

Version
2.0

GAF

We
protect
what
matters
most™

EVERGUARD® TPO/PVC MECHANICALLY ATTACHED

Roofing System Overview & General Requirements Manual

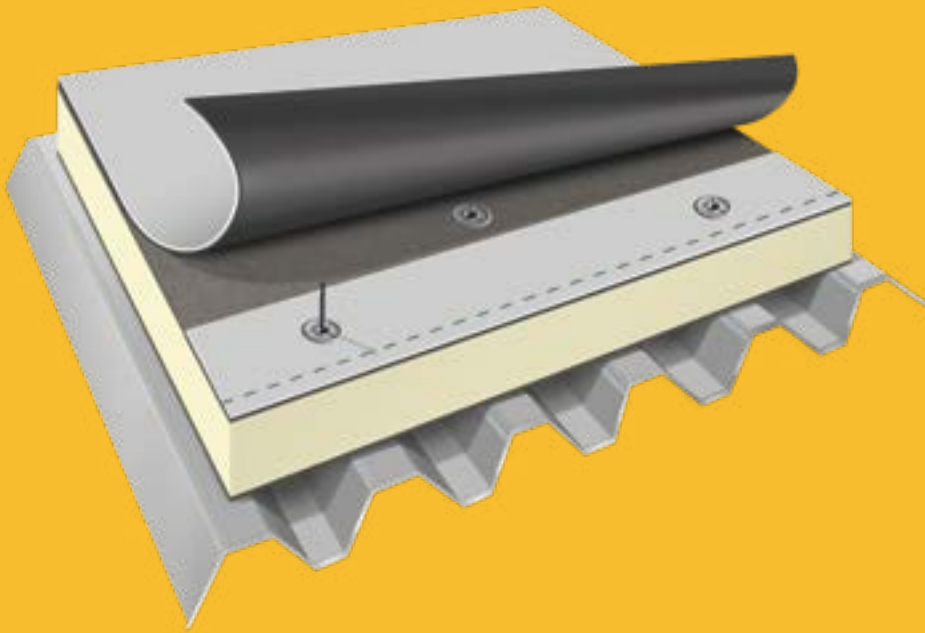


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Note: Refer to www.gaf.com for a complete list of Product Data Sheets.

WELCOME

Thank you for consulting Version 2.0 of the *EverGuard® TPO/PVC Mechanically Attached Roofing System Overview & General Requirements Manual*. You can find further information at www.gaf.com, or call 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 a GAF roof can offer. We are the leading roofing manufacturer in North America, with plants strategically located across the U.S. A member of the Standard Industries family of companies, GAF is part of the largest roofing and waterproofing business in the world.

For roofing contractors and distributors:

- Helping to build your business and avoid hassles

For property owners and architects:

- Helping to assure your best choice in roofing

WHAT IS IN THIS MANUAL?

This Manual contains the following sections:

- Welcome
- Guarantee Program
- Roof Design Considerations
- TPO/PVC Installation Specifications
- Design Considerations & Application Guidelines: Mechanically Attached Roofing Systems

WHAT ARE OUR PRODUCTS AND SERVICES?

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

COMMERCIAL PRODUCTS

- **EnergyGuard™ Insulation**
- **EverGuard Extreme® TPO Single-Ply Roofing Systems**
- **EverGuard® TPO and PVC Single-Ply Roofing Systems**
- **EverGuard® Freedom™ TPO Self-Adhering Roofing Systems**
- **RUBEROID® SBS and APP Modified Bitumen Roofing Systems**
- **LIBERTY™ SBS Self-Adhering Roofing Systems**
- **GAFGLAS® Fiberglass Built-up Roofing Systems**
- **United Coatings™ Liquid-Applied Roof Coatings**
- **HYDROSTOP® Liquid-Applied Roof Membrane**
- **StreetBond® Pavement Coatings**
- **GAF LiveRoof® Garden Roofing System**

RESIDENTIAL SHINGLE PRODUCTS

- **Lifetime Designer Shingles...** Camelot II®, Slateline®, Grand Canyon®, Grand Sequoia®, Grand Sequoia® ArmorShield, Grand Sequoia® Reflector Series, Woodland®, and Glenwood® Shingles
- **Timberline® Roofing Shingles...** Timberline Ultra HD®, Timberline Ultra HD® Reflector Series, Timberline HD®, Timberline HD® Reflector Series, Timberline® Natural Shadow®, Timberline® American Harvest®, Timberline® HDZ, Timberline® Cool Series®, and Timberline® ArmorShield™ II
- **3-Tab Shingles...** Marquis® WeatherMax® and Royal Sovereign®
- **ThermaCal® Nail Base Roof Insulation Panels**

ACCESSORY PRODUCTS

- We offer an extensive line of accessory products for our roof systems, including: EverGuard® TPO and PVC Prefabricated Accessories; Single-Ply Adhesives, Primers & Sealants; Matrix™ Coatings and Cements; Drill-Tec™ Fasteners; M-WELD® Preflashed Accessories; Metalastic® Expansion Joint Covers; Lexsucu® Roof System Accessories; Cobra® and Master Flow® Ventilation Products; Timbertex® Premium Ridge Cap Shingles; WeatherWatch® and StormGuard® Leak Barriers; Shingle-Mate®, Deck-Armor®, Tiger Paw™ and RoofPro™ Roof Deck Protection, among others. See www.gaf.com for complete product offerings.

SERVICES

- GAF has a network of field representatives and distributors to supply and service its quality roofing systems throughout North America.
- Our GAF Technical Support Services is an assistance service that allows you to contact us directly to speak with a representative about specifications, applications, code approvals, and product information. The GAF Technical Support Services number is 800-766-3411.
- Our CARE (Center for the Advancement of Roofing Excellence) program trains industry professionals in safe roofing techniques. Professional, educational programs geared specifically to the roofing industry – given by experts in the roofing industry.
- Architectural Information Services (AIS) is a specification service that helps you to specify an approved GAF roofing system based on your specific roofing needs and will send you a general specification for that roofing system, as well as application methods, product description, and detail drawings. The phone number for AIS is 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. The phone number for TDG is 800-766-3411.
- Visit GAF on the web at www.gaf.com for extensive product information, specifications, and technical literature.

WELCOME

A FEW THINGS TO CONSIDER...

- This Manual contains the latest information relating to the application of GAF's Mechanically Attached 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, or construction flaws.
- 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.
- 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 in or on 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.

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 guaranteed roofing systems must be flashed in accordance with published GAF flashing requirements and details. 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.

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 or modification 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 under any circumstances. Building owners may make reasonable and customary temporary repairs at their own expense to minimize damage to the building or its contents in an emergency.

A GAF guarantee may be cancelled subsequently by GAF for violation of its terms and conditions.

GAF guarantees may be eligible for GAF WellRoof® guarantee extension. Consult with GAF at 800-766-3411 for eligibility requirements.

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 issued for a particular project.

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 Roof 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 to enforce 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 when GAF arrives onsite, GAF reserves the right to charge for such visit.

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 sole 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 Manual and its standard requirements for the issuance of the GAF roofing system guarantee.

SPECIAL CONDITIONS

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

GAF will not issue a roofing system guarantee 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/freezer storage building, unless a ventilated plenum isolates the cold/freezer 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
- 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 fully adhered to the substrate or roof deck, and/or provides an improperly prepared surface
- On plywood/OSB decks not conforming to APA requirements
- 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

GUARANTEE PROGRAM

GAF ROOF GUARANTEE PROGRAM

GAF offers an extensive selection of roof guarantees to meet the needs of most building owners. The following guarantees are available for use with selected EverGuard® Mechanically Attached Roof Systems when installed by an eligible GAF Factory-Certified Contractor. Please call 800-766-3411 for additional information and specific guarantee requirements.

EverGuard® Roofing System Guarantees	Length of Coverage
Diamond Pledge™ NDL Roof Guarantee • Up to 55 mph wind coverage	10 years
	15 years
	20 years
	25 years
	30 years
System Pledge™ Roof Guarantee	10 years
	15 years
	20 years
Weather Stopper® Integrated System Limited Warranty	Up to 20 years
WellRoof™ Guarantee Extension* • Coverage: 25% longer term	Up to 35 years

* When certain requirements are met, GAF will extend its Diamond Pledge™ Guarantee by up to 25% for a maximum of 35 years. Please call 800-766-3411 for qualifying specifications and detailed information. All work must be completed by a GAF Certified Maintenance Professional (CMP). See WellRoof® Guarantee Extension for complete coverage and restrictions.

Note: Refer to the TPO/PVC Guarantee Requirements for maximum guarantee lengths and additional requirements. See pages 7-8.

GUARANTEE PROGRAM

TPO SYSTEM GUARANTEE REQUIREMENTS

EVERGUARD® TPO ROOFING SYSTEMS - MECHANICALLY ATTACHED 15-, 20-, 25-, AND 30-YEAR DIAMOND PLEDGE® NDL ROOF GUARANTEE REQUIREMENTS

The following is a summary of the requirements for the installation of an EverGuard® TPO adhered roofing system in order to be eligible to receive an NDL roof guarantee. 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.

TPO Guarantee Chart				
Attachment Method	Maximum Guarantee Length	EverGuard Extreme® TPO Membrane	EverGuard® TPO Membrane	Insulation Requirements
Mechanically Attached	15 years	50-80 mils	45-80 mils	As required by Insulation Attachment Table(s)
	20 Years	50-80 mils	60-80 mils	As required by Insulation Attachment Table(s)
	25 Years	60-80 mils	80 mils	Minimum of 2 layers of approved insulation ¹
	30 Years	70-80 mils	n/a	Minimum of 2 layers of approved insulation ¹ ; top layer must be an approved cover board ²

¹May be one layer when using a minimum 1/4:12 tapered polyiso insulation system from GAF over concrete, gypsum or cementitious wood fiber (cwf) decks.
²Approved Cover Boards:

1. EnergyGuard™HD Polyiso	5. SECUROCK® Roof Board
2. EnergyGuard™HD Plus Polyiso	6. DensDeck® Prime Roof Board
3. EnergyGuard™NH HD Polyiso	7. DensDeck® Roof Board
4. EnergyGuard™NH HD Plus Polyiso	8. Blue Ridge STRUCTODEK® High Density Fiberboard

Additional Requirements For Extended-Length (25-, 30- and 35- Years) EverGuard® Diamond Pledge™ NDL Roof Guarantees	
Building Height Limitations	Buildings greater than 100' (30.5 m) in height must have a minimum 3' (1 m) parapet wall to be eligible for an extended-length guarantees.
Construction Type	Extended-length guarantees are available only for new construction or a complete tear-off to the deck. Extended-length guarantees are not eligible for re-cover applications.
Air/Vapor Retarders	An air/vapor retarder is required 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. All 10' (3 m) wide or greater membranes with side laps mechanical attachment that exceed 6" (152 mm) o.c
WellRoof™ Guarantee Extension	Any issued guarantee up to 30 years in length is eligible for a GAF WellRoof™ extension; maximum guarantee length, including WellRoof™ Guarantee Extension, is 35 years.
Roof Flashings	For extended-length guarantees, separate counter flashing or cap flashing is required; exposed termination bars are not acceptable.
Flashing Accessories	For extended-length guarantees, regardless of the membrane type, EverGuard Extreme® pre-formed flashing accessories are required. When EverGuard Extreme® pre-formed flashing accessories are not available, unreinforced EverGuard Extreme® membrane must be used.
Roof Edges	EverGuard Extreme® Cover Tape HW, EverGuard Extreme® TPO Coated Metal in conjunction with EverGuard Extreme® Flashing Strip or any of the other EverGuard® pre-fabricated extruded aluminum fascia systems are required.

GUARANTEE PROGRAM

PVC SYSTEM GUARANTEE REQUIREMENTS

EVERGUARD® PVC ROOFING SYSTEMS – MECHANICALLY ATTACHED 15-, 20-, AND 25- YEAR DIAMOND PLEDGE® NDL ROOF GUARANTEE REQUIREMENTS

The following is a summary of the requirements for the installation of an EverGuard® PVC roofing system in order to be eligible to receive an NDL roof guarantee. 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.

PVC Guarantee Chart				
Attachment Method	Maximum Guarantee Length	EverGuard® PVC EverGuard® PVC Fleece-back	EverGuard® PVC KEE EverGuard® PVC KEE Fleece-back	Insulation Requirements
Mechanically Attached	15 Years	50-80 mils	50-80 mils	As required by Insulation Attachment Table(s)
	20 Years	60-80 mils	60-80 mils	
	25 Years	80 mils	80 mils	Minimum of 2 layers of approved insulation ¹

¹May be one layer when using a minimum 1/4:12 tapered polyiso insulation system from GAF over concrete, gypsum or cementitious wood fiber (cwf) decks.

Additional Requirements For Extended-Length (25-Year) EverGuard® Diamond Pledge™ NDL Roof Guarantees	
Building Height Limitations	Buildings greater than 100' (30.5 m) in height must have a minimum 3' (1 m) parapet wall to be eligible for an extended-length guarantees.
Construction Type	Extended-length guarantees are available only for new construction or a complete tear-off to the deck. Extended-length guarantees are not eligible for re-cover applications.
Air/Vapor Retarders	An air/vapor retarder is required 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. All 10' (3 m) wide or greater membranes with side laps mechanical attachment that exceed 6" (150 mm) o.c.
WellRoof™ Guarantee Extension	Any issued guarantee up to 25 years in length is eligible for a GAF WellRoof™ extension; maximum guarantee length, including WellRoof™ Guarantee Extension, is 30 years.
Roof Flashings	For extended-length guarantees, separate counter flashing or cap flashing is required; exposed termination bars are not acceptable.

ROOF DESIGN CONSIDERATIONS

Provides a quick reference of technical requirements for EverGuard® Mechanically Attached Roofing System designs

- 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
- Air Barriers

GAF does not practice architecture or engineering. This section is provided for guidance purposes only based on GAF's experiences in the roofing industry. However, there are many factors that may affect roof design, including specific job site conditions, local building codes, building use, etc., which must be taken into account. GAF recommends consultation with a design professional to determine specific roofing needs and requirements for each particular project.

ROOF DESIGN CONSIDERATIONS

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, we have decades of extensive experience in the practical aspects of roofing.

Our experience suggests that careful consideration of the following will help 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 help building owners save significantly on energy costs and 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*. 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 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 photovoltaics (PV) has highlighted the challenges faced by roofing membranes exposed to concentrated heat, sunlight, and UV. GAF scientists have created a grade of TPO single-ply membrane that is built to handle the extreme demands that can be placed 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/guarantee 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: PV (solar applications), extremes in internal temperature/humidity; positive internal pressure; rooftop traffic/abuse; rooftop-exhausted contaminants; and the use of the roof as living space.

PV (Solar Applications)

- Please review GAF Solar Guidelines, available at www.gaf.com, before installing a PV System on a GAF Guaranteed Roof.

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/blasting 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;
- Cold/freezer storage. Refer to GAF's *A Guide to Cold Storage Roof Systems Design*, available at www.gaf.com, for further information.

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 CONSIDERATIONS

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 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;
- 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.

Refer to www.gaf.com for chemical-resistance information. 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 or to re-cover an existing roofing system is not always clear.

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;
- Only one roofing system in place.

The requirement 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;

ROOF DESIGN CONSIDERATIONS

- 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, GAF does not recommend re-covering over existing coal tar pitch roofs.

ROOF DECKS

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. Additionally, GAF is not responsible for moisture-related problems associated with any deck materials.

Most common structural roof deck types are suitable substrates for the installation of an EverGuard® roofing system.

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

- Minimum 2,500 psi (17,237 kPa) compressive strength.
- 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 (4.08 L/10 m²) 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 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

- Should 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.
- Should 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.
- The underside of the concrete decks, either the vented metal forms or exposed concrete, should remain unobstructed to allow the escape of water vapor. Materials that retard the flow of vapor should 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 things that can trap moisture in the concrete deck below the roof.
- GAF recommends that a vapor retarder be used directly over any poured structural concrete installed over non-removable form decks or any impermeable substrate and **requires** the use of a vapor retarder for lightweight aggregate structural concrete decks in this configuration.
- Roofing professionals must take care with lightweight structural concrete decks. The selection of the deck material and its suitability for use is the responsibility of the designer of record, who must make appropriate design accommodations to address high moisture content encountered in lightweight structural concrete. GAF is not responsible for moisture-related problems associated with any deck materials.

ROOF DESIGN CONSIDERATIONS

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.

Plywood

- Min. 15/32" (12 mm) thickness.
- Deck must be attached with approved fasteners at required spacing.
- Plywood sheathing must comply with roof deck design requirements and local codes for roof deck construction.
- The panels must be secured in accordance with APA-The Engineered Wood Association Construction Guide recommendations. Tongue and groove edges or full blocking required.
- Plywood sheathing must be C-D Exposure 1 APA Rated, minimum 4 ply.
- Plywood sheathing must comply with Structural 1 performance rating.
- Panels must be installed with a 1/8" to 1/4" (3 mm – 6 mm) gap between panels and must match vertically at joints to within 1/8" (3 mm).
- Moisture content not to exceed 16%
- Decking should be kept dry and roofed promptly after installation.
- Must be installed over joists not greater than 24" (610 mm) o.c.
- Insulation above the wood deck may be necessary to prevent condensation from adversely affecting the deck.
- Must meet minimum pull out values
- Minimum 5 test pulls per 1,000 sq. ft. (93 sq. m.)

Oriented Strand Board (OSB)

- Min. 15/32" (12 mm) thickness.
- Deck must be attached with approved fasteners at required spacing. Consult local building codes for specific requirements.
- OSB must comply with roof deck design requirements and local codes for roof deck construction.
- The panels must be secured in accordance with APA-The Engineered Wood Association Construction Guide recommendations. Tongue and groove edges or full blocking required.
- OSB must comply with Structural 1 performance rating.
- Oriented strand board (OSB) must be C-D Exposure 1 APA Rated.
- Must be installed over joists not greater than 24" (610 mm) o.c.

- Insulation above the wood deck may be necessary to prevent condensation from adversely affecting the roof.
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- Moisture content not to exceed 16%
- Decking should be kept dry and roofed promptly after installation.

Note: OSB values vary greatly by manufacturer and with exposure to moisture. OSB exposed to daily condensation or nightly dew has seen significant loss of pull out values. GAF will not accept any liability for substandard or moisture-damaged OSB.

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, please call 800-766-3411 for assistance with installation recommendations.
- If surface is either wet or frozen, a poured gypsum deck is not suitable to receive a roof.

Cementitious Wood Fiber

- Min. 2" (51 mm) thickness.
- Tongue and groove panel edges required.
- Should not be installed over high humidity occupancies.
- All structural wood fiber deck panels must be anchored against uplift and lateral movement.

Lightweight Insulating Concrete (LWIC)

- 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 22 pcf (208 grams/cubic meter). Individual deck manufacturers' standards apply when their specifications exceed these GAF minimum thicknesses, compressive strengths, and density requirements.

ROOF DESIGN CONSIDERATIONS

- 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.
- 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, $15/16$ " (22 mm) deep with $1/2$ " (13 mm) thick mineral board top panel.
- Polystyrene or polyisocyanurate insulation is optional.
- Install only white or light colored membranes on Loadmaster Decks.
- Consult a GAF Field Services Manager or Director for reroofing and re-covering requirements.

Non-Acceptable Substrates

Note: The following are some examples of non-acceptable roof substrates, but should not be considered a complete list. Please call 800-766-3411 or consult with a GAF Field Services Manager or Director regarding the suitability of unusual deck substrates.

- Metal roof panels, unless secured to structural purlins
- Transite roof panels
- Fiberglass roof panels

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.

Plywood/Oriented Strand Board (OSB)

- Plywood must be exterior grade, minimum 4 ply, and at least $15/32$ " (12 mm) thick.
- OSB must comply with Structural 1 rating and be at least $7/16$ " (11 mm) thick.
- Tongue and groove edges.
- Adhesives should only be used with untreated plywood/OSB.
- Surface of plywood/OSB should be dry to the touch with no visible liquid, snow or ice at the time roofing is installed.
- Moisture content not to exceed 16%.

Sheet Metal

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

Gypsum Panel

- Min. $1/2$ " (13 mm) thickness.
- Underlying substrate must allow securement of flashing at prescribed spacing. Mechanical attachment to gypsum panels is not acceptable.
- Use of gypsum panel requires GAF Field Services Area Manager's or Director'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 $1/4$: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.

Design and installation of roof drainage systems should comply with the International Energy Conservation Code (IECC) and the International Plumbing Code (IPC).

ROOF DESIGN CONSIDERATIONS

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.
- 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 EverGuard® Prefabricated Expansion Joint Covers or metal expansion joint 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.
- All expansion joints should have wood nailers.
- EverGuard® Pre-Fab Expansion Joint Covers are available.

AREA DIVIDERS

Area dividers are not structural expansion joints. They can be installed to separate different roofing systems and can be either a curb or low-profile type. Please call 800-766-3411 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.

Alternatively, 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 heavy gas/conduit lines, or where 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, an ANSI/UL 790 or ASTM-E108 Class A, B or C roof fire 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 or Factory Mutual Approval Listing 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.

The following are common references and approvals typically used in conjunction with the wind performance of EverGuard® roofing systems:

• Factory Mutual Approvals

- Testing based on methods described in Approval Standards 4450 and 4470.
- Measures resistance to upward pressure applied to the roof system.
- Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29 provide specific installation guidelines.

• DORA (Directory Of Roofing Assemblies)

The Directory of Roof Assemblies (DORA) is a web application database of roof systems tested in accordance with standards referenced in Chapter 15 of the International Building Code (IBC). This service lists wind uplift load capacity on single ply and modified bitumen roof systems.

- Listed in MasterSpec
- Sponsored by SPRI and administered by InterTek
- Available at <https://www.dora-directory.com/>

• American Society of Civil Engineers (ASCE) document ASCE 7, "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. Check with local code agency as to the latest version that has been adopted.

GAF provides the following thermoplastic Perimeter Half Sheet Table to use as a guide for mechanically attached systems because wind pressures are increased in the corners and perimeter areas of the roof. The field area of the roof normally experiences significantly lower wind pressures than either the corner or perimeter areas.

ROOF DESIGN CONSIDERATIONS

Perimeter Half Sheet Table

Building Width	Building Height	Number of EverGuard® TPO 60" (1.5 m) Half Sheets	Number of EverGuard® PVC 60" (1.5 m) Half Sheets	Number of EverGuard® TPO 72" (1.83 m) Half Sheets
<200' (61 m)	0-34' (0-10 m)	1	1	1
	35-100' (10-30 m)	2	2	2
	>100' (30 m)	Formula Calculations: Install half sheet 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. Note: The minimum perimeter width is 4' (1.2 m). The width is defined as the narrowest dimension.		
≥200' (61 m)	any height	Formula Calculations: Install half sheet 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. Note: The minimum perimeter width is 4' (1.2 m). The width is defined as the narrowest dimension.		

The perimeter area, as defined in the above table, may be adhered as an alternative to using half sheets. When adhering the perimeter area, the number of insulation fasteners must be increased in these areas; refer to the insulation attachment section for adhered membranes to determine the proper insulation attachment pattern. In all cases where the perimeter area is adhered, the membrane must be mechanically fastened where the perimeter area (the adhered area) meets the field roof area. This attachment will prevent pooling of the adhered perimeter area. Refer to the sheet lay-up details in the mechanically attached system section for requirements on the installation of these half sheets. **Note:** When designing for wind loads, ensure that the proper building classification (closed, partially closed, or open) is used if the building has large openings (i.e., docks with large loading bays, etc.). Improper classifications can result in roof attachment failure caused by designing to lower loads than actually exist for the building in question. Factory Mutual Approvals attachment requires the formula calculations.

Important Note: Most states/jurisdictions have not adopted ASCE 7-16. If you are in an area that requires ASCE 7-16, please contact GAF for assistance.

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 (0.0929 sq. m.) sample of a total material assembly in one hour with a temperature difference between the two surfaces of 1°F (5/9 °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 (0.0929 sq m) sample of a given material thickness in one hour.
- The R-value is the reciprocal of the C-value. The C-value represents thermal conductance and depends on the thickness of the material.
- 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 Roofing Manual: Architectural Metal Flashing Condensation and Air Leakage Control, and reroofing

- 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.

• The NRCA Energy Wise Roof Calculator

- 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.
- Go to www.energywise.nrca.net

ROOF DESIGN CONSIDERATIONS

• DOE Energy Calculator

- Go to 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.

• GAF CREST

- GAF CREST (Cool Roof Energy and Sustainability Tool) is a unique tool designed to help contractors consultants and building owners compare the energy cost savings of different roofing systems options.

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.

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 such as a vapor retarder, 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 are 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.
- 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.
- In general, the perm rating of a vapor retarder should be < 0.1 perms (Class 1).

• 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 or °C.

A number of basic considerations factor into determining the need and location of a vapor retarder:

• Temperature and Relative Humidity

- Vapor flows based upon 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.
- 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

- Vapor retarders are intended to be installed as close to the warm side of the roof assembly as possible. Normally, this places the vapor retarder directly on the structural deck or directly over a minimal layer of insulation. **Note: The vapor retarder is not part of the GAF roofing system and is not covered by GAF warranties or guarantees.**
- A sufficient amount of insulation must be installed over the vapor retarder to place the dew point location above the level of the vapor retarder (keeping it on the warm side).
- Determining the need and location of the vapor retarder is the responsibility of the design professional.

• Sealing At Perimeter And Penetrations

- Vapor retarders must be completely sealed at all perimeter and penetration locations.
- Sealing methods must be selected in accordance with the type of vapor retarder being installed.
- Air leakage into the roof system at perimeters 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

- 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.
- These generalizations are not intended to substitute for actual vapor flow calculations based upon specific building and climatic 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.
- A vapor retarder can reduce or eliminate condensation inside the roofing system.

ROOF DESIGN CONSIDERATIONS

• The Case Against The Use Of A Vapor Retarder

- The vapor retarder, together with the roofing membrane, may seal within the roof system entrapped moisture that can eventually destroy the insulation, help split or 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 only appear as a leak when there is a disruption in the vapor retarder. A large area of insulation may be saturated before the punctured roof membrane is discovered and repaired.
- A vapor retarder is a disadvantage in the summer, when vapor migration is generally downward through the roof. Hot, humid air can infiltrate the roofing system through any interruption in the membrane and moisture can condense and then collect on the vapor retarder.

The following resources may provide useful information regarding vapor retarders:

- NRCA Guidelines for Condensation and Air Leakage Control
- ASHRAE Fundamentals Handbook

AIR BARRIERS

1. Designers should consider requiring an air barrier:
 - 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 50 ft. (30.5 m).
 - d. When buildings have large openings or overhangs.
 - e. In conditions where positive internal pressure is applied suddenly, as may be the case at aircraft hangers or distribution centers, where the roofing system may fail due to pressure impact.
2. Refer to FM Global Loss Prevention Data Sheets 1-28 and 1-29 for specific installation procedures for all roofs with large openings.
3. For roofs to be guaranteed by GAF:
 - a. Air barriers are required for all extended-length guarantees on buildings where large wall openings greater than 10% of the total wall area can be opened during a windstorm, including opening due to storm damage.
 - b. All 10' (3 m) wide or greater membranes with side laps mechanically attached with a spacing greater than 6" (152 mm) o.c.

TPO DESIGN TABLE - NEW CONSTRUCTION OR TEAR-OFF - MECHANICALLY ATTACHED

Deck	Insulation/Substrate Attachment		Insulation/Slip Sheet									Membrane Type	
	Mech. Fast.	Adhesive/LRF	ISO	Gypsum Board	Wood Fiber/ Perlite	EPS/XPS	Fanfold ¹	3/6 oz (85/170 g) Polymat	VersaShield [®] Solo [™]	None	Smooth	Fleece (FB)	
Steel	Yes	Yes ²	Yes	Yes	Yes	Yes					Yes		
	Yes	Yes ²	Yes	Yes	Yes	Yes						Yes	
Wood	Yes	Yes ²	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes		
	Yes	Yes ²	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
Structural Concrete & Gypsum	Yes	Yes ²	Yes	Yes	Yes	Yes	Yes	Yes			Yes		
	Yes	Yes ²	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
Lightweight Insulating Concrete	Yes	Yes ²	Yes			Yes	Yes	Yes			Yes		
	Yes	Yes ²	Yes			Yes	Yes	Yes	Yes	Yes		Yes	
Cementitious Wood Fiber	Yes	Yes ²	Yes	Yes	Yes	Yes	Yes	Yes			Yes		
	Yes	Yes ²	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	

¹ Fanfold to be used as a separator board only.

² Low rise foam or hot asphalt can be used for cricket and saddle attachment. If specification requires insulation to be adhered in a mechanically attached system, use foam adhesive designed for insulation attachment, or hot asphalt.

TPO DESIGN TABLE - RE-COVER - MECHANICALLY ATTACHED

Existing Roofing System Type	Insulation/Substrate Attachment		Insulation/Substrate								Membrane Type	
	Mech. Fast.	Adhesive/LRF	ISO	Gypsum Board	Wood Fiber/ Perlite ¹	EPS/XPS	Fanfold ³	3/6 oz (85/170 g) Polymat	VersaShield® Solo™	None	Smooth	Fleece (FB)
Smooth BUR/MB	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Single-Ply Membrane	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes ⁷	Yes	
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Granule-Surfaced BUR/MB	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Gravel-Surfaced BUR/MB ⁵	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Standing Seam Metal ⁶	Yes	Yes ⁴	Yes	Yes	Yes	Yes ²					Yes	
	Yes	Yes ⁴	Yes	Yes	Yes	Yes ²					Yes	Yes

¹ Roof moisture scan required for use of perlite/wood fiber in re-cover roofing systems.

² An approved cover board is required when XPS is used as flute fill material.

³ Fanfold to be used as a re-cover board only.

⁴ Low rise foam or hot asphalt can be used for cricket and saddle attachment. If specification requires insulation to be adhered in a mechanically attached system, use foam adhesive designed for insulation attachment, or hot asphalt.

⁵ All loose gravel must be removed.

⁶ When recovering over an existing standing seam metal roof, fasteners must be directly installed into structural purlins with appropriate fastener type. Fastening into the panel is not permitted.

⁷ Existing single-ply membrane must be clean, smooth, dry and free of debris.

PVC DESIGN TABLE - NEW CONSTRUCTION OR TEAR OFF - MECHANICALLY ATTACHED

Deck	Insulation/Substrate Attachment		Insulation/Slip Sheet									Membrane Type	
	Mech Fast.	Adhesive/LRF	ISO	Gypsum Board	Wood Fiber/ Perlite	EPS/XPS	Fanfold ²	3/6 oz. (85/170 g) Polymat	VersaShield [®] Solo [™]	None	Smooth	Fleece (FB)	
Steel	Yes	Yes ⁴	Yes	Yes	Yes	Yes ¹		Yes			Yes		
	Yes	Yes ⁴	Yes	Yes	Yes	Yes						Yes	
	Yes	Yes ⁴	Yes	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes		Yes		
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
Structural Concrete & Gypsum	Yes	Yes ⁴	Yes	Yes	Yes	Yes ¹	Yes ¹	Yes			Yes		
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
Lightweight Insulating Concrete	Yes	Yes ⁴	Yes			Yes ¹	Yes ¹	Yes			Yes		
	Yes	Yes ⁴	Yes			Yes	Yes		Yes	Yes		Yes	
Cementitious Wood Fiber	Yes	Yes ⁴	Yes	Yes	Yes	Yes ¹	Yes ¹	Yes			Yes		
	Yes	Yes ⁴	Yes	Yes	Yes	Yes ¹	Yes ¹	Yes			Yes		
	Yes	Yes ⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

¹ XPS/Fanfold in combination with a 3/6 oz. (85/170 g) polymat separator.

² Fanfold to be used as a separator board only.

³ Low rise foam or hot asphalt can be used for cricket and saddle attachment. If specification requires insulation to be adhered in a mechanically attached system, use foam adhesive designed for insulation attachment, or hot asphalt.

PVC DESIGN TABLE - RE-COVER - MECHANICALLY ATTACHED

Existing Roofing System Type	Insulation/Substrate Attachment		Insulation/Slip Sheet								Membrane Type	
	Mech Fast.	Adhesive/LRF	ISO	Gypsum Board	Wood Fiber/ Perlite ¹	EPS/ XPS	Fanfold ⁴	3/6 oz. (85/170 g) Polymat	VersaShield [®] Solo [™]	None	Smooth	Fleece (FB)
Smooth BUR/MB	Yes	Yes ⁵	Yes	Yes	Yes	Yes ³	Yes ³	Yes	Yes		Yes	
	Yes	Yes ⁵	Yes	Yes	Yes	Yes	Yes			Yes		Yes
Single-Ply Membrane	Yes	Yes ⁵	Yes	Yes	Yes	Yes ³	Yes ³	Yes	Yes		Yes	
	Yes	Yes ⁵	Yes	Yes	Yes	Yes	Yes			Yes		Yes
Granule-Surfaced BUR/MB	Yes	Yes ⁵	Yes	Yes	Yes	Yes ³	Yes ³	Yes			Yes	
	Yes	Yes ⁵	Yes	Yes	Yes	Yes	Yes			Yes		Yes
Gravel-Surfaced BUR/MB ⁶	Yes	Yes ⁵	Yes	Yes	Yes	Yes ³	Yes ³				Yes	
	Yes	Yes ⁵	Yes	Yes	Yes	Yes	Yes				Yes	Yes
Standing Seam Metal ²	Yes	Yes ⁵	Yes	Yes	Yes	Yes ³	Yes ³	Yes ³			Yes	
	Yes	Yes ⁵	Yes	Yes	Yes	Yes	Yes				Yes	Yes

¹ Roof moisture scan required for use of perlite/wood fiber in re-cover roofing systems.

² An approved cover board is required when XPS is used as flute fill material.

³ XPS/Fanfold in combination with a 3/6 oz. (85/170 g) polymat separator.

⁴ Fanfold to be used as a separator board only.

⁵ Low rise foam or hot asphalt can be used for cricket and saddle attachment. If specification requires insulation to be adhered in a mechanically attached system, use foam adhesive designed for insulation attachment, or hot asphalt. A polymat must be used to cover any asphalt bleed out when a smooth PVC membrane is used.

⁶ All loose gravel must be removed.

INSULATION FASTENER & PLATE TABLE FOR MECHANICALLY ATTACHED SYSTEMS (TABLE 1 OF 2)

For insulation attachment use Table 1 to determine the number of fasteners per board and Table 2 to determine the proper fastener and plate.

Insulation Type	Board Size	Thickness	Number of Fasteners per Board		
			Field	Perimeter	Corner
Polyiso	4'x4' (1.2 m x 2.4 m)	Any	4	4	4
	4'x8' (1.2 m x 2.4 m)	½"-1.2" (13 – 30 mm)	6	6	6
	4'x8' (1.2 m x 2.4 m)	≥ 1.3" (33 mm)	5	5	5
Perlite	4'x4' (1.2 m x 2.4 m)	Any	4	4	4
Wood Fiber	4'x4' (1.2 m x 2.4 m)	Any	4	4	4
	4'x8' (1.2 m x 2.4 m)	Any	6	6	6
Extruded Polystyrene ¹	4'x4' (1.2 m x 2.4 m)	Any	4	4	4
	4'x8' (1.2 m x 2.4 m)	½"-1.2" (13 – 30 mm)	6	6	6
	4'x8' (1.2 m x 2.4 m)	≥ 1.3" (33 mm)	5	5	5
Expanded Polystyrene ¹	4'x4' (1.2 m x 2.4 m)	Any	4	4	4
	4'x8' (1.2 m x 2.4 m)	½"-1.2" (13 – 30 mm)	6	6	6
	4'x8' (1.2 m x 2.4 m)	≥ 1.3" (33 mm)	5	5	5
Fanfold (TPO or PVC Fleece-back only)	Fanfold ²	3/8" min. (10 mm)	2-1-2-1-2	2-1-2-1-2	2-1-2-1-2
Gypsum Board ³	4'x8' (1.2 m x 2.4 m)	1/4"-5/8" (6 – 16 mm)	6	6	6

¹ Smooth PVC must have a 3/6 oz. (85/170 gr) polymat separator sheet. Fleece-back PVC is acceptable.

² Fanfold attachment spacing is for each 2' x 4' (610 mm x 1.2 m) section.

³ Includes approved DensDeck® and SECUROCK® roof board products.

INSULATION FASTENER & PLATE TABLE FOR MECHANICALLY ATTACHED SYSTEMS (TABLE 2 OF 2)

Deck Type	Fastener Type	Plate Type	Penetration (min.)
Steel¹ (22-18 gauge)	Drill-Tec™ #12 Fastener	Drill-Tec™ 3" (76 mm) Steel Plate	3/4" (19 mm) through the deck
	Drill-Tec™ #14 Fastener		
Wood (Plywood, OSB and Plank)	Drill-Tec™ #12 Fastener	Drill-Tec™ 3" (76 mm) Steel Plate	1" (25 mm) thread into/through the deck
	Drill-Tec™ #14 Fastener		
	Drill-Tec™ HXD #15 Fastener		
Structural Concrete	Drill-Tec™ CD-10 Fastener	Drill-Tec™ 3" (76 mm) Steel Plate	1" (25 mm) shank into the deck
	Drill-Tec™ #14 Fastener	Drill-Tec™ 3" (76 mm) Steel Plate	1" (25 mm) thread into the deck
Lightweight Insulating Concrete (LWIC)	Drill-Tec™ #12 Fastener	Drill-Tec™ 3" (76 mm) Steel Plate	3/4" (19 mm) thread through steel form
	Drill-Tec™ #14 Fastener		
	Drill-Tec™ HXD #15 Fastener		
Gypsum Concrete and Cementitious Wood Fiber (Tectum)	Drill-Tec™ Polymer GypTec™ Fastener	Drill-Tec™ 3" (76 mm) GypTec™ Plate	1 1/2" (38 mm) thread into the deck
	Drill-Tec™ LD Fastener	Drill-Tec™ 3" (76 mm) LD Plate	

¹ 24-26 gauge decks require a GAF Field Services Manager's or Director's approval. GAF does not approve the use of metal panels as a roof deck.

10' (3.05 M) WIDE TPO & PVC MEMBRANE ATTACHMENT TABLE - MECHANICALLY ATTACHED SYSTEMS

Deck Type	Minimum Pull-out Values (lbs)	Fastener Type	Plate	Penetration	Standard Pattern	90 psf ¹ Pattern
Steel 22 ga. standard (33 ksi)	450	Drill-Tec™ XHD (#15)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
			2 3/4" (70 mm) barbed SXHD			
	350	Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the deck	6" (152 mm) o.c.	
Drill-Tec™ Eye Hook® AccuSeam® Plate						
Steel 22 ga. high strength (80 ksi)	750	Drill-Tec™ SXHD (#21)	2 3/4" (70 mm) barbed SXHD	3/4" (19 mm) through the deck	12" (305 mm) o.c.	12" (305 mm) o.c.
	450	Drill-Tec™ XHD (#15)	2 3/4" (70 mm) barbed SXHD	3/4" (19 mm) through the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
Steel 24 ga. standard ²	350	Drill-Tec™ XHD (#15)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the deck	6" (152 mm) o.c.	
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
			2 3/4" (70 mm) barbed SXHD			
		Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the deck	6" (152 mm) o.c.	
Drill-Tec™ Eye Hook® AccuSeam® Plate						
2" (51 mm) Nominal Wood Plank	800	Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	1" (25 mm) into the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
		Drill-Tec™ XHD (#15)	2 3/8" (61 mm) barbed XHD			
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
1" (25 mm) Nominal Wood Plank	450	Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	1" (25 mm) through the deck	9" (229 mm) o.c.	
		Drill-Tec™ XHD (#15)	Drill-Tec™ Eye Hook® AccuSeam® Plate			

¹ 90 psf is attachment pattern to provide 90 lbf/ft² (5.3 k Pa) of uplift pressure resistance and may equate to FM I-90. Refer to current FM Approval Guide.

² Does not include metal roofing panels.

Note: For designing at elevated uplift pressures, please consult the current FM Approval Guide/ROOFNAV.

10' (3.05 M) WIDE TPO & PVC MEMBRANE ATTACHMENT TABLE - MECHANICALLY ATTACHED SYSTEMS (CONT.)

Deck Type	Minimum Pull-out Values (lbs)	Fastener Type	Plate	Penetration	Standard Pattern	90 psf ¹ Pattern
3/4" (19 mm) Nominal Plywood	525	Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	1" (25 mm) through the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
		Drill-Tec™ XHD (#15)	2 3/8" (61 mm) barbed XHD			
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
15/32" (12 mm) Plywood or OSB	350	Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	1" (25 mm) through the deck	6" (152 mm) o.c.	
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
Structural Concrete	700	Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed HD	1" (25 mm) into the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
	900	Drill-Tec™ Spike	2 3/8" (61 mm) barbed HD	1" (25 mm) into the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
			2 3/4" (70 mm) barbed SXHD			12" (305 mm) o.c.
	Lightweight Insulating Concrete, 22 ga. standard form	450	Drill-Tec™ XHD (#15)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the form	12" (305 mm) o.c.
Drill-Tec™ Eye Hook® AccuSeam® Plate						
350		Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the form	6" (152 mm) o.c.	
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
Lightweight Insulating Concrete, 24 ga. standard form	350	Drill-Tec™ XHD (#15)	2 3/8" (61 mm) barbed XHD	3/4" (19 mm) through the form	6" (152 mm) o.c.	
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
		Drill-Tec™ HD (#14)	2 3/8" (61 mm) barbed XHD			
			Drill-Tec™ Eye Hook® AccuSeam® Plate			
Gypsum Concrete	400	Drill-Tec™ Polymer	GYPTec™ 2" (51 mm) barbed	1 1/2" (38 mm) into the deck	9" (229 mm) o.c.	6" (152 mm) o.c.
Cementitious Wood Fiber	300	Drill-Tec™ Polymer Screw	Drill-Tec™ Eye Hook® AccuSeam® Plate	1 1/2" (38 mm) into the deck	6" (152 mm) o.c.	

¹ 90 psf (5.3 kPa) attachment pattern to provide 90 lbs per square foot of uplift resistance of the roof membrane to the deck. Consult FM Approvals' RoofNav when a FM Approved assembly is required.

Note: For designing at elevated uplift pressures, please consult the current FM Approval Guide/ROOFNAV.

12 FT. (3.66 M) WIDE EVERGUARD® TPO MEMBRANE ATTACHMENT TABLE - MECHANICALLY ATTACHED OVER STEEL DECK

Deck Type	Minimum Pull-out Values (lbs)	Fastener Type	Plate	Penetration	Standard Pattern	90 psf Pattern ¹
Steel 22 ga. (33 ksi)	750	Drill-Tec™ SXHD (#21)	2-3/4" (70 mm) double barbed SXHD	3/4" (19 mm) through the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
	450	Drill-Tec™ XHD (#15)	2" (51 mm) double barbed XHD		6" (152 mm) o.c.	6" (152 mm) o.c.
			2-3/8" (61 mm) barbed XHD Drill-Tec™ Eye Hook® AccuSeam® Plate			
Steel 22 ga. (80 ksi)	750	Drill-Tec™ SXHD (#21)	2-3/4" (70 mm) double barbed SXHD	3/4" (19 mm) through the deck	12" (305 mm) o.c.	6" (152 mm) o.c.
	450	Drill-Tec™ XHD (#15)	2-3/4" (70 mm) double barbed SXHD		6" (152 mm) o.c.	
			2-3/8" (61 mm) barbed XHD			
			2" (51 mm) double barbed XHD			
			Drill-Tec™ Eye Hook® AccuSeam® Plate			

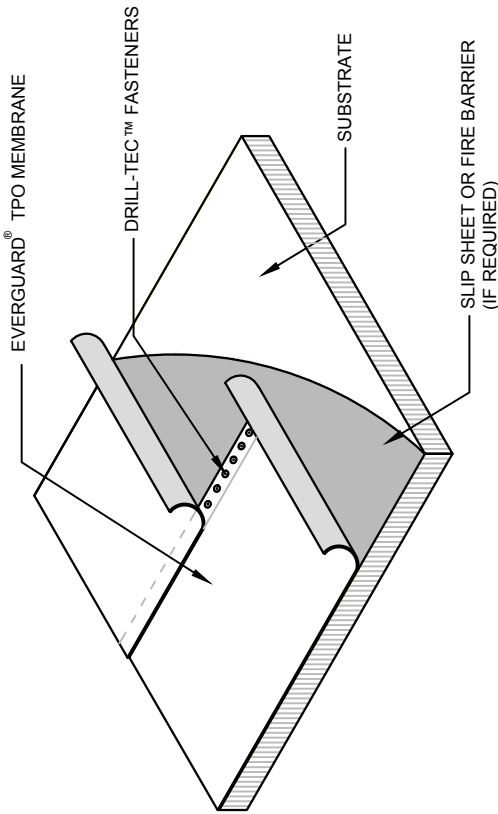
¹90 psf (5.3 kPa) attachment pattern to provide 90 lbs per square foot of uplift resistance of the roof membrane to the deck. Consult FM Approvals' RoofNav when a FM Approved assembly is required.

PERIMETER HALF SHEET TABLE

Building Width	Building Height	Number of EverGuard® TPO 60" (1.5 m) Half Sheets	Number of EverGuard® PVC 60" (1.5 m) Half Sheets	Number of EverGuard® TPO 72" (1.83 m) Half Sheets
<200' (61 m)	0-34' (0-10 m)	1	1	1
	35-100' (10-30 m)	2	2	2
	>100' (30 m)	Formula Calculations: Install half sheet 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. Note: The minimum perimeter width is 4' (1.2 m). The width is defined as the narrowest dimension.		
≥200' (61 m)	any height			

Note: FM attachment requires the Formula calculation.

INSULATED & NON-INSULATED TPO MECHANICALLY ATTACHED SYSTEMS SPECIFICATION PLATE



MEMBRANE TYPE
T = TPO

CONSTRUCTION TYPE
N = NEW
R = RECOVER
T = TEAR OFF (COMPLETE)

60

I

N

MA

T

MEMBRANE (THICKNESS AND TYPE)
45 = 45 MIL SMOOTH
60 = 60 MIL SMOOTH
80 = 80 MIL SMOOTH
45FB = 45 MIL FLEECE-BACK
60FB = 60 MIL FLEECE-BACK
80FB = 80 MIL FLEECE-BACK
50EX = 50 MIL EXTREME
60EX = 60 MIL EXTREME
70EX = 70 MIL EXTREME
80EX = 80 MIL EXTREME
50EXFB = 50 MIL EXTREME FLEECE-BACK
60EXFB = 60 MIL EXTREME FLEECE-BACK
70EXFB = 70 MIL EXTREME FLEECE-BACK
80EXFB = 80 MIL EXTREME FLEECE-BACK

MEMBRANE ATTACHMENT
MA = MECHANICALLY ATTACHED

MEMBRANE TYPE	MEMBRANE ATTACHMENT	CONSTRUCTION TYPE	INSULATION	GUARANTEE LENGTH UP TO (YEARS)			
				15	20	25 ²	30 ²
T	MA	N R' T	I N	45 45FB	60 60FB 50EX 50EXFB	80 80FB 60EX 60EXFB	70EX 70EXFB 80EX 80EXFB
MINIMUM MEMBRANE REQUIREMENTS							

1. For a non-insulated recover with smooth membrane only: Slip sheet or fire barrier required; 3 or 6 oz. (85 or 170 g.) polyamat or VersaShield[®] Solo[™] Fire-Resistant Slip Sheet.

2. New & Tear-off only. Refer to the Guarantee Requirements Table for additional requirements on extended-length guarantees.

EVERGUARD® TPO MECHANICALLY ATTACHED SPECIFICATIONS

GAF Specification Number	EverGuard® Membrane Type	Attachment Type	Construction Type	Insulation	TPO Thickness (mil)	Maximum Guarantee Length (Years)
T-MA-N-I-45	TPO Smooth	Mechanically Attached	New	Yes	45	15
T-MA-N-I-60					60	20
T-MA-N-I-80					80	25
<hr/>						
T-MA-T-I-45	TPO Smooth	Mechanically Attached	Tear-off	Yes	45	15
T-MA-T-I-60					60	20
T-MA-T-I-80					80	25
<hr/>						
T-MA-R-I-45	TPO Smooth	Mechanically Attached	Recover	Yes	45	15
T-MA-R-I-60					60	20
T-MA-R-I-80					80	20
<hr/>						
T-MA-N-I-45FB	TPO Fleece-Back	Mechanically Attached	New	Yes	45	15
T-MA-N-I-60FB					60	20
T-MA-N-I-80FB					80	25
<hr/>						
T-MA-T-I-45FB	TPO Fleece-Back	Mechanically Attached	Tear-off	Yes	45	15
T-MA-T-I-60FB					60	20
T-MA-T-I-80FB					80	25
<hr/>						
T-MA-R-I-45FB	TPO Fleece-Back	Mechanically Attached	Recover	Yes	45	15
T-MA-R-I-60FB					60	20
T-MA-R-I-80FB					80	20
<hr/>						
T-MA-N-N-45	TPO Smooth	Mechanically Attached	New	No	45	15
T-MA-N-N-60					60	20
T-MA-N-N-80					80	20
<hr/>						
T-MA-T-N-45	TPO Smooth	Mechanically Attached	Tear-off	No	0.045	15
T-MA-T-N-60					0.060	20
T-MA-T-N-80					0.080	20
<hr/>						
T-MA-R-N-45	TPO Smooth	Mechanically Attached	Recover	No	0.045	15
T-MA-R-N-60					0.060	20
T-MA-R-N-80					0.080	20

EVERGUARD® TPO MECHANICALLY ATTACHED SPECIFICATIONS (CONT.)

GAF Specification Number	EverGuard® Membrane Type	Attachment Type	Construction Type	Insulation	TPO Thickness (mil)	Maximum Guarantee Length (Years)
T-MA-N-N-45FB	TPO Fleece-Back	Mechanically Attached	New	No	45	15
T-MA-N-N-60FB					60	20
T-MA-N-N-80FB					80	20
T-MA-T-N-45FB	TPO Fleece-Back	Mechanically Attached	Tear-off	No	45	15
T-MA-T-N-60FB					60	20
T-MA-T-N-80FB					80	20
T-MA-R-N-45FB	TPO Fleece-Back	Mechanically Attached	Recover	No	45	15
T-MA-R-N-60FB					60	20
T-MA-R-N-80FB					80	20

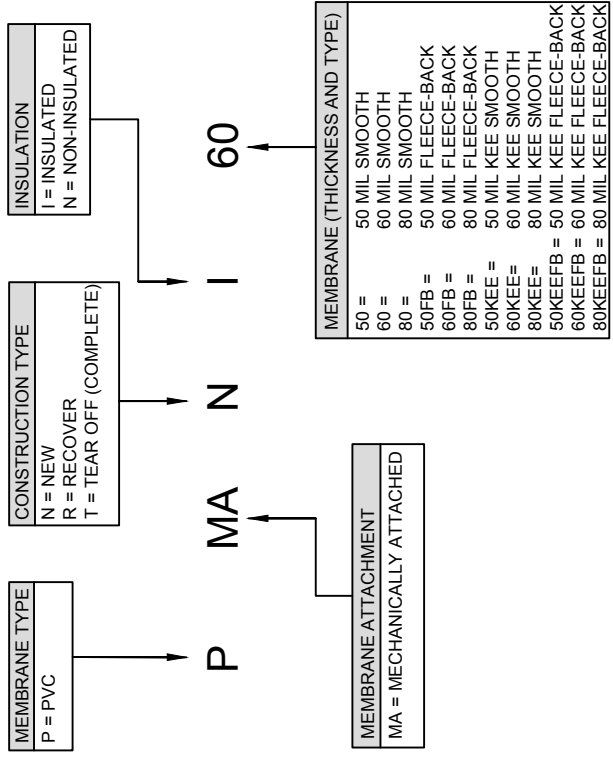
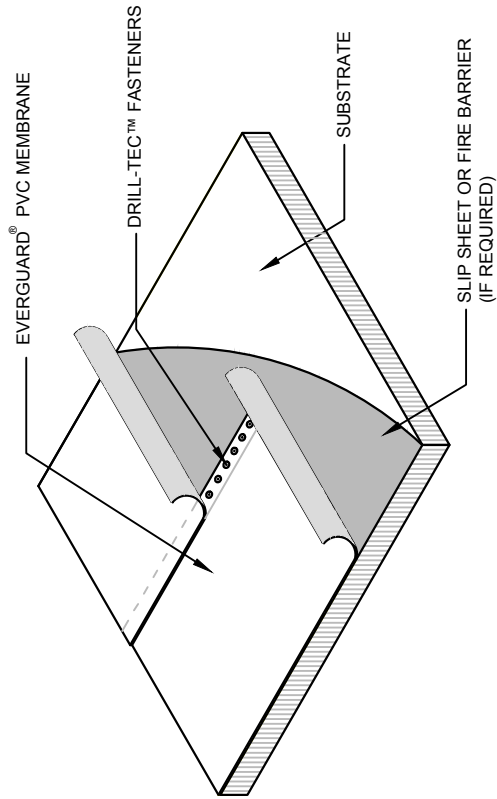
EVERGUARD EXTREME® TPO MECHANICALLY ATTACHED SPECIFICATIONS

GAF Specification Number	EverGuard® Membrane Type	Attachment Type	Construction Type	Insulation	TPO Thickness (mil)	Maximum Guarantee Length (Years)
T-MA-N-I-50EX	Extreme TPO Smooth	Mechanically Attached	New	Yes	50	20
T-MA-N-I-60EX					60	25
T-MA-N-I-70EX					70	30
T-MA-N-I-80EX					80	30
<hr/>						
T-MA-T-I-50EX	Extreme TPO Smooth	Mechanically Attached	Tear-off	Yes	50	20
T-MA-T-I-60EX					60	25
T-MA-T-I-70EX					70	30
T-MA-T-I-80EX					80	30
<hr/>						
T-MA-R-I-50EX	Extreme TPO Smooth	Mechanically Attached	Recover	Yes	50	20
T-MA-R-I-60EX					60	20
T-MA-R-I-70EX					70	20
T-MA-R-I-80EX					80	20
<hr/>						
T-MA-N-I-50EXFB	Extreme TPO Fleece-Back	Mechanically Attached	New	Yes	50	20
T-MA-N-I-60EXFB					60	25
T-MA-N-I-70EXFB					70	30
T-MA-N-I-80EXFB					80	30
<hr/>						
T-MA-T-I-50EXFB	Extreme TPO Fleece-Back	Mechanically Attached	Tear-off	Yes	50	20
T-MA-T-I-60EXFB					60	25
T-MA-T-I-70EXFB					70	30
T-MA-T-I-80EXFB					80	30
<hr/>						
T-MA-R-I-50EXFB	Extreme TPO Fleece-Back	Mechanically Attached	Recover	Yes	50	20
T-MA-R-I-60EXFB					60	20
T-MA-R-I-70EXFB					70	20
T-MA-R-I-80EXFB					80	20
<hr/>						
T-MA-N-N-50EX	Extreme TPO Smooth	Mechanically Attached	New	No	50	20
T-MA-N-N-60EX					60	20
T-MA-N-N-70EX					70	20
T-MA-N-N-80EX					80	20

EVERGUARD EXTREME® TPO MECHANICALLY ATTACHED SPECIFICATIONS (CONT)

GAF Specification Number	EverGuard® Membrane Type	Attachment Type	Construction Type	Insulation	TPO Thickness (mil)	Maximum Guarantee Length (Years)
T-MA-T-N-50EX	Extreme TPO Smooth	Mechanically Attached	Tear-off	No	50	20
T-MA-T-N-60EX					60	20
T-MA-T-N-70EX					70	20
T-MA-T-N-80EX					80	20
T-MA-R-N-50EX	Extreme TPO Smooth	Mechanically Attached	Recover	No	50	20
T-MA-R-N-60EX					60	20
T-MA-R-N-70EX					70	20
T-MA-R-N-80EX					80	20
T-MA-N-N-50EXFB	Extreme TPO Fleece-Back	Mechanically Attached	New	No	50	20
T-MA-N-N-60EXFB					60	20
T-MA-N-N-70EXFB					70	20
T-MA-N-N-80EXFB					80	20
T-MA-T-N-50EXFB	Extreme TPO Fleece-Back	Mechanically Attached	Tear-off	No	50	20
T-MA-T-N-60EXFB					60	20
T-MA-T-N-70EXFB					70	20
T-MA-T-N-80EXFB					80	20
T-MA-R-N-50EXFB	Extreme TPO Fleece-Back	Mechanically Attached	Recover	No	50	20
T-MA-R-N-60EXFB					60	20
T-MA-R-N-70EXFB					70	20
T-MA-R-N-80EXFB					80	20

INSULATED & NON-INSULATED PVC MECHANICALLY ATTACHED SYSTEMS SPECIFICATION PLATE



MEMBRANE TYPE	MEMBRANE ATTACHMENT	CONSTRUCTION TYPE	INSULATION	GUARANTEE LENGTH UP TO (YEARS)	
				15	20
P	MA	N	I	15	25 ²
		R ¹	N	50	80
		T		50FB	80FB
				50KEE	80KEE
				MINIMUM MEMBRANE REQUIREMENTS	
				50 KEEFB	80 KEEFB

1. For a non-insulated recover with smooth membrane only. Slip sheet or fire barrier required; 3 or 6 oz. (85 or 170 g.) polymat or VersaShield® Solo™ Fire-Resistant Slip Sheet.
 2. New & Tear-off only. Refer to the Guarantee Requirements Table for additional requirements on extended-length guarantees.

EVERGUARD® PVC MECHANICALLY ATTACHED SPECIFICATIONS

GAF Specification Number	EverGuard® Membrane Type	Attachment Type	Construction Type	Insulation	TPO Thickness (mil)	Maximum Guarantee Length (Years)
P-MA-N-I-50	PVC	Mechanically Attached	New	Yes	50	15
P-MA-N-I-60					60	20
P-MA-N-I-80					80	25
P-MA-T-I-50	PVC	Mechanically Attached	Tear-off	Yes	50	15
P-MA-T-I-60					60	20
P-MA-T-I-80					80	25
P-MA-R-I-50	PVC	Mechanically Attached	Recover	Yes	50	15
P-MA-R-I-60					60	20
P-MA-R-I-80					80	20
P-MA-N-I-50FB	PVC Fleece-Back	Mechanically Attached	New	Yes	50	15
P-MA-N-I-60FB					60	20
P-MA-N-I-80FB					80	25
P-MA-T-I-50FB	PVC Fleece-Back	Mechanically Attached	Tear-off	Yes	50	15
P-MA-T-I-60FB					60	20
P-MA-T-I-80FB					80	25
P-MA-R-I-50FB	PVC Fleece-Back	Mechanically Attached	Recover	Yes	50	15
P-MA-R-I-60FB					60	20
P-MA-R-I-80FB					80	20
P-MA-N-N-50	PVC Smooth	Mechanically Attached	New	No	50	15
P-MA-N-N-60					60	20
P-MA-N-N-80					80	20
P-MA-T-N-50	PVC Smooth	Mechanically Attached	Tear-off	No	50	15
P-MA-T-N-60					60	20
P-MA-T-N-80					80	20
P-MA-R-N-50	PVC Smooth	Mechanically Attached	Recover	No	50	15
P-MA-R-N-60					60	20
P-MA-R-N-80					80	20
P-MA-N-N-50FB	PVC Fleece-Back	Mechanically Attached	New	No	50	15
P-MA-N-N-60FB					60	20
P-MA-N-N-80FB					80	20
P-MA-T-N-50FB	PVC Fleece-Back	Mechanically Attached	Tear-off	No	50	15
P-MA-T-N-60FB					60	20
P-MA-T-N-80FB					80	20
P-MA-R-N-50FB	PVC Fleece-Back	Mechanically Attached	Recover	No	50	15
P-MA-R-N-60FB					60	20
P-MA-R-N-80FB					80	20

EVERGUARD® PVC MECHANICALLY ATTACHED SPECIFICATIONS (CONT.)

GAF Specification Number	EverGuard® Membrane Type	Attachment Type	Construction Type	Insulation	TPO Thickness (mil)	Maximum Guarantee Length (Years)
P-MA-N-I-50KEE	PVC KEE	Mechanically Attached	New	Yes	50	15
P-MA-N-I-60KEE					60	20
P-MA-N-I-80KEE					80	25
P-MA-T-I-50KEE	PVC KEE	Mechanically Attached	Tear-off	Yes	50	15
P-MA-T-I-60KEE					60	20
P-MA-T-I-80KEE					80	25
P-MA-R-I-50KEE	PVC KEE	Mechanically Attached	Recover	Yes	50	15
P-MA-R-I-60KEE					60	20
P-MA-R-I-80KEE					80	20
P-MA-N-I-50KEEFB	PVC KEE Fleece-Back	Mechanically Attached	New	Yes	50	15
P-MA-N-I-60KEEFB					60	20
P-MA-N-I-80KEEFB					80	25
P-MA-T-I-50KEEFB	PVC KEE Fleece-Back	Mechanically Attached	Tear-off	Yes	50	15
P-MA-T-I-60KEEFB					60	20
P-MA-T-I-80KEEFB					80	25
P-MA-R-I-50KEEFB	PVC KEE Fleece-Back	Mechanically Attached	Recover	Yes	50	15
P-MA-R-I-60KEEFB					60	20
P-MA-R-I-80KEEFB					80	20
P-MA-N-N-50KEE	PVC KEE	Mechanically Attached	New	No	50	15
P-MA-N-N-60KEE					60	20
P-MA-N-N-80KEE					80	20
P-MA-T-N-50KEE	PVC KEE	Mechanically Attached	Tear-off	No	50	15
P-MA-T-N-60KEE					60	20
P-MA-T-N-80KEE					80	20
P-MA-R-N-50KEE	PVC KEE	Mechanically Attached	Recover	No	50	15
P-MA-R-N-60KEE					60	20
P-MA-R-N-80KEE					80	20
P-MA-N-N-50KEEFB	PVC KEE Fleece-Back	Mechanically Attached	New	No	50	15
P-MA-N-N-60KEEFB					60	20
P-MA-N-N-80KEEFB					80	20
P-MA-T-N-50KEEFB	PVC KEE Fleece-Back	Mechanically Attached	Tear-off	No	50	15
P-MA-T-N-60KEEFB					60	20
P-MA-T-N-80KEEFB					80	20
P-MA-R-N-50KEEFB	PVC KEE Fleece-Back	Mechanically Attached	Recover	No	50	15
P-MA-R-N-60KEEFB					60	20
P-MA-R-N-80KEEFB					80	20

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DESIGN CONSIDERATIONS & APPLICATION GUIDELINES: MECHANICALLY ATTACHED ROOFING SYSTEMS

TPO & PVC

PART 1 – GENERAL

1.01 System Description

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

1.02 Specification Designations

- A. See Specification Plates in TPO/PVC Installation Specifications Section.

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 ¼:12 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 a GAF representative.
- D. The following are common items of discussion at a pre-job conference:
 - 1. Submittals of materials, drawings, and project documents.
 - 2. Roof deck conditions.
 - 3. Flashing and expansion joint details.
 - 4. Insurance underwriters or building code requirements.
 - 5. Unusual project conditions.
 - 6. Protection of the roof, building, building occupants, and contents during and after application.
 - 7. Application techniques.
 - 8. Coordination and scheduling of other trades that will be working on the project.
 - 9. Designation by the roofing contractor of a qualified person responsible for quality control. This person should be on the project full time during application of the roof system.
 - 10. Scheduling of material shipments, material storage, and rooftop loading.

1.04 Delivery, Storage, & Protection

- A. Deliver products to site in original containers with seals unbroken and labeled with manufacturers' name, product brand name, and type.
- 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 covers are not designed for rooftop storage. Use "breathable" type covers, such as canvas tarpaulins, to protect from weather and moisture. If condensation is present inside of factory shroud, cut and allow to vent.
 - 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. Reference product data sheets for 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. 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 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.
- 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

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materials when moisture, such as liquid water, dew, condensate, snow or ice, 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 45°F (7.2°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 after removal from warming box.
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 substrate(s) 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 workday. Remove all temporary work at the beginning of the next workday.
- 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 that would be detrimental to the proper execution of specified work, immediately notify the building owner and the designer of record of these conditions for consultation on acceptable remedy or resolution of the problem.

1.07 Safety Considerations & Warnings

- A. As with any construction project, 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, eye protection, 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.
- E. EverGuard® TPO or PVC roof membranes may be slippery when wet. Exercise caution when walking on the TPO or PVC membranes during or after a rain shower, or if moisture is present in the form of dew, frost or ice. Pay attention while walking on light-colored surfaces as ice or frost build-up may not be as visible as on a dark surface.

PART 2 – PRODUCTS

2.01 Membrane

- A. EverGuard® TPO
- B. EverGuard Extreme® TPO
- C. EverGuard® TPO FB Ultra
- D. EverGuard Extreme® TPO FB Ultra
- E. EverGuard® PVC
- F. EverGuard® PVC Fleece-back
- G. EverGuard® PVC KEE
- H. EverGuard® PVC KEE Fleece-back

2.02 Flashing - Wall & Curb

- 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. The use of EverGuard Extreme® TPO flashings is required on EverGuard Extreme® systems.
- C. Because colored TPO membranes may exhibit different welding characteristics, please call 800-766-3411 before attempting to weld different-colored TPO membranes with white membranes or flashings.
- D. EverGuard® TPO and PVC Fleece-Back membranes are optional flashing membranes for all EverGuard® TPO and PVC roofing systems, respectively. These membranes may be a solution when a contaminated substrate is encountered.

2.03 Flashing Accessories

- A. EverGuard® preformed flashing accessories must be of the same type as the roofing membrane.

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- 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 with which you are working.
- C. The use of EverGuard Extreme® TPO flashing accessories is required on EverGuard Extreme® systems.
- D. Unreinforced EverGuard Extreme® flashing membrane is available and required on areas where prefabricated accessories cannot be used or are unavailable.
- E. All EverGuard® accessories must be stored indoors and protected from moisture and extreme temperatures. See specific instructions on packaging for further details.

2.04 Fasteners

- A. 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.
- D. Drill-Tec™ “flat” plates (without the countersunk screw holes protruding from the bottom of the plates) are required when plates are installed over hard surfaces such as wood decks, DensDeck®, SECUROCK® or other hard cover boards to allow the plates to rest flush on the surface.

2.05 Adhesives, Sealants, Primers, & Cleaners

- A. Adhesives (Vertical Flashings Only on Mechanically Attached Systems)
 - 1. Solvent-Based
 - a. EverGuard® #1121 TPO Bonding Adhesive
 - b. EverGuard® TPO Low VOC Bonding Adhesive
 - 2. Water-Based
 - a. EverGuard® WB 181 Bonding Adhesive (Smooth TPO only)
 - b. EverGuard TPO Quick Spray Adhesive
 - c. EverGuard TPO Quick Spray LV50 Adhesive
 - 3. Low-Rise Foam (LRF) (Insulation only)
 - a. LRF-M Adhesive
 - b. OlyBond500® Adhesive
- B. Sealants
 - 1. EverGuard® One-Part Pourable Sealant (urethane based)
 - 2. FlexSeal™ Caulk Grade Sealant
 - 3. FlexSeal™ LV Caulk Grade Sealant (low-viscosity)
 - 4. EverGuard® Water-Block
 - 5. EverGuard® TPO Cut Edge Sealant
- C. Primers
 - 1. EverGuard® TPO Primer
 - 2. EverGuard® Low VOC Primer

D. Cleaners

- 1. EverGuard® CleanWeld™ Conditioner (low-VOC)
- 2. EverGuard® TPO Seam Cleaner
- 3. EverGuard® PVC Membrane Conditioner

2.06 Traffic Protection

A. EverGuard® TPO Walkway Roll

- 1. This product is designed to be heat-welded to the top of GAF TPO roofing membranes.
- 2. The Walkway Roll is available in standard gray or “safety” yellow color with a “diamond tread” pattern, and comes in 34.25" x 50" (870 mm x 15.2 m) rolls.
- 3. 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 Roll

- 1. This product heat-welds directly to GAF EverGuard® PVC roofing membranes.
- 2. The Walkway Roll is available in standard gray with a “herringbone” traction surface, and comes in 30" x 36" (762 mm x 914 mm) rolls.
- 3. The EverGuard® PVC Walkway Roll features a 2" (51 mm) welding strip (smooth border) along each longitudinal edge that is compatible with hand or automatic welders.

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 insulation must be used in roofing systems to be guaranteed by GAF.
- B. Insulation boards of the types listed below are acceptable for use in roofing systems guaranteed by GAF. 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.
 - 1. EnergyGuard™ Polyiso Insulation is made of glass fiber-reinforced cellulosic felt facers bonded to a core of polyisocyanurate foam. Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 2 (20 psi), and available in Grade 3 (25 psi).
 - 2. EnergyGuard™ Tapered Polyiso Insulation is made of glass fiber-reinforced cellulosic felt facers bonded to a core of polyisocyanurate foam. It is readily available in various slopes such as the most popular and efficient tapers, 1/8:12 (1%), 1/4:12 (2%), and 1/2:12 (4%). Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 2 (20 psi), and available in Grade 3 (25 psi). Maximum board size is 4' x 4' (1.21 m x 1.21 m).
 - 3. EnergyGuard™ Ultra Polyiso Insulation is made of coated glass-fiber mat facer laminated to a closed-cell polyisocyanurate foam core. Meets or exceeds the requirements of ASTM C1289 Type II, Class 2, Grade 2 (20 psi), and available in Grade 3 (25 psi).

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4. EnergyGuard™ NH Polyiso Insulation is made of glass-reinforced cellulosic felt facers bonded to a core of non-halogenated polyisocyanurate foam. Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 2 (20 psi), and available in Grade 3 (25 psi).
5. EnergyGuard™ NH HD Ultra Polyiso Insulation is made of coated glass facers bonded to a core of non-halogenated polyisocyanurate foam. Meets or exceeds the requirements of ASTM C1289 Type II, Class 2, Grade 2 (20 psi), and available in Grade 3 (25 psi).
6. EnergyGuard™ Perlite roof insulation is composed of expanded perlite particles, selected binders and cellulose fibers that meets or exceeds the requirements of ASTM C728, Type I.
7. EnergyGuard™ Tapered Perlite roof insulation is composed of expanded perlite particles, selected binders and cellulose fibers that meets the requirements of ASTM C728, Type I.
8. Expanded Polystyrene Insulation (EPS) with plastic facer meets or exceeds the requirements of ASTM C578, Type II nominal 1.5 lb. (42 g/cm³) density and minimum 15 psi (110 kPa) compressive strength.
9. Extruded Polystyrene Insulation (XPS) meets or exceeds the requirements of ASTM C578, Type II nominal 1.5 lb. (42 g/cm³) density and minimum 15 psi (110 kPa) compressive strength.
6. Expanded Polystyrene Insulation (EPS) with plastic facer meets or exceeds the requirements for ASTM C578, Type IX [min. 25 psi (173 kPa) compressive strength].
7. Extruded Polystyrene Insulation (XPS) meets or exceeds the requirements for ASTM C578, Type IV [min. 25 psi (173 kPa) compressive strength].

2.09 Cover/Re-cover Boards

- A. Cover/Re-cover boards of the following types listed below are acceptable for use in roofing systems guaranteed by GAF. Board size can be 4' x 4' or 4' x 8' (1.21 m x 1.21 m or 1.21 m x 2.4 m) panels for mechanical attachment and 4' x 4' or 4' x 8' (1.21 m x 1.21 m or 1.21 m x 2.4 m) for adhered attachment and tapered systems, except for fanfold re-cover board, which comes in 2' (610 mm) x 4' (1.21 m) sections with a 50' (15.2 m) total length.
1. EnergyGuard™ HD Polyiso Insulation is a ½" (12.7 mm) thick high-density polyiso cover board made of coated glass-fiber mat facers bonded to high-density closed cell polyisocyanurate foam cores. Meets or exceeds the requirements of ASTM C1289 Type 2, Class 4, Grade 1 (80 psi).
 2. EnergyGuard™ HD PLUS Polyiso Insulation is a ½" (12.7 mm) thick high-density polyiso cover board made of coated glass-fiber mat facers bonded to high-density closed cell polyisocyanurate foam cores. Meets or exceeds the requirements of ASTM C1289 Type 2, Class 4, Grade 2 (110 psi).
 3. EnergyGuard™ Barrier Polyiso Insulation consists of coated glass-fiber and a special coated glass-fiber laminated to a closed-cell polyisocyanurate foam core. Meets or exceeds the requirements of ASTM C1289 Type 2, Class 4, Grade 2.
 4. USG SECURROCK® Brand Gypsum-Fiber Roof Board is a high-performance, non-combustible, moisture and mold resistant roof board that meets the requirements of ASTM C1278.
 5. DensDeck® and DensDeck® Prime Roof Board is made of glass mat facings front and back that are embedded into a water-resistant and moisture-resistant treated gypsum core. Meets the requirements of ASTM C1177.
 6. STRUCTODEK® High Density Fiberboard Roof Insulation Cover Board with Primed Red Coating incorporates a non-asphaltic Primed Red Coating integrated on the surface board that meets the requirements of ASTM C208, Type II, Grade 1 and Grade 2.
 7. EnergyGuard™ Perlite roof insulation is composed of expanded perlite particles, selected binders and cellulose fibers that meets the requirements of ASTM C728, Type I.
 8. Extruded Polystyrene Insulation Fan-fold Re-cover Board 3/8" (9.5 mm) with plastic facer meets or exceeds the requirements for ASTM C578, Type IV [min 25 psi (173 kPa) compressive strength].
 9. Extruded Polystyrene Insulation Re-cover Board 1/2" (13 mm) with plastic facer meets or exceeds the requirements for ASTM C578, Type IV [min 25 psi (173 kPa) compressive strength].
- ### 2.08 High Traffic Applications
- A. Insulation boards of the types listed below are acceptable for use in roofing systems guaranteed by GAF. 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.
1. EnergyGuard™ Polyiso Insulation is made of glass fiber-reinforced cellulosic felt facers bonded to a core of polyisocyanurate foam. Meets the requirements of ASTM C1289 Type II, Class 1, Grade 3 (25 psi) min.
 2. EnergyGuard™ Tapered Polyiso Insulation is made of glass fiber-reinforced cellulosic felt facers bonded to a core of polyisocyanurate foam. It is readily available in various profiles such as the most popular and efficient tapers, 1/8:12 (1%), 1/4:12 (2%), and 1/2:12 (4%). Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 3 (25 psi). Maximum board size is 4' x 4' (1.21 m x 1.21 m).
 3. EnergyGuard™ Ultra Polyiso Insulation is made of coated glass-fiber mat facer laminated to a closed-cell polyisocyanurate foam core. Meets or exceeds the requirements of ASTM C1289 Type II, Class 2, Grade 3 (25 psi).
 4. EnergyGuard™ NH Polyiso Insulation is made of glass-reinforced cellulosic felt facers bonded to a core of non-halogenated polyisocyanurate foam. Meets or exceeds the requirements of ASTM C1289 Type II, Class 1, Grade 3 (25 psi).
 5. EnergyGuard™ NH HD Ultra Polyiso Insulation is made of coated glass facers bonded to a core of non-halogenated polyisocyanurate foam. Meets or exceeds the requirements of ASTM C1289 Type II, Class 2, Grade 3 (25 psi).

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10. Expanded Polystyrene Insulation Fan-fold Re-cover Board 3/8" (9.5 mm) with plastic facer meets or exceeds the requirements for ASTM C578, Type IX [min 25 psi (173 kPa) compressive strength].
11. Expanded Polystyrene Insulation Re-cover Board 1/2" (13 mm) with plastic facer meets or exceeds the requirements for ASTM C578, Type IX [min 25 psi (173 kPa) compressive strength].

2.10 Base Sheets

- A. Not required.

2.11 Slip Sheet/Protection Layer

- A. EverGuard® Polymat slip sheet, 3.0 oz/sq. yd. (102 g/sq. m.).
- B. EverGuard® Polymat cushioning slip sheet, 6.0 oz/sq. yd. (203 g/sq. m.).
- C. GAF VersaShield® Solo™ Fire-Resistant Slip Sheet.

2.12 Other Accessories

- A. The following items may also be required, depending on the project:
 1. Wood Nailers: New wood nailers must be #2 or better 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.
 5. Fire Barrier: Gypsum panels, min. 1/4" (6.3 mm) thick (DensDeck®, DensDeck® Prime or SECUROCK™ Roof Board).

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, and 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. Refer to GAF Roof Guarantee Program for specific requirements for extended guarantees.

3.02 Preparation Of Roofing Area – New & 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 quality and condition of roof decking by visual inspection and by fastener pull-out testing by an individual trained by the roof fastener manufacturer. GAF recommends these test results to be kept on file as part of the acceptability of the substrate surface for a Diamond Pledge™ NDL Roof Guarantee. Submission of results to GAF is not required.
- C. Secure all loose decking. Remove and replace all deteriorated decking.
- D. Remove abandoned equipment and equipment supports.
- E. Confirm that height of equipment supports will allow the installation of full-height flashings.
- F. Refer to Section 3.06 for air/vapor retarders.
- G. For extended-length guarantees, new roof construction or a 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 surfacing 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 before the application of new slip sheet and/or membrane.
 1. PVC must be separated from existing PVC roofs and other types of single-ply membranes and asphaltic membranes that have active sealants, including asphalt cement, single-ply adhesives, or other non-compatible materials. This can be accomplished by installing a polymat slip sheet, insulation, cover board, or fleece-back PVC membrane.
 2. Installation over an existing mechanically attached membrane is only acceptable if all existing fasteners are flush and do not cause ridging/tenting at the existing 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. If the wall/curb flashings are in good condition and tightly adhered to the substrate, new TPO or PVC flashing materials may be installed over these to a height of 30" (762 mm) without adhesives for

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sheets up to 10' (3 m) wide. For sheets up to 12' (3.5 m) wide, flashings may be installed up to 36" (914 mm). New PVC flashing materials must be installed over a layer of polymat or insulation board.

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. Take test cuts to verify the existing roof construction and condition. Generally three test cuts should be made for roofs under 100 squares (920 sq. m) and one test cut per 100 squares (920 sq. m) above the minimum amount.
2. Test cuts must be representative of the roofing system(s).

I. Remove abandoned equipment and equipment supports.

J. Raise equipment supports to allow the installation of full-height flashings.

K. Re-cover installations over coal tar pitch roofs are not recommended. However, if the designer of record chooses to re-cover over an existing coal tar pitch roof, GAF requires the following:

1. Existing loose gravel must be broomed or vacuumed (do not spud).
2. If high spots remain, a thicker insulation board must be used to provide a smooth substrate for the EverGuard® membrane.
3. A minimum 1" (25 mm) re-cover board is required for TPO applications.
4. A minimum 1.5" (38 mm) re-cover board is required for PVC applications.
5. Do not use a EPS/XPS re-cover board over coal tar pitch roofs.

3.04 Wood Nailer Installation

A. General

1. GAF recommends perimeter blocking and flashing be installed in accordance with the most current version of ANSI/SPRI ES-1 and FM Global Property Loss Prevention Data Sheet 1-49.
2. Additionally, GAF does not guarantee the attachment of the wood nailers, nor the performance of the wood nailers or any leaks that may be caused by nailer installation.

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.

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. Every piece must be properly secured to the substrate.
3. Gypsum boards installed in multiple layers must have the joints between boards staggered in all directions a minimum of 6" (152 mm) between layers.
4. Gypsum boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over flute surface for bearing support.
5. Do NOT use gypsum boards that are wet, warped, or buckled; they must be discarded. Boards that are broken, cracked, or crushed must not be installed unless the damaged area is first removed and discarded.
6. Remove and replace gypsum boards that become wet or damaged after installation.
7. Install no more gypsum board than can be properly covered with roofing membrane by the end of each day.

C. Securement

1. Mechanical Attachment

- a. Use appropriate number, type, and length of Drill-Tec™ fastener for structural deck type. See Insulation Attachment Tables in this Manual.
- b. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
- c. Install fastener so as to firmly imbed the plate to the insulation surface without over-driving.

3.06 Air/Vapor Retarder Installation

A. General

1. Air/Vapor retarder components must typically be installed when required by the design professional to address internal building air pressure or humidity conditions.

B. 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 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.

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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).
7. Install no more gypsum board than can be properly covered with roofing membrane by the end of each day.

C. Application – Adhered

1. Apply compatible adhesive to the structural deck or fire barrier board per air/vapor retarder manufacturers' recommendations.
2. Install the vapor retarder components loose applied to the deck or fire barrier board so that wrinkles and buckles are not formed. Broom air/vapor barrier components to ensure embedment into the adhesive.
3. Overlap vapor retarder components 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 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.

D. Application – Self-Adhered

1. Roll out the GAF SA Vapor Retarder over clean, dry deck and allow to relax. For metal decks, the width of the membrane is designed to match with the top of the flute.
2. GAF SA Primer is not required for metal decks. Other acceptable substrates (plywood, gypsum, or concrete) must be primed prior to application.
3. Apply GAF SA Primer using brush, roller, or sprayer at approximately 0.5-0.66 gallons per 100 square feet (0.2-0.27 L/m²). Lightly prime for uniform coverage. Do not apply primer in heavy or thick coats.
4. Place GAF SA Vapor Retarder in desired position. Once the membrane is in place, while holding the membrane tight, peel off the silicone release film by pulling diagonally from the underside of the sheet.
5. Install subsequent rolls of membrane in the same way, taking care to overlap the longitudinal side laps a minimum of 3" (76 mm) and end laps a minimum of 6" (152 mm).
6. For metal decks, install a 6" x 42" (152 mm x 1.07 m) metal plate at the end of the roll to support the membrane end lap between the metal flutes, ensuring a complete end lap seal. Overlap end laps a minimum of 6" (152 mm).
7. Once installed, pressure must be applied over the whole surface using a weighted roller to ensure adequate adhesion to the substrate.
8. Seal perimeter and penetration areas with closed-cell foam sealant. The GAF SA Vapor Retarder must be tied into the building's air/vapor retarder system as appropriate with compatible SBS asphaltic materials.
9. Because the water resistance characteristics of vapor retarders can be compromised by storms, physical damage and installation issues, vapor retarders should be covered by a primary roof covering as soon as possible after installation.
10. If GAF SA Vapor Retarder is not immediately covered, particular attention should be paid to implementation

of details to ensure a temporary seal or GAF will have no responsibility for any moisture infiltration that results from improper seals or phasing.

11. All T-joints and 90 degree transitions must be sealed with Matrix™ 201 SBS Flashing Cement. If fishmouths or other openings are created at overlap, they must be repaired and sealed with Matrix™ 201 SBS Flashing Cement. All wet and damaged materials or leaks through the GAF SA Vapor Retarder must be repaired before installing the finished roof.
12. GAF SA Vapor Retarder is UV resistant up to 90 days. The 90-day UV resistance refers to standardized testing conducted to ensure the product will not physically degrade when exposed to UV. GAF SA Vapor Retarder is **NOT** waterproof. **DO NOT USE** GAF SA Vapor Retarder as a temporary roof to protect property or possessions.

3.07 Polymat Slip Sheet Installation

A. General

1. Install polymat slip sheet between the roofing membrane and the substrate in accordance with the Design Table at the front of this Manual.
2. Install polymat slip sheet loose-applied over substrate surface so that wrinkles and buckles are not formed.
3. Overlap polymat slip sheets a minimum of 6" (152 mm) for side and end laps.

3.08 Fire-Resistant Slip Sheet/Coating Installation

A. General

1. GAF VersaShield® Solo™ Fire Resistant Slip Sheet is typically installed when required by design professional or code authority to address code or approval requirements, or as a slip layer in accordance with the Design Table at the front of this Manual.
 - a. Install GAF VersaShield® Solo™ Fire Resistant Slip Sheet loose-applied over substrate surface so that wrinkles and buckles are not formed.
 - b. Overlap GAF VersaShield® Solo™ Fire Resistant Slip Sheet a minimum of 2" (51 mm) for side and 4" (102 mm) for end laps.
 - c. GAF VersaShield® Solo™ Fire Resistant Slip Sheet should be installed perpendicular to the direction of the TPO membrane.
 - d. Typically GAF VersaShield® Solo™ Fire Resistant Slip Sheet does not need presecurement. However, 1" (25 mm) cap nails with 1" (25 mm) minimum head or appropriate fasteners and plates may be used until the primary roof can be installed. Do not install more VersaShield® Solo™ than can be covered with finished roofing in that same day. For additional instructions, please visit www.gaf.com.
2. GAF FireOut™ Fire Barrier Coating is installed at an application rate of one gallon per 100 sq. ft. (9 sq. m) via spray, brush, or roller. The substrate must be clean, dry, and free of foreign matter.

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3.09 Base Sheet

- A. Not required.

3.10 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 Tables in this Manual.
3. The use of extruded or expanded polystyrene insulation is limited in PVC roofing systems. These insulation types are to be used under a fleece-back membrane, with an approved slip sheet or non-EPS/XPS cover board.

B. Placement

1. Butt insulation boards together with a 1/4" (6.3 mm) maximum space between adjoining boards. Fit insulation boards around penetrations and perimeter with a 1/4" (6.3 mm) 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 a minimum 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.

C. Securement

1. Mechanical Attachment of Insulation.
 - a. Use appropriate number, type, and length of Drill-Tec™ Fastener for structural deck type. See Insulation Attachment Tables in this Manual.
 - b. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
 - c. Install fastener so as to firmly secure the plate to the insulation surface without overdriving.

2. Foam Adhesive of Supplemental Insulation

- a. For supplemental securement of saddles or crickets to insulation with low-rise foam adhesive, GAF recommends a 1" (25 mm) bead width spaced 12" (305 mm) on center.

3.11 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 sustained exposure to high temperatures requires.

A. Substrate Surface Preparation

1. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications.
2. Preparation includes, but is not limited to, removal of existing flashings, replacement of wet/damaged existing roofing materials, removal of loose aggregate, removal of abandoned equipment, supports and penetrations, replacement of damaged decking, etc.
3. 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.

B. Placement

1. Place roof membrane so that wrinkles and buckles are not formed. Remove any wrinkles or buckles from the sheet prior to permanent securement. Roof membrane must be mechanically fastened after it is rolled out, followed by welding to adjacent sheets.
2. Full-width rolls must be installed in the field of the roof.
3. Half-width rolls must be installed in the perimeter region of the roof. Width of the roof perimeter region must be determined in accordance with the Perimeter Half Sheet Table in this Manual.
4. Install membrane so that the laps run across the roof slope lapped toward drainage points. On metal decking, install sheets perpendicular to deck direction so that fasteners will penetrate the top flanges and not the flutes; however, there will be limited areas of the roof (i.e., perimeter areas) where this is not practical. If the deck is running opposite the slope of the roof (flutes running horizontally), then the membrane should run ridge-to-gutter to ensure proper fastening to the top flanges of the deck.

5. TPO/PVC

- a. For TPO membranes, overlap roof membrane a minimum of 6" (152 mm) for side laps of mechanically attached systems. Membranes are provided with lap lines along the side laps; the inside line is for mechanically attached system overlaps. TPO fastener spacing marks should resemble a "pyramid" pattern.

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b. For PVC membranes, the solid line (overlap line) is marked on the top ply 5" (127 mm) from the sheet edge. The fastener line is a nominal 2" (51 mm) from the sheet edge, and an "X" is placed between the sheet edge and the field seam overlap line with spacing every 6" (152 mm).

6. For selvage edge laps of EverGuard® PVC and TPO membranes, overlap the roof membrane a minimum of 3" (76 mm) and heat weld the laps. Non-selvage end laps of EverGuard® PVC and TPO Fleece-Back membranes are made by butting adjacent sheets and heat welding an 8" (203 mm) wide EverGuard® PVC and TPO reinforced membrane flashing strip over the end laps. Alternatively, an 8" (203 mm) wide flashing strip can be cut out of smooth PVC membrane of the same thickness as the field sheet and used as the flashing strip.

7. All exposed sheet corners must be rounded a minimum of 1" (25 mm).

C. Membrane Securement

1. Roof membrane must be mechanically fastened in the side lap area to the roof deck with fasteners and plates of a type and spacing appropriate to the deck type and as required by the Membrane Attachment Tables in this Manual.
2. The metal plates must be placed within $\frac{1}{4}$ " - $\frac{3}{4}$ " (6 mm x 18 mm) of the membrane edge. Plates must not be placed closer than $\frac{1}{4}$ " (6 mm) to the membrane edge.
3. Fasteners must be installed to achieve the proper embedment depth. Install fasteners vertical to the deck, without lean or tilt. Do not over- or under-drive fasteners.
 - a. Use appropriate type and length of Drill-Tec™ fastener and plates for structural deck type. See the Insulation Attachment Table in the Roof Design Considerations Section of this Manual.
 - b. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
 - c. 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 (underdriving), and will not cause wrinkling of the membrane (overdriving).
4. Mechanically attach membrane with screws and plates to the roof deck at locations of deck slope changes in excess of 1:12.
5. Membrane may be heat-welded to EverGuard® coated metal flanges.
 - a. Membrane must be secured to the roof deck within 6" (152 mm) of the base of walls and curbs, at the perimeter, and all penetrations with Drill-Tec™ Fasteners of a type and spacing in accordance with in-lap attachment requirements, with a 12" (305 mm) o.c. maximum spacing.
 - b. 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. Use Drill-Tec™ Fasteners and inverted termination bar of type and spacing in accordance with in-lap

attachment requirements, with a 12" (305 mm) o.c. maximum spacing. Vertical attachment with seam plates and fasteners may also be used. This alternative detail, including termination bar, is required for pressurized buildings.

c. 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 (underdriving), and will not cause wrinkling of the membrane (overdriving).

D. Supplemental Securement

1. In the corner areas, additional fasteners will also be installed through the perimeter half-width membrane rolls to form a grid pattern, with an 8" (203 mm) wide reinforced membrane flashing strip heat-welded over the additional fasteners. "Corners" include both outside and inside corners that measure 75°-105°. Perimeter cap sheets may overlap one another in the corner areas. Alternatively, the half sheet may be laid out in a "picture frame" manner, burying the fasteners under the half sheets.
2. 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.

E. Membrane Surface Preparation for Seaming

1. Proper preparation of the area to be heat-welded is critical to forming a good, long-lasting seam. Heat-welding uses the thermoplastic nature of the material to melt two pieces of material together, fusing it into a single piece. In order to properly fuse these two discreet pieces together, the materials must be clean and dry; if not clean and dry, contaminants will interfere with the weld and, generally, the result is a poor or false weld.
2. Satisfactory heat welding requires that the membrane be clean of dirt and contaminants, and free from dew, rain, and other sources of moisture.
3. Factory-fresh membrane typically will not require cleaning prior to welding, provided that welding is performed immediately after placement of the membrane. Membrane that has been exposed for a longer period of time will require additional cleaning methods, depending on the type of contamination present.
 - a. Any material rolled out and put into place needs to be welded the same day, including welding of any detail work.
 - b. Membrane that has been exposed overnight or for more than 12 hours or has otherwise become contaminated, will require cleaning.

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F. Seam Cleaning

1. **Light Contamination:** Membrane that has been exposed for a few days or less to air-borne debris, foot traffic, or dew or light precipitation can usually be cleaned with a cloth moistened with EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner (low VOC) for TPO membranes. For PVC membranes, EverGuard® PVC Membrane Cleaner, MEK (methyl ethyl ketone) or acetone can be used. Be sure to wait for cleaner to dry/flash-off prior to welding.
2. **Dirt-Encrusted 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. Rinse area thoroughly with clean water and allow to dry. This must be followed by cleaning with a cloth moistened with (a) EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner (low VOC) for TPO, or (b) EverGuard® PVC Membrane Cleaner, MEK (methyl ethyl ketone) or acetone for PVC. Be sure to wait for cleaner to dry/flash-off prior to welding.
3. **Weather or Oxidized Contamination:** Membrane that is weathered/oxidized will require the use of a low-residue cleaner such as Formula 409® and a mildly abrasive scrubbing pad to remove the weathered/oxidized top surface layer. This must be followed by cleaning with a cloth moistened with (a) EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner (low VOC) for TPO, or (b) EverGuard® PVC Membrane Cleaner, MEK (methyl ethyl ketone) or acetone for PVC. Be sure to wait for cleaner to dry/flash-off prior to welding.
4. **Chemical Based Contamination:** Membrane that is contaminated with bonding adhesive, asphalt, flashing cement, grease and oil, and most other contaminants usually cannot be cleaned sufficiently to allow an adequate heat weld to the membrane surface. Removal and replacement of the membrane is required in these situations.
5. **If Low-Rise Foam Adhesive** is accidentally spilled on the surface of the finished roof, use the following procedure to clean the roof:
 - a. Carefully scrape of the adhesive without rupturing the underlying roof membrane.
 - b. After removal of adhesive, cover the affected area with either EverGuard® smooth or fleece-back membrane.

Summary of Seam Cleaning Recommendations

Type of Contamination	Membrane Cleaner	Method	Notes/Tips
Light	<ul style="list-style-type: none"> • TPO: EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner (low VOC) • PVC: EverGuard® PVC Membrane Cleaner, MEK or acetone 	<ul style="list-style-type: none"> • Clean with cloth moistened with membrane cleaner. • Allow solvents to flash off. 	<ul style="list-style-type: none"> • Rinse area thoroughly with clean water • Use white terry cloth; avoid use of industrial cleaning cloths. • Colored cloths can transfer the dye in the cloth to the area to be welded and should not be used. • Do not over-use cloths; dispose of cloths when dirty. • Use scrub brushes sparingly as they can damage the membrane. • Drying time for cleaner increases 3-5 minutes for every 1°F drop in temperature.
Dirt-Encrusted	<ul style="list-style-type: none"> • TPO: EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner (low VOC) • PVC: EverGuard® PVC Membrane Cleaner, MEK or acetone 	<ul style="list-style-type: none"> • Scrub with low-residue cleaner (409®) using a mildly abrasive pad. • Clean with cloth moistened with membrane cleaner. • Allow solvents to flash off. 	
Weather and/or Oxidized	<ul style="list-style-type: none"> • TPO: EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner (low VOC) • PVC: EverGuard® PVC Membrane Cleaner, MEK or acetone 	<ul style="list-style-type: none"> • Scrub with low-residue cleaner (409®) using a mildly abrasive pad. • Clean with cloth moistened with membrane cleaner. • Allow solvents to flash off. 	
Chemical Based	<ul style="list-style-type: none"> • Not Recommended; consult GAF 	<ul style="list-style-type: none"> • Remove and replace membrane 	

G. Heat Welding Equipment

1. Successful hot air welding requires the use of specialized, properly maintained and adjusted equipment operated by experienced personnel familiar with hot air welding techniques. Achieving consistent welds is a function of ensuring that the roofing membrane surface is clean and prepared for heat welding, conducting test welds to determine proper equipment settings, and evaluating weld quality after welding has been completed.
2. Welding equipment consists of three main components: power supply, hot air welder (either automatic or hand-held), and extension cords. The newest automatic welding equipment provides improved control of speed, temperature, pressure, and membrane. The use of the latest model of automatic welder is highly recommended. Older models may not achieve consistent welds. Follow the equipment manufacturer's recommendations regarding correct equipment operation and adjustment.

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- a. Current generation automatic hot-air welder (recommended)
 - i. Minimum Power Supply: 220 volts, 30 amps, 10,000 watt continuous
- b. Current generation hand-held hot-air welder (recommended)
 - i. Minimum Power Supply: 110 volts, 15 amps, 2500 watt continuous
- c. Commercial Grade 10,000-watt voltage-controlled generator (minimum)
 - i. THD (Total Harmonic Distortion) rating should be six (6) or less for quality welds
 - ii. 240v & 120v Outlets
 - iii. GFCI Line Cords
 - iv. Volt Meters
- d. Extension Cords
 - i. Automatic Welders - #10 wire with a standard plug configuration. Maximum 100' (30.5 m) in length.
 - ii. Hand-Held Welders - #12 wire with a standard plug configuration. Maximum 100' (30.5 m) in length.
 - iii. For longer lengths, consult an electrician for line voltage drop. Heavier-gauge extension cords are likely to be required.
3. Stable power supply- Adequate wattage and consistent voltage is critical to obtaining consistent hot air welds and to prevent damage to the welder. The use of a contractor-supplied portable generator is recommended. House-supplied power is acceptable for hand welders only. Do not connect to a power source that is:
 - a. Used for other equipment that cycles on and off.
 - b. Is subject to momentary disruptions or power surges.
 - c. Incapable of providing sufficient power.
 - i. THD greater than six (6) may lead to fluctuations which may impact welding.
4. Silicone Hand Roller (used in conjunction with hand-held welders)
 - a. Ensure that the roller is in good condition. Rollers with rounded edges should be replaced.

Note: Outdated welding equipment and inadequate or fluctuating electrical power are the most common causes of poor seam welds.

H. Equipment Maintenance

1. Owner maintenance of welding equipment includes keeping the equipment safe from physical abuse and damage from the elements, keeping the welding nozzles clean from membrane residue, keeping the air filters free from clogging, and replacing heating elements when needed.
 - a. Follow the equipment manufacturer's recommendations regarding other aspects of equipment maintenance and repair (i.e., motor brushes, switches, belts, etc.).
 - b. Store welding equipment in weather tight tool boxes. Tool boxes for automatic welders in particular should be fitted with cushioning foam material to protect the welder during transit and hoisting operations.

- c. Clean welding nozzles on a daily basis with a wire brush. Nozzles have a tendency to retain membrane residue on their surfaces. This buildup of residue can interfere with welding if not removed.
- d. Clean air filters on a weekly basis. Clogged air filters restrict air flow. This prevents the welding tool from operating efficiently, and can cause the fan motor to overheat.
- e. Heating elements are readily field-replaceable. Heating elements are vulnerable to both physical and thermal shock, particularly if the welder is shut off without first being allowed to cool down.

I. Equipment Settings

1. Setting up the hot air robotic welder properly is key to having a properly installed roof and performing test welds is one of the most important steps to ensure that you are obtaining a properly welded roof. Making appropriate adjustments before you begin the final welding process assures that the correct combinations are achieved.
2. Test welds should be performed at the beginning of every work period.
 - a. Just before welding in the morning,
 - b. Upon returning from lunch in the afternoon, and
 - c. When there's been a significant change in weather (e.g., air temperature, wind speed, cloud cover, etc.)
3. 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. This is called a "film tearing bond." A deficient weld fails by separating between the two layers of the membrane.
4. Adjustments to Equipment Settings—many factors will affect the settings: 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. For initial automatic air welder setting, use the formula below:
 - a. Speed Formula: Start at $(\text{ambient temp}/10) + 2 = \text{FPM}$ (Feet Per Minute)
 - b. Example: $70/10 + 2 = 9 \text{ FPM}$

Note: This formula serves as an initial starting point. Adjustments may need to be made accordingly from there. New equipment may run faster and hotter. Remember, settings required for a good weld will change based on equipment type, weather conditions and membrane thickness.

5. Cautions & Warnings

- a. Do not touch the welding nozzle and heat shield, and avoid keeping unprotected skin in the flow of hot air. The welding nozzle, heat shield, and hot air being expelled from hot air welders is very hot and can result in severe burns.
- b. Any attempt to run a robotic welder at a speed greater than 16 ft. (9.6 m)/min. may result in defective seam welds.

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- c. 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.
- d. Robotic welders running too fast may not allow the operator to monitor the weld width and ensure that critical T-joint areas have been correctly creased.
- e. The operator must keep in mind the relationship between ambient temperature, automatic air welder speed, heat setting and how much weight is on the machine in order to achieve a film tearing bond (weld).

J. Test Welds

1. Take 2 pieces of “bag fresh” EverGuard® membrane approximately 18” (457 mm) long
2. Set your automatic welder’s speed and heat. For full size welders, such as the BAK LarOn, GAF suggests starting at the following settings:
 - a. Temperature between 800°F (427°C) and 1,148°F (620°C). Speed 10-16 feet (3.05-4.88 m) per minute. New equipment may run faster and hotter.
 - b. For an initial setting, use the formula below as a general guideline:

Speed Formula: Start at $(\text{ambient temp}/10) + 2 = \text{FPM}$ (Feet Per Minute)

Example Scenario: Start out by setting the speed at 10 FPM and the temperature at 600°F (315°C) and do a test weld. Bump temperature up 100°F (38°C) to 700°F (371°C) keeping same 10 FPM. Perform another test weld. Continue doing this in 100°F (38°C) increments keeping speed the same until machine is maxed out [typically 1,148°F (620°C)] and find the weld window. Set up machine in the middle of the weld window.

Note: Remember, settings required for a good weld will change based on equipment type, weather conditions and membrane thickness.

3. Weld the 18” (457 mm) pieces together and then allow the membrane to cool for at least 10 minutes. Cut 1” (25 mm) wide strips across the welded material. The welds are tested by application of pressure causing the seam to peel apart.
4. An acceptable weld will fail by exposing the scrim reinforcement. This is called a “film tearing bond” or “FTB”. The film tearing bond will be between 1” (25 mm) and 1.5” (38 mm) wide.
5. A partial weld will fail by partially separating between the two layers of the membrane.
6. An unacceptable weld will fail by separating between the two layers of the membrane. This is also known as a “cold weld” or “false weld”.
7. During cooler temperatures, it is even more critical to perform test welds in the morning, after any extended break such as lunch, or after significant change in weather (e.g., air temperature, wind speed, cloud cover, etc.).
8. Hand welding during colder temperatures also needs to be adjusted.
 - a. Perform test welds on membrane you will be using that day
 - b. Do not use scrap material to create test welds
 - c. Perform daily quality control including probing and checking seams at the end of the day

K. Adjustments to the Hot Air Robotic Welder Settings

1. Many factors will affect the settings, including overcast skies and lower air temperatures. This will generally require a slower speed and lower heat settings. The slower speed and heat provides the additional heat energy to compensate for heat-draining conditions.
2. The correct speed and temperature settings for automatic welders are determined by preparing test welds at various speed and heat settings.
3. Only make one change at a time and avoid changing heat and speed together.
4. If you are welding at 1,148°F (620°C) and do not get a good weld, do not automatically adjust the speed because the temperature may be too high. Lowering the temperature or increasing speed may be a necessary adjustment.
5. If the weld is greater than 1.5” (38 mm), you may have the temperature too high and this could lead to a failed weld over time.
6. Having too much weight on the automatic hot-air welder combined with too high of a speed setting can potentially cause wrinkle issues in the weld area.

L. Automatic Hot Air Welding of Field Seams

1. Successful automatic welding is primarily a function of proper machine adjustment and ensuring a consistent power supply.
2. Membrane MUST be cleaned and free from all dirt and debris prior to hot air welding of seams.
3. Verify correct power supply voltage with a voltmeter.
4. Determine proper welder speed and temperature settings by performing the test weld procedure.
5. Mark all locations where automatic welding starts and stops to identify locations of possible weld discontinuities. These areas should be carefully probed and repaired as required.
6. The weld must provide a maximum film-tearing bond of 1.5” (38 mm) and a minimum 1” (25 mm) film-tearing bond.
7. Membrane laps must be heat-welded together. All welds must be continuous, without voids or partial welds. Welds must be free of burns or scorch marks; however, seaming of PVC membrane should exhibit bleed-out when properly welded.
8. All reinforced membrane TPO and PVC field seams should be made using an automatic hot air welder.
9. Attend to all T-joints by carefully pressing each joint down by silicone roller edge or other hard-edged tool immediately after the T-joint has emerged from the automatic welder.
 - a. 60, 70 & 80 mil TPO membrane T-joints require the installation of a heat-welded membrane cover patch.
 - b. 80 mil PVC membrane T-joints require the installation of a heat-welded membrane cover patch.

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10. All cut edges of TPO reinforced membranes must be sealed with EverGuard® TPO Cut Edge Sealant. PVC reinforced membranes do not require cut edge sealant.

M. Hand-Held Welding of Seams

1. Successful hand welding is a skill that involves individual technique, normally developed and refined over time. Operator should be proficient in different nozzle configurations. Correct selection of welder temperature and nozzle width can have an effect on the quality of the hand weld.
2. Membrane **MUST** be cleaned and free from all dirt and debris prior to hand-welding.
3. During basic hand welding, the hot air welder is held in one hand, and a hard silicone roller is typically held in the other hand. When hand welding with a roller, finger pressure is often used to place and tack the upper piece of membrane in position. However, a silicone roller must always be used for final welding. Tack welding and back-tacking is **not** permitted in the field welding of seams.
4. The membrane must be heat-welded together using the "two-pass method". Weld from the interior on the first pass and finish the weld with the second pass.
5. The welding nozzle is introduced between the two layers of membrane, and the silicone roller is rolled back and forth perpendicular to the nozzle mouth to press the membrane together and accomplish the weld. The roller should remain flat to ensure proper compression.
6. All welds must be continuous, without voids or partial welds. TPO welds must be free of burns or scorch marks; however, seaming of PVC membrane should exhibit bleed-out when properly welded. There should be no bleed out on TPO.
7. The ability to achieve satisfactory welds with the hot air welder being held in either hand facilitates welding at various angles and in various situations.
8. The weld must provide a maximum film-tearing bond of 1.5" (38 mm) and a minimum 1" (25 mm) film-tearing bond.
9. Depending on the type of welding being performed, the temperature setting will vary, as will the width of the welding nozzle.

N. Seam Probing

1. Seam probing is the physical inspection of a hot air weld area by running a suitable blunt probe along the length of a seam with horizontal pressure applied into the bottom edge of the weld. Seam probing checks the integrity of the weld to help ensure a water-tight roofing system and is critical to locating small skips in a welded lap. Seam probing is **NOT** a replacement for conducting test welds.
2. All hot air welded seams must be physically probed with a blunt or dull cotter key puller hand tool (sharp points or edges must be filed down).
3. Contractors are responsible for initial probing of their welds. Do **NOT** wait for a GAF Field Services Representative to find issues with the welds during the roof inspection after the roof is already completed. This could lead to more difficult and costly repairs requiring re-inspection by GAF.

4. Probing **MUST** be conducted daily.
5. Initial probing should be done on hands and knees.
6. Subsequent probing may be completed with a cotter key hand tool that can be affixed to standard extension handle, which allows the tool to be used from a standing position.
7. Exercise care when handling and walking with the seam probe to avoid injuries from the point end.
8. Continuous use of the probe will cause it to become sharper. Ensure that the point is blunted/rounded off at all times.
9. Allow the seam to cool down at least 30 minutes or to ambient temperature before probing. Premature probing can damage seams because the welds may still be warm.
10. Run the probing tool parallel to the edge of the seam applying ample pressure at the base of the weld. Use caution to avoid damaging the membrane surface with the point of the probing tool.
11. When probing, extra attention must be given to all membrane seam intersections, heat-welded seams above insulation joints and areas where the robotic welder stops and starts again.
12. Mark all voids, open welds or cold-welds using a water-soluble marker or crayon so repairs can be made.
13. Repair all voids, open welds or cold-welds routinely throughout the day but no later than the end of each workday using a hand-welder.
14. To make a minor repair on a seam, use a T-Joint Cover Patch, UN-55 Detailing Membrane, or the same material type being used for the field sheet.
15. If repairs are needed for an entire open seam, use reinforced membrane a minimum of 4" (102 mm) wide. Finish the detail by heat-welding T-Joint Cover Patches at each corner. Any damage caused to the field sheet (not in the seams) must be patched with reinforced membrane.
16. All repaired seams should be probed after they have cooled completely to determine if the weld is acceptable. If the repaired seam is not acceptable, repair areas as necessary until corrected.
17. Apply GAF EverGuard® Cut-Edge Sealant on all TPO reinforced membrane cut edges after seam probing is completed. EverGuard® Cut-Edge Sealant is not required when using PVC.

3.12 Flashing Installation

Refer to the construction details in the Architectural Roofing Details Manual, available at www.gaf.com, 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 EverGuard® coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
2. All EverGuard® coated metal and membrane flashing corners must be reinforced with pre-formed corners or non-reinforced membrane.

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3. All flashing membranes and accessories are to be heat-welded using a hand welder. Refer to Section 3.11 M.
 4. All cut edges of reinforced TPO 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 should be installed is 6" (152 mm). When you must go past 6" (152 mm), move the attachment to the vertical substrate.
 8. Alternatively, RhinoBond® plates and fasteners can be used where applicable for base termination on a Mechanically Attached system. Place plates and fasteners out from wall a minimum 4.5" (114 mm) to a maximum of 6" (152 mm) with spacing of 12" (305 mm), which allows the field sheet to be used as a wall flashing.
 9. Installation of EverGuard® PVC flashing membrane over asphalt-based substrates must have a polymat slip sheet or approved insulation boards, metal, wood, etc., under the PVC flashing membrane.
 10. EverGuard Extreme® membrane flashings should be of same type, thickness, and color as the roofing membrane.
 11. For TPO or PVC membranes installed over granulated modified bitumen flashings, a polymat separator sheet must be installed for dry-hung flashings. In adhered applications, a barrier board must be installed.
 12. When using EverGuard® TPO or PVC adhesives, use any one of the following substrates: polyisocyanurate insulation and high density (without foil facer); high density fiberboard roof insulation; gypsum roof board; cured structural concrete (without curing and sealing compound present); untreated OSB; untreated CDX plywood; Type X gypsum board; and dry, sound masonry (without curing and sealing compounds present).
 13. DensGlass® Gold gypsum board is NOT to be used as a substrate for adhered attachment on parapet walls, according to the manufacturer.
 14. Use fire-treated plywood/wood for parapet walls only if covered with an approved gypsum board for adhered EverGuard® membranes only.
- B. EverGuard® Coated Metal Flashing
1. EverGuard® 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 metalwork maintenance during the life of the roofing system.
 2. EverGuard® coated metal must be formed in accordance with construction details. Where required, EverGuard® coated metal should be designed in accordance with SMACNA details, the applicable building code and tested for resistance in accordance with the applicable ANSI/SPRI/FM 4435/ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems."
 3. The use of EverGuard Extreme® TPO Coated Metal Flashing is required on EverGuard Extreme® Systems.
 4. EverGuard® coated metal sections used for roof edging, base flashing, and coping must be butted together with a 1/4" (6 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. A 2" (51 mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
 5. 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) membranes.
 6. EverGuard® coated metal base flashings must be provided with min. 4" (102 mm) wide flanges screwed to wood nailers. EverGuard® coated metal base flashings must be formed with a 1" (25 mm) cant.
 7. Provide a 1/2" (13 mm) hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
 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 EverGuard® 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 Flashing - Smooth Surface
1. The thickness of the flashing membrane must be the same as the thickness and type of the roofing membrane.
 2. 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.
 3. Porous substrates may require double application of adhesive.
 4. Application of bonding adhesive
 - a. Apply bonding adhesive as per application instructions on product container equally to both the substrate and the underside of the flashing membrane.
 5. Carefully position the membrane flashing prior to application to avoid wrinkles and buckles.
 - a. Please note that solvent-based adhesive must be allowed to dry until *tacky* to the touch before mating flashing membrane. Water-based adhesive must be allowed to dry *completely* to the touch. Typically, the flashing should be installed within one hour of applying the water-based adhesive. However, this may vary depending on ambient temperature conditions.
 6. Heat-weld all laps in EverGuard® smooth reinforced flashing membrane in accordance with heat-welding guidelines.
 7. For extended-length guarantees, separate counter flashing or cap flashing is required; exposed termination bars are not acceptable.

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8. 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 flashings may be dry hung or adhered in place. For adhered flashing applications, apply adhesive to both the underside of the substrate and the flashing membrane to adhere the membrane.
 9. Never use any TPO Primer or United Coatings® Surface Seal SB Primer to prime walls to accept adhesives; only use the adhesive you are using as a primer for the roof to prime the walls.
- D. Adhered Reinforced Membrane Flashing - Fleece-Back
1. Apply bonding adhesive or approved low-rise foam adhesive to the substrate per application instructions on product container.
 2. The bonding adhesive must remain wet to the touch for one-surface applications. The use of solvent-based adhesive is not recommended.
 3. Apply the adhesive or low-rise foam only when the outside temperature is above 40°F (4.4°C) and rising. Application temperatures above 50°F (10°C) are recommended to allow easier adhesive application.
 4. When installing fleece-back membranes to a vertical surface, the material should be rolled in with hand rollers and should have top edge fastening and termination installed immediately to avoid slippage. For best results, flashings may need to be rolled in several times with a hand-held, silicone roller.
 5. Non-selvage edge laps in EverGuard® Fleece-Back and flashing membrane are made by butting adjacent sheets and heat welding an 8" (203 mm) wide flashing strip of EverGuard® flashing membrane over the joint.
 6. Overlap roof membrane a minimum of 3" (76 mm) for end laps of EverGuard® PVC and TPO membranes. For EverGuard® TPO Fleece-Back membranes use an 8" (203 mm) wide EverGuard® TPO reinforced membrane flashing strip over the joints. For PVC, cut a flashing strip of smooth PVC fleece-back membrane of the same thickness as the field sheet and use as the flashing strip.
 7. All TPO cut edges on reinforced membranes must be sealed with EverGuard® TPO Cut Edge Sealant.
 8. Never use any TPO Primer or United Coatings® Surface Seal SB Primer to prime walls to accept adhesives; only use the adhesive you are using as a primer for the roof to prime the walls.
 9. For extended-length guarantees, a counter flashing must be used. Exposed termination bars are not acceptable.
- E. Loose Reinforced Membrane Flashing
1. Carefully position the EverGuard® smooth or fleece-back reinforced flashing membrane prior to application to avoid wrinkles and buckles.
 2. All laps in EverGuard® smooth reinforced flashing membrane must be heat-welded in accordance with heat-welding guidelines. All fleece-back membrane flashings with non-selvage edges must be stripped in using 8" (203 mm) wide flashing strips.
3. Maximum flashing height is 30" (762 mm) without adhesives for sheets up to 10' (3 m) wide unless incremental attachment is used. For sheets up to 12' (3.5 m) wide, flashings may be installed up to 36" (914 mm) unless incremental attachment is used.
 4. For extended-length guarantees, a counter flashing must be used. Exposed termination bars are not acceptable.
- F. Non-reinforced Membrane Flashing
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 flashing 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 onto 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. Refer to section 3.12 C for application instructions.
 4. All round and square pipe type flashings require EverGuard® FlexSeal™ Caulk Grade or EverGuard® Water-Block between the penetration and the membrane. Add and tighten stainless steel band and seal top of membrane with EverGuard® FlexSeal™ Caulk Grade.
 5. T-joint Patches
 - a. T-joint patches are to be a minimum 4" (102 mm) in size and made of non-reinforced 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. Pre-fabricated 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 patches are required on 60, 70 and 80 mil TPO and 80 mil PVC only.
- G. Roof Edging
1. TPO roof edge flashing is applicable for both gravel stop/drip edge conditions, as well as exterior edges of parapet walls.
 - a. For guarantees up to 20 years, use EverGuard® Cover Tape HW, or EverGuard® Cover Tape with all edges sealed with EverGuard® Cut Edge Sealant, EverGuard® TPO Coated Metal, or any of the other EverGuard® pre-fabricated extruded aluminum fascia systems.
 - b. For extended-length guarantees (greater than 20 years), use weldable metal, pre-fabricated extruded aluminum fascia systems, or EverGuard Extreme® Cover Tape HW only.
 2. Where required, metal roof edging should be designed in accordance with the applicable building code and tested for resistance in accordance to the applicable ANSI/SPRI/FM 4435/ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems." When not required, refer to Items 3 and 4.

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3. Flash roof edges with EverGuard® coated metal flanged edging with minimum 3" (76 mm) wide flange nailed 4" (102 mm) o.c. or Drill-Tec™ screws 12" (305 mm) o.c. into wood nailers with a reinforced flashing strip welded to the coated metal and to the field of the roof.
 - a. For TPO coated metal, heat weld an 8" (203 mm) TPO reinforced flashing strip.
 - b. For EverGuard® PVC membranes, an 8" (203 mm) reinforced heat-weldable flashing strip must be used. Cover tape products are not acceptable for use with PVC membranes.
 4. 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 maximum of 4" (102 mm) o.c.
 5. 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.
 6. For guarantee lengths up to 20-years, metal edging may be flashed using EverGuard® TPO Cover Tape after priming both the metal and the TPO membrane.
 - a. 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, 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.
 - b. 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 extended-length guarantees, use EverGuard Extreme® TPO Cover Tape Heat Weld. 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 welder or automatic heat welder, to all membrane-to-membrane surfaces.
2. Secure membrane flashing at the top horizontal edge with a termination bar. Apply FlexSeal™ Caulk Grade Caulking between the wall surface and membrane flashing underneath all termination bars. Exposed termination bars must be mechanically fastened 6" (152 mm) o.c. (20-year max. guarantee); termination bars that are counter flashed must be fastened 6" (152 mm) o.c. for extended-length guarantee(s).
 3. Roof membrane must be mechanically attached along the base of walls that are flashed with membrane flashing. Attach with screws and plates/termination bar. Use a fastener spacing in accordance with in-lap attachment requirements, with a maximum 12" (305 mm) o.c. spacing.
 4. Metal counter flashings with adhered or dry hung membrane wall flashings are required on 20-year guarantees or longer. (They are not required for guarantees of less than 20 years.) All termination bars, either exposed or covered, must be sealed with FlexSeal™ Caulk Grade caulking or EverGuard® Water-Block.
 5. Flash wall scuppers with a scupper insert of EverGuard® coated metal that is mechanically attached to the wall and integrated as part of the wall flashing. Refer to Scupper section for other detail options.
 6. Where required, metal cap flashings should be designed in accordance with the applicable building code and tested for resistance in accordance with the applicable ANSI/SPRI/FM 4435/ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems."
 7. Maximum flashing height without intermediate fastening:
 - 30" (762 mm) – Loose-Applied Flashing
 - 60" (1.7 m) – Adhered Flashing
 8. 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.

I. Round and Square Tube Penetrations

1. Four options are available for penetration flashings: stepped pipe boots; split pipe boots; square tube wraps; and field fabrication with unreinforced membrane and target.
2. All flashings require the installation of a stainless steel draw band around the top of the flashing. Install EverGuard® Water-Block on the inside top of the flashing and add the draw band with FlexSeal™ Caulk Grade caulking around the top of the flashing.
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.

J. Irregularly Shaped Penetrations

1. Metal Sealant Pans /Pre-formed TPO or PVC Accessories
 - a. Flash irregularly shaped penetrations with flanged sealant pans formed of EverGuard® coated metal, secured to the deck through the roof membrane with screws 6" (152 mm) o.c., a minimum of two per side.
 - b. Strip in metal flanges with 8" (203 mm) wide membrane flashing strips and vertical pop riveted seams with 4" (102 mm) unreinforced membrane.

Note: Any overlap ends must be stripped in with flashing detail membrane and welded completely to finish the detail. EverGuard® TPO Cut Edge Sealant must be installed on all edges of the HW Flashing Strip.

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

H. Parapet and Building Walls

1. There are 3 options for flashing parapet and building walls: adhered membrane flashings, metal flashings, and loose-hung flashings.

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- c. Prime inside of pocket with TPO primer. Priming is not required for PVC membranes. Fill sealant pans with non-shrink quick-set grout. Top off sealant pans with a 2" (51 mm) minimum thickness of an approved EverGuard® Sealant. If using 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.
- d. Installation of pre-formed PVC sealant pans requires 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.
- e. 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.
- f. If a preformed 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.
- g. EverGuard® TPO reinforced targets must be sealed with EverGuard® TPO Cut Edge Sealant.

2. MajorSeal™ Liquid Flashing is only to be used when EverGuard® TPO flashing accessories and standard details cannot be used. You must contact your GAF Field Services Area Manager to assess suitability prior to use.

- a. Not suitable for areas around drains, scuppers, or areas that pond water.
- b. 20-year maximum guarantee. Not eligible for extended-length guarantee coverage.
- c. Cannot be used with PVC.

K. Curbs

1. Flashing can be done two different ways, either with adhesive applied to the membrane and substrate, or loose-applied up to 30" (762 mm) high.
2. Secure membrane flashing at the top edge with a termination bar, flat stock, or counter flashing. Apply FlexSeal™ Caulk Grade sealant or EverGuard® Water-Block 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 shank nails 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 inside of the curb.

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 must be used for extended guarantee lengths. All termination bars must be sealed with FlexSeal™ Caulk Grade Sealant or EverGuard® Water-Block.

L. 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 for TPO and one for PVC. TPO and PVC can also be field fabricated to meet expansion joint needs.
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 proper expansion/contraction.
4. Metal fastening strip on prefabricated expansion joints must be set in FlexSeal™ Caulk Grade Sealant or EverGuard® Water-Block and secured with EverGuard® Drill-Tec™ fasteners and neoprene washers fastened 6" (152 mm) o.c.

M. 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 4:12.
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 FlexSeal™ Caulk Grade Sealant or EverGuard® Water-Block on the drain flange prior to securing with the compression clamping ring.
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 FlexSeal™ Caulk Grade Sealant or EverGuard® Water-Block and secured as above. EverGuard® TPO Cut Edge Sealant must be used on TPO drain targets.
6. Do NOT locate lap seams within the sump area. Where lap seams must be located within the sump area, a separate smooth reinforced membrane drain flashing a minimum of 9" (229 mm) larger than the sump area must be installed. The membrane flashing must be heat welded to the roof membrane. Alternatively, 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.

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N. Retrofit Drain Inserts

1. Drain inserts must only be used in the event the original drain is damaged and cannot be repaired without complete replacement of the drain. Drain inserts will reduce water flow. Consult the design professional to ensure adequate drainage is maintained.
2. Clean the drain lines a minimum of 24" (610 mm) where the drain insert is to be installed. Failure to clear this section of drain line can prevent the sealing of the drain and degrade the performance of the drain seal and is required.
3. All drains must be provided with a drain sump of 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 per penetration.
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.

O. Scuppers

1. EverGuard® 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. EverGuard® 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. Alternatively, a wall scupper box may be field flashed using non-reinforced flashing membrane heat welded to membrane on the wall face and roof deck. Be sure that all corners are reinforced with universal corners or non-reinforced EverGuard® material. Fully adhere to the scupper box and terminate on the outside wall face with a termination bar and FlexSeal™ Caulk Grade Sealant or EverGuard® Water-Block.
7. EverGuard® TPO has prefabricated scuppers in standard and custom sizes available. Consult your Territory Manager or local distributor for details.
8. Scuppers may be set in a bed of FlexSeal™ Caulk Grade Caulking or EverGuard® Water-Block for additional resistance to movement.

P. Heater Stacks

1. The temperature of any heater stack that comes into contact with the EverGuard® membrane or flashing should not exceed 160°F (71°C) for EverGuard® TPO membrane, 190°F (88°C) for Everguard TPO Extreme® or 140°F (°C) for EverGuard® PVC membrane.
2. 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.
3. 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.
4. Mechanically attach the roof membrane to the structural deck with Drill-Tec™ screws and plates around the penetration base prior to flashing installation.
5. All stack flashings must be secured at their top edge by a stainless-steel clamping band over FlexSeal™ Caulk Grade Sealant or EverGuard® Water-Block. Seal the detail with FlexSeal™ Caulk Grade Sealant.
6. Field-fabricated membrane flashings may be adhered to the flashing sleeve with EverGuard® adhesives. Make sure to use the correct bonding adhesive with the membrane being installed.

Q. 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, gas lines, and condensation and drain lines.
2. Install wood support blocking over a protective layer of EverGuard® TPO walkway rolls or PVC walkway pads. Place wood blocking on oversized slip sheet, fold two sides vertically, and fasten with roofing nails into the blocking.
3. If using pre-fabricated pipe stands with rubber-like bases, no slip sheet is required on TPO membranes. Do not use on PVC membranes.

R. Satellite Dish Support Bases

1. Install non-penetrating satellite dish support bases over a protective layer of TPO/PVC membrane.

S. Lightning Suppression

1. Secure lightning suppression cable 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.
2. Secure lightning rod to reinforced EverGuard® membrane patch that is heat welded in place. Securement should not penetrate the roof membrane.

3.13 Traffic Protection

- A. Walkway rolls or pads should be installed at all roof access locations, including ladders, hatchways, stairs, and doors. Install walkway rolls or pads at other designated locations, including roof-mounted equipment work locations and areas of repeated rooftop traffic.

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- B. Walkway rolls or pads must be spaced 6" (152 mm) to allow for drainage. Edges of walkway rolls or pads must be placed 6" (152 mm) from any seam.
- C. Heat-weld walkway rolls or pads to the roof membrane surface continuously around the walkway roll or pad perimeter.

3.14 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. Remove all temporary night-seal materials prior to continuing with the roof installation and dispose of properly.

3.15 Field Quality Control

- A. Field quality control should be performed in accordance with NRCA's *Quality Control and Quality-assurance Guidelines for the Application of Membrane Roof Systems*.
- B. 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.
- C. 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.
- D. 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.

3.16 Clean-up

- A. Remove bonding adhesive, bituminous markings, and other contaminants from finished surfaces. In areas where other 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 and remove any sheet membrane contaminated with solvent-based adhesive, bituminous markings, and other contaminants from finished surface.
- C. Cleaning the adjacent area with an all-purpose cleaner, then rinse off soapy residue.
- D. Apply EverGuard® TPO Seam Cleaner or EverGuard® CleanWeld™ Conditioner for TPO membrane and EverGuard® PVC Membrane Conditioner, MEK (methyl ethyl ketone) or acetone for PVC membrane. Refer to Section 3.11, F.
- E. Complete the repair by installing a patch of like material to specific system requirements.

3.17 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 of any damage or defect should follow GAF recommendations. For further information, contact GAF.

NOTES



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protect
what
matters
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