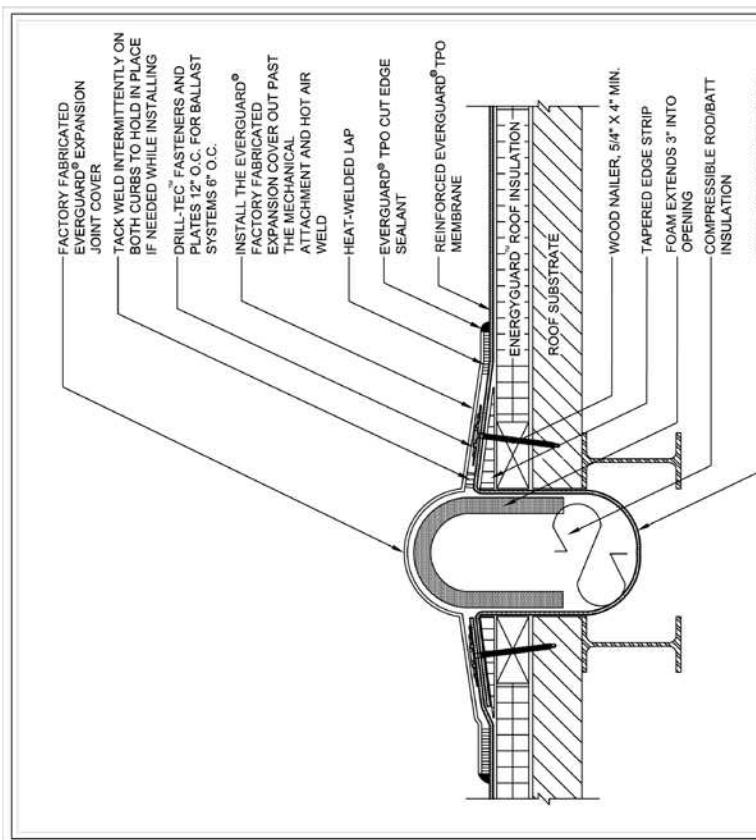


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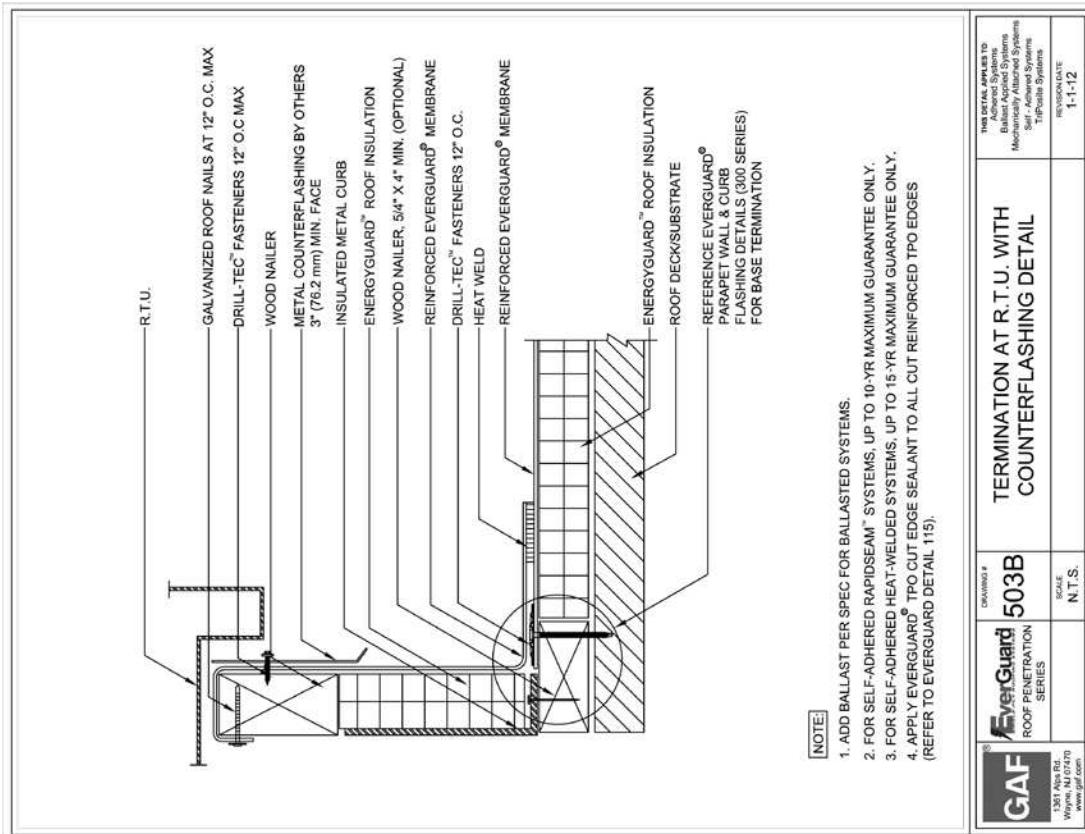
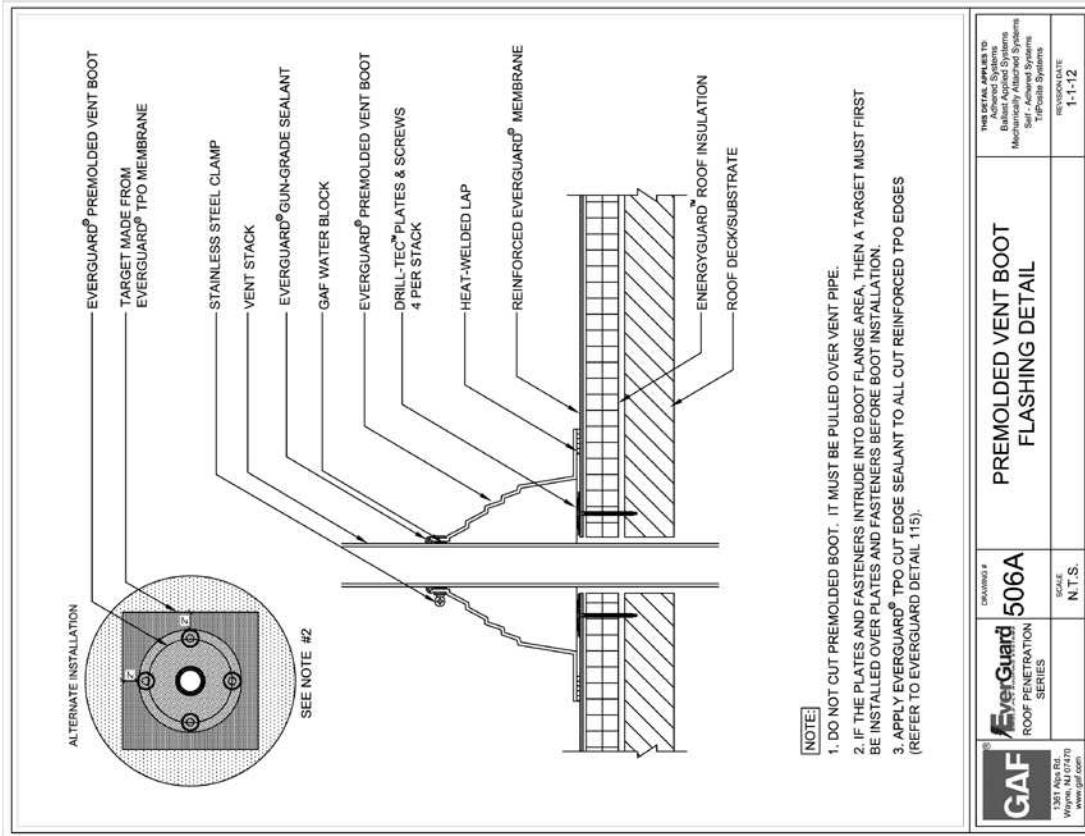
1. ADD BALLAST PER SPEC FOR BALLASTED SYSTEMS.
2. FOR SELF-ADHERED RAPIDSEAM™ SYSTEMS, UP TO 10-YR MAXIMUM GUARANTEE ONLY.
3. FOR SELF-ADHERED HEAT-WELDED SYSTEMS, UP TO 15-YR MAXIMUM GUARANTEE ONLY.
4. APPLY EVERGUARD® TPO CUT EDGE SEALANT TO ALL CUT REINFORCED TPO EDGES (REFER TO EVERGUARD DETAIL 115).

DRAWING #		TERMINATION AT R.T.U. WITH WELDED LAP DETAIL	
401A		503A	
REVISED DATE	1-1-12	REVISED DATE	1-1-12
GAF	EverGuard	GAF	EverGuard
FACTORY FABRICATED EXPANSION JOINT SERIES	FACTORY FABRICATED EXPANSION JOINT SERIES	FACTORY FABRICATED EXPANSION JOINT SERIES	FACTORY FABRICATED EXPANSION JOINT SERIES
SCALE	SCALE	SCALE	SCALE
N.T.S.	N.T.S.	N.T.S.	N.T.S.

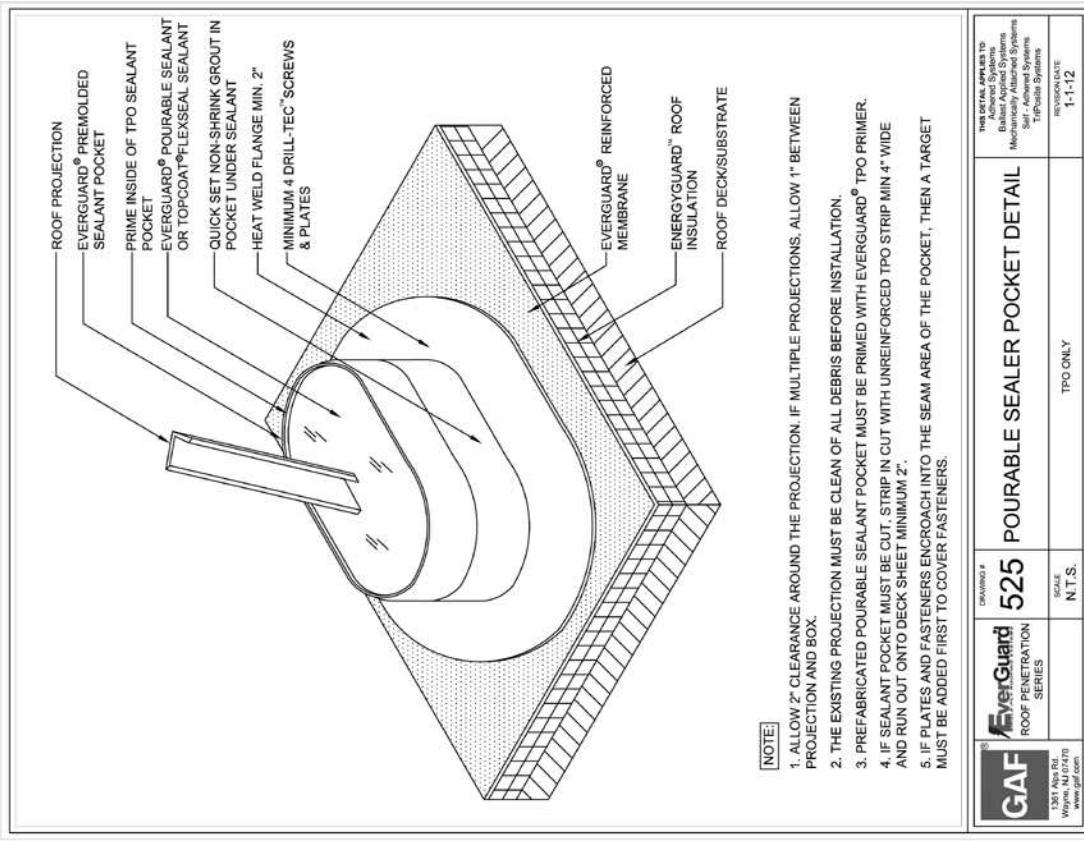
THIS DETAIL APPLIES TO Ballast And Systems Mechanically Attached Systems Self- Anchored Systems Tie-Down Systems	REVISION DATE
1301 Asia Rd. Wayne, NJ 07470 www.gaf.com	1-1-12



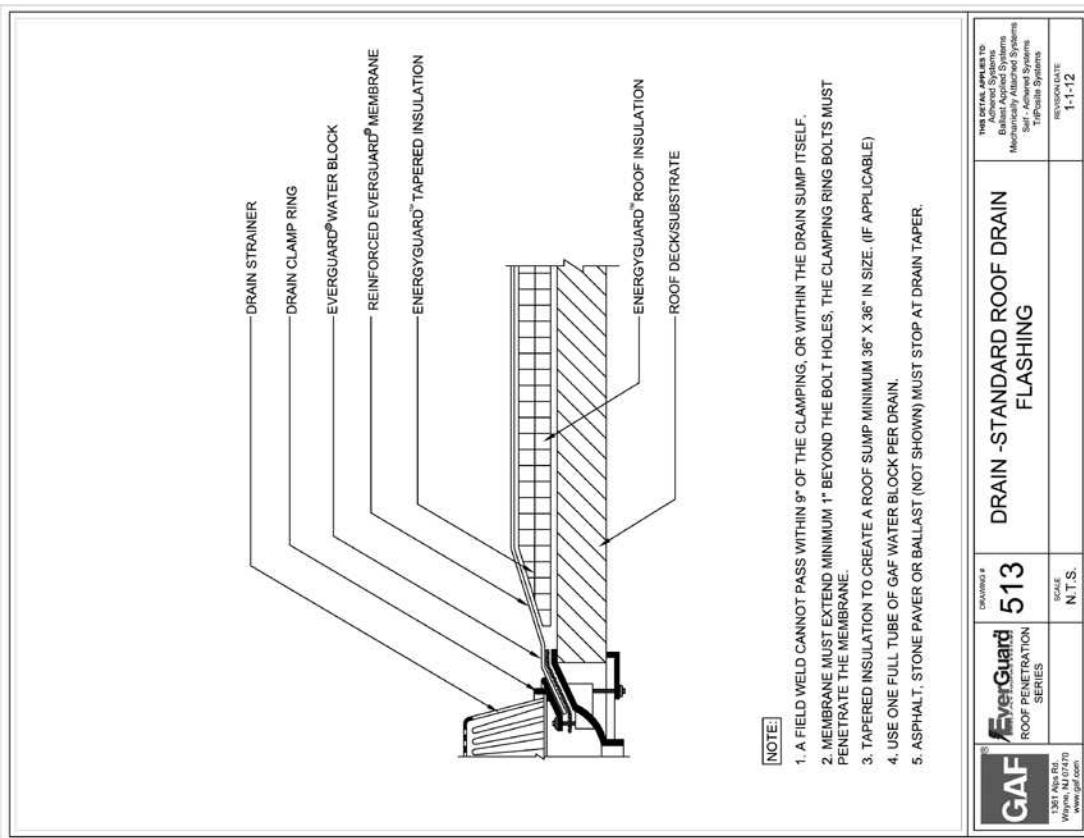
## ROOFING DETAILS



## ROOFING DETAILS

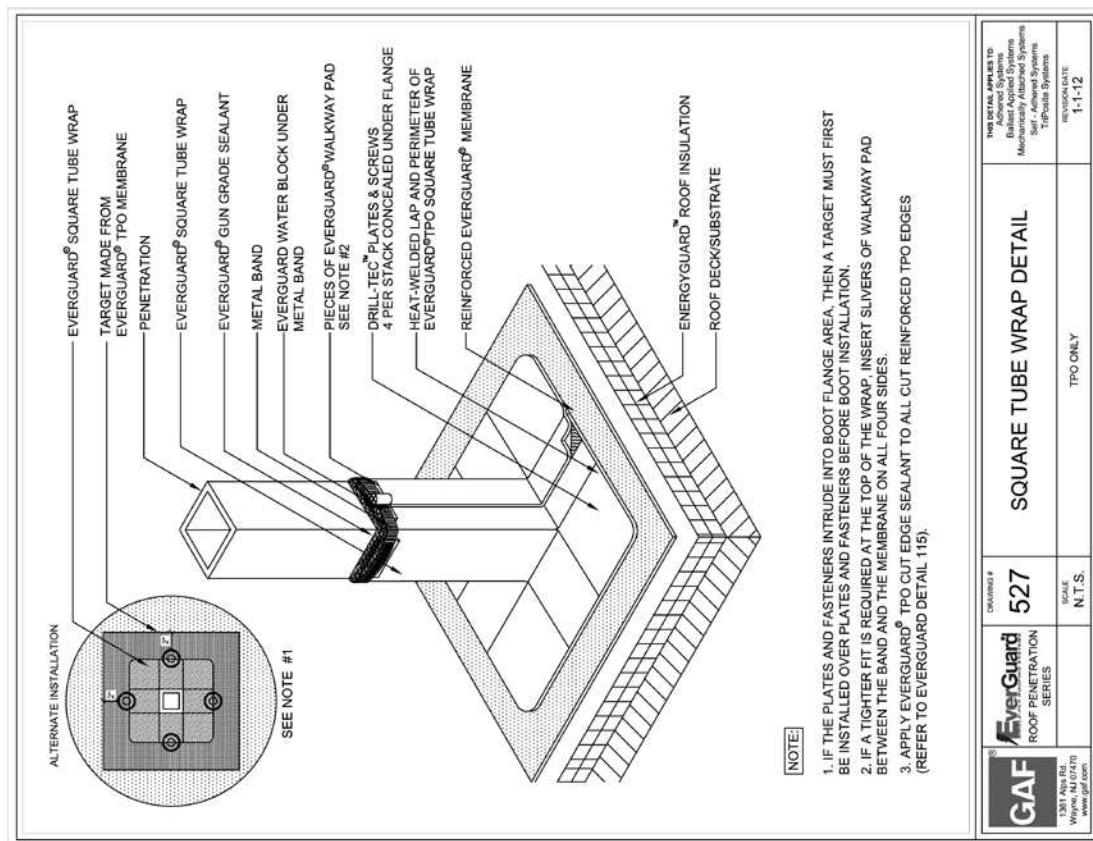
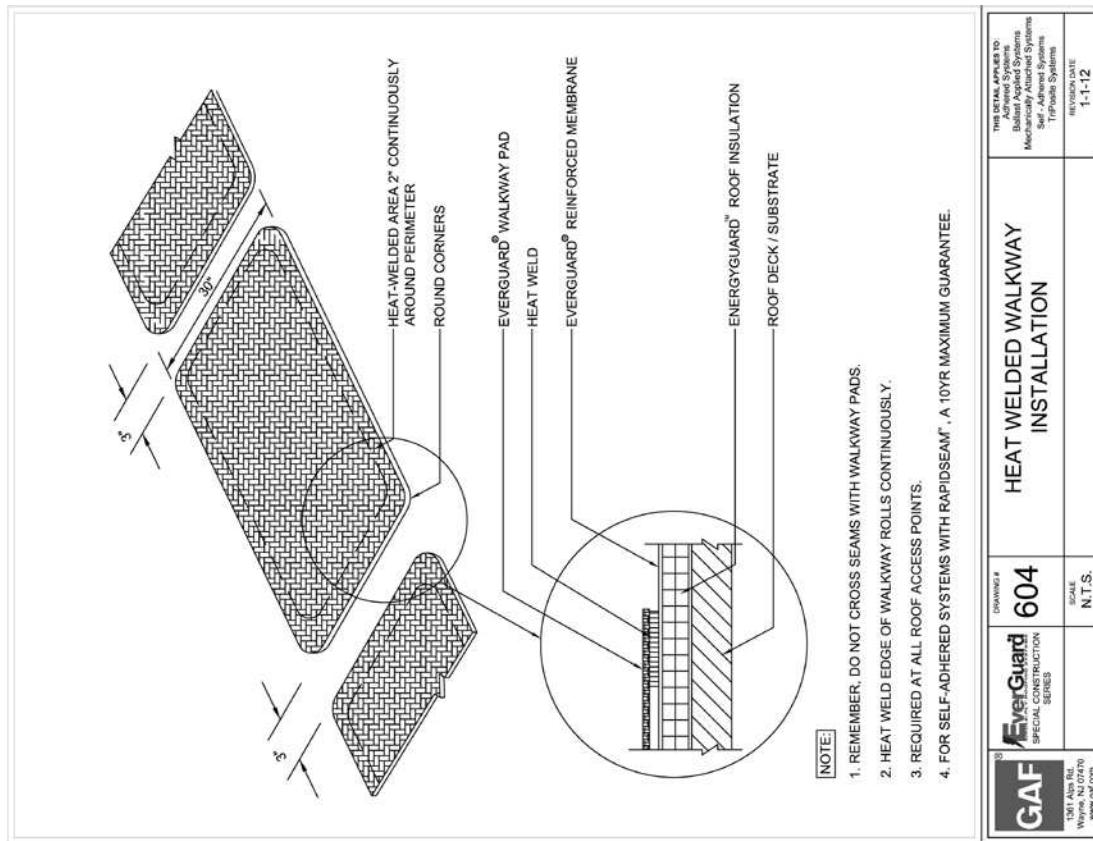


DRAWING #		525 POURABLE SEALER POCKET DETAIL		REVISION DATE 1-1-12
GAF	EverGuard® ROOF PENETRATION SERIES	SCALE N.T.S.	PRIMER TPO ONLY	
1301 Asia Rd. Wayne, NJ 07470 www.gaf.com				



DRAWING #		513 DRAIN - STANDARD ROOF DRAIN FLASHING		REVISION DATE 1-1-12
GAF	EverGuard® ROOF PENETRATION SERIES	SCALE N.T.S.	PRIMER TPO ONLY	
1301 Asia Rd. Wayne, NJ 07470 www.gaf.com				

## ROOFING DETAILS



<b>EverGuard</b> ROOF PENETRATION SERIES		<b>DRAWING #</b> <b>504</b> <b>HEAT WELDED WALKWAY</b> <b>INSTALLATION</b>		<small>THIS DETAIL APPLIES TO:          Adhesive Systems          Ballast Applied Systems          Mechanically Attached Systems          Self-Adhered Systems          T-Profile Systems</small>
1-361 Attn Rd. Wayne, NJ 07470 www.gaf.com	1-1-12	SCALE N.T.S.	SCALE N.T.S.	INSTRUMENT NO. 1-1-12

## NOTES



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North America's  
Largest Roofing  
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