



EVERGUARD EXTREME TPO

RhinoBond System Specification Section - 07540

GAF Spec Number Legend

T = TPO

RB= RhinoBond System

N=New
T=Tear-off
R=Recover

I=Insulated
N=Non-insulated

45EX= 45 mil
60EX= 60 mil
80EX= 80 mil

GAF® EVERGUARD EXTREME® TPO SPECIFICATION

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PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Thermoplastic Polyolefin Single-Ply Roofing Membrane
 - 2. Thermoplastic Polyolefin Flashings
 - 3. Thermoplastic Polyolefin Accessories
 - 4. Roof Insulation
- B. Related Sections
 - 1. Section 06100: Rough Carpentry
 - 2. Section 07620: Sheet Metal Flashing and Trim
 - 3. Section 15430: Plumbing Specialties

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM) - *Annual Book of ASTM Standards*
 - 1. ASTM D-751 – Standard Test Methods for Coated Fabrics
 - 2. ASTM D-2137 - Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
 - 3. ASTM E-96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 4. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Non Rigid Thermoplastic Sheeting or Film at Elevated Temperature
 - 5. ASTM D-471 - Standard Test Method for Rubber Property—Effect of Liquids
 - 6. ASTM D-1149 - Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
 - 7. ASTM C-1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
 - 8. ASTM C-1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
 - 9. ASTM E 903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres
- B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - *Architectural Sheet Metal Manual*
- C. National Roofing Contractors Association (NRCA)
- D. American Society of Civil Engineers (ASCE)
- E. U.S. Green Building Council (USGBC)
 - 1. Leadership in Energy and Environmental Design (LEED)
- F. Factory Mutual (FM Global) - *Approval Guide*
- G. Underwriters Laboratories (UL) - *Roofing Systems and Materials Guide* (TGFU R1306)
- H. California Title 24 Energy Efficient Standards
- I. ENERGY STAR
- J. Cool Roof Rating Council (CRRC)

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K. Miami Dade County

1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this section.

1.04 SUBMITTALS

- A. Product Data: Provide product data sheets for each type of product indicated in this section.
- B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.
- C. Samples: Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.
- D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.
- E. L.E.E.D. submittal: Coordinate with Section 01115 - Green Building Requirements, for LEED certification submittal forms and certification templates.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: GAF® shall provide a roofing system that meets or exceeds all criteria listed in this section.
- B. Installer's Qualifications:
1. Installer shall be classified as a **Master or Master Select™** contractor as defined and certified by GAF®.
 2. Installer shall be classified as a **Master Select™** contractor as defined and certified by GAF®.
 3. Installer shall be classified as a **Master** contractor as defined and certified by GAF®.
 4. Installer shall be classified as a **Certified Maintenance Professional** as defined and certified by GAF®.
- C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.
- D. Final Inspection Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.06 QUALITY ASSURANCE

- A. Cold storage, more than most construction, requires correct design, quality materials, good workmanship, and close supervision. Design should ensure that proper installation can be accomplished under various adverse job site conditions. Materials must be compatible with each other. Installation must be made by careful workers directed by an experienced, well-trained superintendent. Close cooperation between the general, roofing, insulation, and other contractors increases the likelihood of a successful installation.
- B. The cold storage/freezer envelope system must be installed by a **Master or Master Select™** in compliance with shop drawings as approved by GAF. There must be no deviations made without PRIOR WRITTEN APPROVAL of GAF.

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- C. For a start-up and/or an interim inspection contact a Field Service Representative of GAF®.
- D. Upon completion of the installation, an inspection will be conducted by a Field Service Representative of GAF® to ascertain the roofing system has been installed according to GAF's specifications and details.
- E. In the United States, the U.S. Public Health Service Food and Drug Administration developed the Food Code (FDA 1997), which consists of model requirements for safeguarding public health and ensuring that food is unadulterated. The code is a guide for establishing standards for all phases of handling refrigerated foods. These standards must be recognized in the design and operation of refrigerated storage facilities.
- F. Regulations of the Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), and other standards must also be followed.
- G. Incorrect design and poor installation can cause moist air leakage into the facility, resulting in frost and ice formation, energy loss and, eventually, expensive repairs.
- H. A continuous and uninterrupted vapor/air seal must encapsulate the building structure to prevent warm, humid air from infiltrating the roof assembly around the perimeter and penetrations. In freezer applications the vapor barrier under the floor slab must provide a sealed transition to prevent air leakage at the insulated wall panel/floor junction.
- I. Cold storage facilities can change in dimension due to settling, temperature change, and other factors; therefore, cold storage facilities should be inspected regularly to spot problems early, so that preventive maintenance can be performed in time to avert serious damage.

1.07 PRE-INSTALLATION CONFERENCE

- A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAF® representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.08 PERFORMANCE REQUIREMENTS

- A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
- B. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures determined in FM Global Loss Prevention Data Sheet 1-28, to meet a 1-60 or greater wind uplift rating as required by location.
- C. GAF® shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.09 REGULATORY REQUIREMENTS

- A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.

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- B. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class **A B C** rating for roof slopes indicated.
- C. Windstorm Classification: Provide a roofing system which will achieve a Factory Mutual **1-60 1-75 1-90 1-120** wind uplift rating, as listed in the current FM Approval Guide.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver all roofing materials to the site in original containers, with factory seals intact. All products are to carry a GAF® label.
- B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range. Reference data sheets for product storage requirements.
- C. Do not expose materials to moisture in any form before, during or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- D. Use “breathable” type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.

1.11 PROJECT CONDITIONS

- A. Weather
 - 1. Proceed with roofing only when existing and forecasted weather conditions permit.
 - 2. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.

1.12 JOB CONDITIONS

- A. All steel beams, columns, and large pipes that project through the insulation should be vapor-sealed and insulated with a 4-foot high wrap of insulation. The height of insulation at conduits, small pipes, and rods should be four times the regular wall insulation thickness. In both cases, the thickness of insulation on the projection should be half that on the regular wall or ceiling.
- B. Temperature Pulldown
 - 1. Because of the low temperatures in freezer facilities, contraction of structural members in these spaces will be substantially greater than in any surrounding ambient or cooler facilities. Therefore, contraction joints must be properly designed to prevent structural damage during facility pulldown.
 - 2. The first stage of temperature reduction should be from ambient down to 35° F at whatever rate of reduction the refrigeration system can achieve.
 - 3. The room should then be held at that temperature until it is dry. Finishes are especially subject to damage when temperatures are lowered too rapidly. Portland cement plaster should be fully cured before the room is refrigerated.
 - 4. If there is a possibility that the room is airtight (most likely for small rooms, 20 feet by 20 feet maximum), swinging doors should be partially open during pulldown to relieve the internal vacuum caused by the cooling of the air, or vents should be provided. Permanent air relief vents are needed for continual operation of defrosts in small rooms with only swinging doors. Both conditions of possible air heating during defrost and cooling should be considered in design of air vents and reliefs.

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5. The concrete slab will contract during pulldown, causing slab/wall joints, contraction joints, and other construction joints to open. At the end of the holding period (i.e., at 35° F), any necessary caulking should be done.
6. An average time for achieving dryness is 72 hours. However, there are indicators that may be used, such as watching the rate of frost formation on the coils or measuring the rate of moisture removal by capturing the condensation during defrost.
7. After the refrigerated room is dry, the temperature can then be reduced again at whatever rate the refrigeration equipment can achieve until the operating temperature is reached. Rates of 10° F per day have been used in the past, but if care has been taken to remove all the construction moisture in the previous steps, faster rates are possible without damage.

1.13 WARRANTY/GUARANTTEE Provide manufacturers standard WeatherStopper®

Diamond Pledge™ Guarantee

1. **Single source coverage** and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
 - a) **Duration: Five (5), Ten (10), Fifteen (15), Twenty (20) years from the date of completion.**
 - b) **WELL ROOF™ Extension.** GAF® also guarantees to the original or first subsequent owner coverage extension by 25% of the original guarantee length, provided that the roof in inspected and maintained in accordance with the MAINTAINENCE section of this specification.

B. Provide manufacturers standard WeatherStopper® System Pledge™ Guarantee

1. Single source coverage and a monetary limitation of one (1) dollar per square foot where the manufacturer agrees to repair or replace components in the roof system, which cause a leak due to failure in materials or workmanship.
 - a) **Duration: Five (5), Ten (10), Fifteen (15), Twenty (20) years from the date of completion.**

**Materials and workmanship of listed products within this section when installed in accordance with current GAF® application and specification requirements. Contact GAF® Contractor Services for the full terms and conditions of the guarantee.*

C. Provide manufacturers standard WeatherStopper® Integrated Roofing System Guarantee

1. The manufacturer agrees to repair or replace the portion of the roofing materials, which have resulted in a leak due to a manufacturing defect or defects caused by ordinary wear and tear.
 - a) **Duration: Five (5), Ten (10), Fifteen (15), Twenty (20) years from the date of completion.**

D. Provide manufacturers Vapor Seal Addendum to the Diamond Pledge NDL Roof Guarantee

1. The manufacturer agrees to repair or replace roof to wall junctures of the roofing system that has been compromised due to a manufacturing defect or misapplication of the GAF Vapor Barrier Product.
 - a) **Duration: Five (5) years from the date of warranty issuance**

**This Guarantee does NOT cover conditions other than leaks, except to the extent of condensation or moisture intrusion issues due to a manufacturing defect or misapplication of the GAF Vapor Barrier Products installed on the roof. Contact GAF® Technical Support Services for the full terms and conditions.*

E. Provide manufacturers standard prorated material warranty

1. The manufacturer agrees to repair or replace the portion of the roofing materials that have resulted in a leak due to a manufacturing defect or defects caused by ordinary wear and tear.
 - a) **Duration:**

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PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. GAF® - 1 Campus Drive, Parsippany, NJ 07054

2.02 AIR AND VAPOR RETARDER SYSTEM

- A. Proprietary formulated elastomeric styrene-butadiene-styrene (SBS) polymer modified bitumen in combination with a high tack self-adhesive, **GAF SA Vapor Retarder** by GAF.

2.03 INSULATION

- A. Rigid polyisocyanurate board, with a strong white or black fibrous glass facer
 - 1. **EnergyGuard™ Polyiso Insulation** by GAF®,
 - a) Board Thickness:
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
 - 2. **EnergyGuard™ Tapered Polyiso Insulation** by GAF®,
 - a) Board Thickness: tapered
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
- B. Non-halogenated rigid polyisocyanurate board, with glass-reinforced cellulosic felt containing no hazardous halogenated flame-retardant chemicals and conforming to or exceeding the requirements of ASTM C 1289,
 - 1. **EnergyGuard™ NH Polyiso Insulation** by GAF®,
 - a) Board Thickness:
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
 - 2. **EnergyGuard™ NH Tapered Polyiso Insulation** by GAF®,
 - a) Board Thickness: tapered
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
- C. Red List Free certified, holding both an Environmental Product Declaration (EPD) and a Health Product Declaration (HPD) coated glass-fiber bonded to a core of isocyanurate foam meeting the requirements of ASTM D3273 for resistance to mold growth, **EnergyGuard™ Barrier Polyiso Roof Insulation** by GAF®.
 - 1. Board Thickness:
 - 2. Thermal Resistance (LTTR value) of: >20
 - 3. **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - 4. **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
- D. Non-halogenated Red List Free certified, holding both an Environmental Product Declaration (EPD) and a Health Product Declaration (HPD) coated glass-fiber bonded to a core of isocyanurate foam containing no hazardous halogenated flame-retardant chemicals meeting the requirements of ASTM

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D3273 for resistance to mold growth, **EnergyGuard™ NH Barrier Polyiso Roof Insulation** by GAF®.

1. Board Thickness:
 2. Thermal Resistance (LTTR value) of: >20
 3. **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 4. **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
- E. Rigid polyisocyanurate foam insulation with 1/2" perlite roof insulation laminated to one side and a strong fibrous glass facer on the other; conforms to or exceeds the requirements of ASTM C 1289 / FS HH-I-1972. **EnergyGuard™ Composite Insulation**, by GAF®.
1. Board Thickness:
 2. Thermal Resistance (LTTR value) of:
 3. Lamination:
 - a) **1/2" perlite roof insulation**
 - b) **1/2" gypsum board**
 - c) **1/2" cellulose fiber board**
- F. UltraShield™ coated glass-fiber mat facer laminated to a closed-cell polyisocyanurate foam core, ,
1. **EnergyGuard™ Ultra Polyiso Insulation** by GAF®.
 - a) Board Thickness:
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
 2. **EnergyGuard™ Ultra Tapered Polyiso Insulation** by GAF®.
 - a) Board Thickness:
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
- * Stated Dimensional Stability Tolerance: Board thickness shall not diminish by more than 2% max*
- G. Non-halogenated UltraShield™ coated glass-fiber mat facer laminated to a closed-cell polyisocyanurate foam core, containing no hazardous halogenated flame-retardant chemicals and meets ASTM C1289, Type II, Class 2, Grade 2* ,
1. **EnergyGuard™ NH Ultra Polyiso Insulation** by GAF®.
 - a) Board Thickness:
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
 2. **EnergyGuard™ NH Ultra Tapered Polyiso Insulation** by GAF®.
 - a) Board Thickness:
 - b) Thermal Resistance (LTTR value) of:
 - c) **Compressive Strength: 20 PSI, meets ASTM C1289, Type II, Class 1, Grade 2*.**
 - d) **Compressive Strength: 25 PSI, meets ASTM C1289, Type II, Class 1, Grade 3*.**
- * Stated Dimensional Stability Tolerance: Board thickness shall not diminish by more than 2% max*
- H. Expanded perlite mineral aggregate board conforming to or exceeding the requirements of FS HH-I-529b, ANSI/ASTM C 728.
1. **EnergyGuard™ Perlite**, with the following characteristics:
 2. **EnergyGuard™ Tapered Perlite**, with the following characteristics:
 - a) Board Density: 9-lb. per cu. ft. min.
 - b) Board Thickness:

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c) Thermal Resistance (R value) of:

I. Expanded Polystyrene Board

**A separation mat or cover board must be installed over this insulation prior to installing an EverGuard® TPO roof membrane.*

1. **ASTM C-578 Type II, recover board (EPS)**, with the following characteristics:
 - a) Compressive Strength: 15 psi minimum
 - b) Board Density: 1.35 lbs. per cubic foot. minimum
2. **ASTM C-578 Type IX, High density (EPS)**, with the following characteristics:
 - a) Compressive Strength: 25 psi nominal
 - b) Board Density: 1.8 lbs. per cubic foot. minimum
3. **ASTM C-578 Type X, (XPS)**, with the following characteristics:
 - a) Compressive Strength: 15 psi minimum
 - b) Board Density: 1.3 lbs. per cubic foot. Minimum
4. Board Thickness:
5. Thermal Resistance (R value) of:

J. Fan Fold Polystyrene Board

**A separation mat or cover board must be installed over this insulation prior to installing an EverGuard® TPO roof membrane.*

1. **ASTM C-578 Type X, 3/8" fan-fold board (XPS)**, with the following characteristics:
 - a) Compressive Strength: 15 psi minimum
 - b) Board Density: 1.3 lbs. per cubic foot. minimum
 - c) Board Thickness: 3/8" (5mm)
 - d) Thermal Resistance (R value) of: 1.5

K. Overlayment board made of cellulose fiber conforming to or exceeding the requirements of FS LLL-I-535, Class C, ANSI/ASTM C 208, with the following characteristics:

1. Board Thickness: 1/2"
2. Thermal Resistance (R value) of: 1.32

2.04 ROOF BOARD

A. Underlayment or overlayment board with a water-resistant and silicone treated gypsum core with glass fiber facers embedded on both sides, and pre-primed on one side. **GP Dens-Deck® Prime Roof Board**, distributed by GAF®.

1. Board Thickness:
2. Thermal Resistance (R value) of:

B. Underlayment or overlayment board with a water-resistant and silicone treated gypsum core with glass fiber facers embedded on both sides. **GP Dens-Deck® Roof Board**, distributed by GAF®

1. Board Thickness:
2. Thermal Resistance (R value) of:

C. Underlayment or overlayment board with a water-resistant and silicone treated gypsum core with glass fiber facers embedded on both sides and a factory-applied low perm, integrated, durable coating that enhances bond strength of the membrane system. **GP Dens-Deck® DuraGuard™ Roof Board**, distributed by GAF®

1. Board Thickness:
2. Thermal Resistance (R value) of:

2.05 ROOF COVER BOARD/RECOVER BOARD

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- A. High-density polyisocyanurate cover board, with a coated glass facers on both major surfaces of the core foam meets ASTM C1289, Type II, Class 4, Grade 2.

1. **EnergyGuard™ HD Polyiso Insulation** by GAF®,
 - a) Board Thickness: ½" or 12.7mm
 - b) Minimum Compressive Strength: 80psi (551kPa)
 - c) Thermal Resistance (LTTR value) of: >2.5
 - d) Recycle Content: Max 8%
2. **EnergyGuard™ HD PLUS Polyiso Insulation**, by GAF®
 - a) Board Thickness: ½" or 12.7mm
 - b) Minimum Compressive Strength: 110psi (758 kPa)
 - c) Thermal Resistance (LTTR value) of: >2.5
 - d) Recycle Content: Max 8%

** Stated Dimensional Stability Tolerance: Board thickness shall not diminish by more than 2% max*

- B. Non-halogenated high-density polyisocyanurate cover board, with a coated glass facers on both major surfaces of the core foam containing no hazardous halogenated flame-retardant chemicals and meets ASTM C1289, Type II, Class 4, Grade 2.

1. **EnergyGuard™ NH HD Polyiso Insulation** by GAF®,
 - a) Board Thickness: ½" or 12.7mm
 - b) Minimum Compressive Strength: 80psi (551kPa)
 - c) Thermal Resistance (LTTR value) of: >2.5
 - d) Recycle Content: Max 8%
2. **EnergyGuard™ NH HD PLUS Polyiso Insulation**, by GAF®
 - a) Board Thickness: ½" or 12.7mm
 - b) Minimum Compressive Strength: 110psi (758 kPa)
 - c) Thermal Resistance (LTTR value) of: >2.5
 - d) Recycle Content: Max 8%

** Stated Dimensional Stability Tolerance: Board thickness shall not diminish by more than 2% max*

- C. Expanded perlite mineral aggregate board conforming to or exceeding the requirements of FS HH-I-529b, ANSI/ASTM C 728.

1. **EnergyGuard™ Perlite**, with the following characteristics:
2. **EnergyGuard™ Tapered Perlite**, with the following characteristics:
 - a) Board Density: 9-lb per cu. ft. min.
 - b) Board Thickness:
 - c) Thermal Resistance (R value) of:

- D. Fiber-reinforced gypsum panel with an integral water-resistant core. **Securock®** Roof Board by US Gypsum.

1. Board Thickness: ¼"
2. Thermal Resistance (R value) of: .20

- E. High-density fiberboard roof insulation with unique, patent-pending, non-asphaltic primed red coating that allows for a solid membrane bond and meets ASTM C208, Type II, Grade 1 and Grade 2,

- STRUCTODEK® HD Fiberboard** by Blue Ridge FiberBoard®
- a) Compressive Strength: 15 lbf/in² (103 kPa) minimum
 - b) Board Thickness: 1/2" 1"
 - c) Thermal Resistance (R value) of: 1.3 (for 1/2") 2.5 (for 1")

2.06 SEPARATION SHEET

- A. Fire Resistant non-woven fiberglass slip sheet used as a separation sheet over polystyrene foam insulation or beneath insulation over wood substrates providing a UL class A fire rating. Each roll

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contains ten (10) squares (1,000 sq. ft.) of material, 6' x 166.7' (1.83m x 50.8m), 110 lbs nominal weight, **VersaShield™ Solo®** Fire Resistant Slip Sheet by GAF®.

- B. Fire resistant glass fiber mat used as a separation sheet over polystyrene foam insulation or beneath insulation over wood substrates. Each roll contains ten (10) squares (1,000 sq. ft.) of material, 4' x 250' (1.2m x 76.9m), 80 lbs. (36.4 kg), **Fiberglass Fire Sheet 10** by GAF®.
- C. Fire resistant glass fiber mat used as a separation sheet over polystyrene foam insulation or beneath insulation over wood substrates. Each roll contains four (4) squares (420 sq. ft.) of material, 4' x 105' (1.2m x 32.3m), 79 lbs. (35.9 kg), **Fiberglass Fire Sheet 50** by GAF®.
- D. Non-woven polyester UV-stabilized mat, 3 oz. per sq. yd. used as a separation sheet beneath membranes as a protection layer and used over membranes in ballast applied assemblies. Each roll contains thirty (30) squares (3,000 sq. ft.) of material, 10' x 300' (3.07m x 92.3m), 75 lbs. (34.1 kg), **EverGuard® Poly Separation Layer 3 oz.** by GAF®.
- E. Non-woven polyester UV-stabilized mat, 6 oz. per sq. yd. used as a separation sheet beneath membranes as a protection layer and used over membranes in ballast or paver applied assemblies. Each roll contains thirty (30) squares (3,000 sq. ft.) of material, 10' x 300' (3.07m x 92.3m), 125 lbs. (56.8 kg), **EverGuard® Poly Cushioning Layer 6 oz.** by GAF®.

2.07 MEMBRANE MATERIALS

- A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Dade County Product Approval, Florida Building Code Approved.

1. EverGuard® Extreme TPO

- a) Thickness: **50mil 60mil 70 mil 80mil**
- b) Full Sheet size:
 - i) **12' x 100, 1200 sq.ft**
 - ii) **10' X 100', 1000 sq.ft.**
 - iii) **8 x 100, 800 sq. ft.**
- c) Half sheet size:
 - i) **6' x 100, 600 sq.ft.**
 - ii) **5' x 100', 500 sq.ft.**
- d) Color:
 - i) **White - Energy Star Listed, CRRC Listed and Title 24 Compliant.**
 - ii) **Gray - Energy Star Listed, and CRRC Listed.**
 - iii) **Tan - Energy Star Listed, and CRRC Listed.**
 - iv) **Energy Gray - Energy Star Listed, CRRC Listed and Title 24 Compliant.**
 - v) **Energy Tan - Energy Star Listed, CRRC Listed and Title 24 Compliant.**
 - i) **Available Pre-Formulated Colors: Colonial Red, Dark Brown, Dark Bronze, Desert Tan, Electric Blue, Goldenrod, Ivy Green, Moss Green, Patina Green, Slate Gray, Teal, Terra Cotta, Tropical Green, Smoke Gray, Regal Red Regal Blue Hartford Green**

- B. **Custom colors available**

2.08 FLASHING MATERIALS

- A. Advanced heat and UV protected, smooth type, polyester scrim reinforced thermoplastic polyolefin membrane, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Dade County Product Approval, Florida Building Code Approved.

1. EverGuard® Extreme TPO

- a) Thickness: **50mil 60mil 70 mil 80mil**
- b) Full Sheet size:
 - i) **12' x 100, 1200 sq.ft**

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- ii) 10' X 100', 1000 sq.ft.
- iii) 8 x 100, 800 sq. ft.
- c) Half sheet size:
 - i) 6' x 100, 600 sq.ft.
 - ii) 5' x 100', 500 sq.ft.
- d) Color:
 - i) White - Energy Star Listed, CRRC Listed and Title 24 Compliant.
 - ii) Gray - Energy Star Listed, and CRRC Listed.
 - iii) Tan - Energy Star Listed, and CRRC Listed.
 - iv) Energy Gray - Energy Star Listed, CRRC Listed and Title 24 Compliant.
 - v) Energy Tan - Energy Star Listed, CRRC Listed and Title 24 Compliant.
 - i) Available Pre-Formulated Colors: Colonial Red, Dark Brown, Dark Bronze, Desert Tan, Electric Blue, Goldenrod, Ivy Green, Moss Green, Patina Green, Slate Gray, Teal, Terra Cotta, Tropical Green, Smoke Gray, Regal Red Regal Blue Hartford Green

C. Custom colors available

2.09 INDUCTION WELDING EQUIPMENT

- A. Non-penetrating fastening system for TPO single-ply roofing, **RhinoBond® Portable Bonding Machine**
 - 1. Minimum 5,000-watt, continuous generator per two RhinoBond® Portable Bonding Machines
 - 2. 100' (2.5 m) max length, #12 minimum gauge electrical cords
 - 3. Cooling clamps (stand-up magnets that put pressure on the newly-welded plate)

2.10 RHINO BOND PLATES AND FASTENERS

- A. 3" (76 mm) diameter Galvalume® steel plate with a special thermoplastic polyolefin (TPO) coating, **DRILL-TEC™ RhinoBond® TPO XHD Plate** by GAF®
- B. 1.5"(40 mm) – 6.5" (165 mm) Patented polyamide tube insert compatible with DRILL-TEC™ RhinoBond® TPO XHD Plate, **TreadSafe Tubes** by OMG.
- C. #3 Phillip Truss, CR-10 corrosion resistant coated **DRILL-TEC™ XHD #15 Roofing Fastener** by GAF®

2.11 ADHESIVES, SEALANTS and PRIMERS

- A. Sprayable solvent-based adhesive for smooth TPO: **EverGuard® TPO Quick Spray Adhesive**, by GAF®.
- B. Low VOC Sprayable solvent-based adhesive for smooth TPO: **EverGuard® TPO Quick Spray Adhesive LV50**, by GAF®.
- C. Water-based Bonding Adhesive: Water based rubberized adhesive for use with EverGuard® TPO membranes, **EverGuard® WB181 Bonding Adhesive**, by GAF®.
- D. Solvent-based bonding adhesive for use with smooth TPO membranes, **EverGuard® 1121 Bonding Adhesive**, by GAF®.
- E. Low VOC solvent-based bonding adhesive for use with smooth TPO membranes, **EverGuard® Low VOC Bonding Adhesive**, by GAF®.
- F. Low VOC solvent-based bonding adhesive covering 3 squares per pail for use with smooth TPO membranes, **EverGuard® TPO 3 square Low VOC Bonding Adhesive**, by GAF®.
- G. Two-part VOC free low rise polyurethane foam adhesive for use with fleece-back membranes, **LRF Adhesive O or M** by GAF®.

GAF® EVERGUARD EXTREME® TPO SPECIFICATION

- H. Low temp two-part VOC free low rise polyurethane foam adhesive for use with insulation and fleece-back membranes, **TPO LRF Adhesive M Low Temp** by GAF®.
- I. Sustainable low temp two-part VOC free low rise polyurethane foam adhesive for use with insulation and fleece-back membranes, **TPO LRF Adhesive M LTA** by GAF®.
- J. Two-part low rise polyurethane foam adhesive for use with insulation and fleece-back membranes, **Oly-Bond 500™ Roofing Adhesive - Equipment-Free Canister** by GAF®.
- K. Solvent based primer for preparing surfaces to receive butyl based adhesive tapes, **EverGuard® TPO Primer**, by GAF®.
- L. Low VOC solvent based primer for preparing surfaces to receive butyl based adhesive tapes, **EverGuard® TPO Low VOC Primer**, by GAF®.
- M. Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding, **EverGuard® TPO Seam Cleaner**, by GAF®.
- N. Low VOC solvent based cleaner used to clean exposed or contaminated seam prior to heat-welding or priming, **EverGuard® CleanWeld™ Conditioner**, by GAF®.
- O. Solvent based, trowel grade synthetic elastomeric sealant. Durable and UV resistant suitable for use where caulk is typically used. Available in 10 oz. tubes, **FlexSeal™ Caulk Grade Sealant** by GAF®.
- P. Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings and comes with a 20 yr. ltd warranty against leaks caused by manufacturing defects. Meets the performance criteria of ASTM D412, ASTM D2196, ASTM D1475 and ASTM D1644, **FlexSeal™ Roof Sealant**, by GAF®.
- Q. One-part moisture cure, self-leveling sealant designed for use in pitch pans **EverGuard® One-Part Pourable Sealer** by GAF®.
- R. One part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange. **EverGuard® Water Block**, by GAF®.
- S. Solvent based liquid, required to protect field cut edges of EverGuard® TPO membranes. Applied directly from a squeeze bottle, **EverGuard® TPO Cut Edge Sealant**, by GAF®.
- T. Insulation Adhesive: **Oly-Bond 500™** distributed by GAF®.
- U. Insulation Adhesive: **Oly-Bond 500™ Spot Shot** distributed by GAF®.

2.12 PLATES & FASTENERS

- A. **Drill•Tec™ Standard Screws:** Standard duty alloy steel insulation fastener with CR-10 coating with a .215" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips head for use on steel and wood decks.
- B. **Drill•Tec™ ASAP® 3P Fastener:** Assembled screw and 3" locking plastic plate. Alloy steel fastener with CR-10 coating with a .215" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head.
- C. **Drill•Tec™ ASAP® 3S Fastener:** Assembled screw and 3" steel plate. Alloy steel fastener with CR-10 coating with a .215" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head.

GAF® EVERGUARD EXTREME® TPO SPECIFICATION

- D. **Drill•Tec™ Polymer GypTec™ Fastener:** Glass-filled nylon auger with 1" (25.4 mm) with major thread diameter of .675. To be used with 3" steel plate for insulation and 2" steel plate for single-ply membranes. Miami Dade and Factory Mutual Standard 4470 approved (for insulation attachment)
- E. **Drill•Tec™ HD Screws:** Heavy gauge alloy steel fastener with CR-10 coating with a .245" diameter thread. Miami Dade and Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on wood, concrete and steel decks.
- F. **Drill•Tec™ XHD Screws:** Heavy gauge alloy steel fastener with CR-10 coating with a .275" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on heavy steel decks, O.S.B or aluminum roof decks.
- G. **Drill•Tec™ SXHD Screws:** Heavy gauge alloy steel fastener with CR-10 coating with a .320" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on specific FM assemblies on heavy steel decks.
- H. **Drill•Tec™ Lite-Deck Fastener:** A large diameter reinforced nylon screw with a #3 square drive flat head. Thread diameter of .375" and shank diameter of .312". Uses a 3" (76 mm) Metal Round Plate fastening system.
- I. **Drill•Tec™ CR Base Sheet Fastener:** G-90 galvanized, CR-10 Corrosion resistant coating with 1.125" x1" (25.4 mm) head and 1 3/4" (44 mm) leg length. Preassembled with 2 3/4" (70 mm) diameter Galvalume steel roof disc.
- J. **Drill•Tec™ CR 1.2 Base Sheet Fastener:** G-90 galvanized, CR-10 Corrosion resistant coating with 1.125" x1" (25.4 mm) head and 1.2" leg length. Preassembled with 2 3/4" (70 mm) Diameter Galvalume steel roof disc.
- K. **Drill•Tec™ Purlin Fastener:** Alloy steel fastener with CR-10 coating with a .210" diameter thread. Factory Mutual Standard 4470 Approved, 1/4" hex head. For use when mechanically fastening single-ply membranes in metal-retrofit applications.
- L. **Nail-Tite Type-R Fasteners:** Self-locking one-piece fastener for securing base ply when roofing over existing poured gypsum roof decks. Shank: 1" (25.4 mm) tapered cone precision formed from corrosion resistant galvanized (G-90) steel. Cap: 1-1/4" round cap formed from corrosion resistant Galvalume (AZ-55) steel, reinforced to resist cupping during driving. The shank is securely wedged to cap forming rigid one-piece fastener, by E. S. Products.
- M. **Drill•Tec™ AccuTrac Insulation Plates:** Galvalume coated steel 3" square plates recessed or flat bottom. Miami Dade and Factory Mutual Standard 4470 Approved and suitable for use with Drill•Tec™ standard fasteners, Drill•Tec™ heavy duty fasteners, Drill•Tec™ extra heavy duty fasteners. Made for east use with Drill•Tec™ AccuTrac stand up tool
- N. **Drill•Tec™ Accuseam Plates:** Galvalume coated steel 3" diameter plates. Miami Dade and Factory Mutual Standard 4470 Approved and suitable for use with Drill•Tec™ Philips head fasteners and Drill•Tec™ extra heavy duty fasteners. Made for east use with Drill•Tec™ AccuTrac stand up tool
- O. **Drill•Tec™ Insulation Plates:** Galvalume, 3" (76 mm) diameter, suitable for use with Drill•Tec™ Standard and HD screws, and Drill•Tec™ Spikes. Special design available for use with Drill•Tec™ Polymer Screws.
- P. **Drill•Tec™ XHD Plates:** Galvalume, 2 3/8" (60 mm) diameter, with a barbed underside. Suitable for use with Drill•Tec™ Standard, HD, and XHD Screws, and Drill•Tec™ Spikes.
- Q. **Drill•Tec™ SXHD Plates:** Galvalume, 2 3/4" (70 mm) diameter, with a double barbed underside. Required for use with Drill•Tec™ SXHD Screws, HD Screws and Drill•Tec™ Spikes for specific FM assemblies.
- R. **Drill•Tec™ SHD Plates:** Galvalume, 2" (52 mm) diameter, with a double barbed underside. Suitable for use with Drill•Tec™ Standard, HD, XHD, and SXHD Screws, and Drill•Tec™ Spikes.
- S. **Drill•Tec™ Lite-Deck Plate:** Galvalume, plate with extra wide diameter designed specifically for Lite-Deck Fastener.
- T. **Drill•Tec™ Locking Impact Nail:** Factory Assembled, G-90 Galvalume Coated fastener designed to install base sheets or insulation to gypsum or cementitious wood fiber. 1.8" to 4.8" lengths available with a 2.7" diameter plate.

2.13 NAILS & SPIKES

GAF® EVERGUARD EXTREME® TPO SPECIFICATION

- A. **DRILL-TEC™ CD-10:** Hammer-in, non-threaded fastener designed to secure insulation and membrane to structural concrete. Miami Dade and Factory Mutual Standard 4470 approved
- B. **DRILL-TEC™ Spikes:** Hammer-in, non-threaded fastener designed to secure insulation and membrane to structural concrete. Alloy steel fastener with a CR-10 coating and a .250 shank diameter.
- C. **DRILL-TEC™ Masonry Anchor:** Zinc alloy anchor with stainless steel or zinc plated steel pin available in either 1/4" or 3/16" diameter. Designed to attach termination bars to concrete or masonry walls.
- D. **Threaded Cap Nail:** Annular-threaded electro-galvanized with yellow di-chromate coating, with 1" (25.4 mm) round or square cap, as manufactured by the Simplex Nail Corporation.
- E. **Two-Piece Tube Nail:** 1" diameter cap; when the nail is driven down through the tube of first part that was installed, the nail hooks up to provide back out resistance, as manufactured by The Simplex Corporation

2.14 PAVERS

- A. Extruded polystyrene insulation panels with an integral latex-molded mortar top face. Nominal 2" thick insulated pavers to be provided with tongue and groove interlocking edges.

2.15 ACCESSORIES

A. GENERAL FLASHING ACCESSORIES

- 1. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, available in White, 0.055 inches (55 mils) nominal thickness and sheet size: 24in x 50ft. **EverGuard Extreme® TPO Detailing Membrane**, by GAF®.
- 2. An 8 inch (203 mm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness with 100 foot length, available in White, **EverGuard Extreme® TPO Flashing Membrane**, by GAF®.
- 3. 25 mil TPO membrane laminated to galvanized sheet metal for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. **EverGuard Extreme® TPO Coated Metal**, by GAF®.
 - a) Metal type: 24 gauge, 20 gauge Aluminum Stainless steel
 - b) Sheet per pallet: 5 10 30
 - c) Sheet Size: 4' x 10' Custom size
 - d) Sheet Color: White
 - i) Custom colors available
- 4. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6" on center or 8" on center. 3/4" x 10' with 0.090" cross section, **DRILL-TEC™ Termination Bar**, by GAF®.

B. ROOF EDGE ACCESSORIES

- 1. Two-part assembly with a continuous cleat and a formed high-quality KYNAR 500® finish cover tested per ANSI/SPRI/FM4435/ES-1. The system shall have all concealed fasteners with no penetration on horizontal roof surface available in 10' lengths, **EverGuard® Standard Drip Edge** by GAF®.

GAF® EVERGUARD EXTREME® TPO SPECIFICATION

2. Two part decorative fascia edge metal tested per ANSI/SPRI/FM4435/ES-1. The system shall have all concealed fasteners with no penetration on horizontal roof surface available in 10' lengths,
 - a) 20 gauge galvanized retainer, **EverGuard® EZ Fascia** by GAF®.
 - b) 0.50 aluminum retainer, **EverGuard® EZ Fascia AR** by GAF®.
 - c) 24 gauge galvanized retainer, **EverGuard® EZ Fascia LT** by GAF®.
 - d) Extruded aluminum retainer, **EverGuard® EZ Fascia EX** by GAF®.
3. Decorative metal fascia with continuous galvanized steel spring cant to terminate single-ply roofing at perimeter. The system shall be watertight with concealed splice plates and no exposed fasteners available in 10' lengths, **EverGuard® Snap-on Fascia** by GAF®
4. 20 gauge galvanized steel box with pre-punched holes and supplied with corrosion-resistant fasteners, **EverGuard Edge Box RI** by GAF®.

C. WALL & CURB ACCESSORIES

1. .045" reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in fully adhered systems. Size 6" x 100', **EverGuard Extreme® RTA (Roof Transition Anchor) Strip™**, by GAF®
2. 55 mil TPO membrane and 24 gauge coated metal prefabricated into standard and custom size thru wall scuppers. Available in two sizes: 4" x 6" x 12" (l x w x d) with a 5.75" x 3.75" opening and 8" x 10" x 12" (l x w x d) with a 9.75" x 7.75" opening, **EverGuard Extreme® TPO Scupper**, by GAF®
3. .045" or .060" thick reinforced TPO membrane fabricated corners. Available in four standard sizes to flash curbs that are 24", 36", 48", and 60" in size. Four corners are required to flash the curb, **EverGuard Extreme® Corner Curb Wraps**, by GAF®.
4. 0.060" thick molded TPO membrane outside corners of base and curb flashing. Hot-air welds directly to EverGuard® TPO membrane. Size 4" x 4" with 6" flange, **EverGuard Extreme® TPO Universal Corners** by GAF®.
5. 0.055" molded TPO membrane inside corners of base and curb flashing. Hot-air welds directly to EverGuard® TPO membrane. Size 6" x 6" x 5.5" high **EverGuard Extreme® TPO Preformed Corners** by GAF®.
6. 8" diameter, nominal .050" vacuum formed unreinforced TPO membrane for use in flashing outside corners of base and curb flashings, **EverGuard Extreme® TPO Fluted Corner**, by GAF®.

D. PENETRATION ACCESSORIES

1. 0.075" thick molded TPO membrane sized to accommodate most common pipe and conduits, (1" (25.4 mm) to 6" diameter pipes), including square tube. Hot-air welded directly to EverGuard® TPO membrane, supplied with stainless steel clamping rings, **EverGuard Extreme® TPO Preformed Vent Boots** by GAF®.

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2. 0.045" or 0.60" thick molded TPO membrane preformed boots are split to accommodate most common pipes and conduits and available in three standard sizes, **EverGuard Extreme® TPO Split Pipe Boots**, by GAF®.
3. 0.045" or 0.60" thick molded TPO membrane preformed square boots are split to accommodate most common square penetrations and conduits and available in three standard sizes, **EverGuard Extreme® TPO Square Tube Wraps**, by GAF®.
4. .070 thick molded penetration pocket to provide structure and foundation for the application of a pourable sealant for a variety of roof penetrations, weldable and 9" x 6" x 4" (l x w x h). **EverGuard Extreme® TPO Pourable Sealer Pocket**
5. .055" thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications. **EverGuard® TPO Drain** by GAF®

E. FIELD OF ROOF ACCESSORIES

1. Pre-manufactured expansion joint covers used to bridge expansion joint openings in a roof structure. Fabricated to accommodate all roof to wall and roof to roof applications, made of .060" reinforced TPO membrane, available in 5 standard sizes for expansion joint openings up to 8" wide. **EverGuard Extreme® TPO Expansion Joint Covers**, by GAF®
2. .055" thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60, 70 and 80 mil membrane applications. **EverGuard Extreme® T-Joint Patches**, by GAF®.
3. 1/8" thick extruded and embossed TPO roll 30" x 50', heat welds directly to roofing membrane. Unique herringbone traction surface. Gray in color, **EverGuard® TPO Walkway Rolls**, GAF®.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

3.02 SUBSTRATE PREPARATION

A. Recover

1. Suitable roofs for recover shall be free of dust, dirt, debris, and any contaminants that may adversely affect the performance of the new roof. Areas of substantial deck deflection or membrane imperfections shall be corrected prior to installing any new roofing.

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2. For recover installations over single-ply, fluid applied, coal tar and metal roofs, contact Technical Support Services for prior approval and technical requirements.
3. Taking test cuts to verify the existing roof construction and condition. Three test cuts should be made for roofs under 100 squares and one test cut per 100 squares above the minimum amount. It is highly recommended and in certain circumstances, required, that a moisture survey be made to determine the extent of wet insulation and moisture entrapment. Contact Technical Support Services for more information on moisture surveys.
4. Existing substrates and insulation (if applicable) must be dry over the majority of the roof area. Wet or deteriorated areas of insulation and substrate must be removed and replaced with new materials. When adhering insulation or new roofing directly to the existing roof surface, the existing roof system components must be well attached to each other and their substrate.
5. All applicable code requirements must be met for recover over an existing roofing system.
6. GAF does not recommend partial recover or re-roofing of a single roof area due to the potential for defects in the portion of the roof system not replaced or negatively affecting the performance of the new membrane. When required by project conditions or budget considerations, GAF requires full separation of the old and new roof areas by means of a full curb mounted expansion joint or area divider installed to provide a complete watertight seal or break between areas. Tie-in constructions, in which the old and new membranes are adhered directly to each other and stripped in are not acceptable for coverage under certain guarantees

B. Tear-off

1. 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.
2. Confirm the quality and condition of the roof decking by visual inspection. Fastener pull-out testing must be conducted by the roof fastener manufacturer.
3. Secure all loose decking. Remove and replace all deteriorated decking.
4. Remove abandoned equipment and equipment supports.
5. Confirm that the height of equipment supports will allow the installation of full-height flashings.

C. Steel Deck

1. Metal decks must be a minimum uncoated thickness of 22 gauge (0.8 mm) and shall have a G-90 galvanized finish on all panels. FM requirements may supersede those set forth in this section. Consult the current FM Guide for more information.
2. Decks must comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.
3. When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.
4. In all retrofit roof applications, it is required that deck be inspected for defects. Any defects are to be corrected per the deck manufacturer's recommendations prior to the new roof application.
5. Existing metal roof panels' flutes are to be filled with flute filler insulation: EPS, XPS, or polyiso insulation. Flute insulation should fit snugly between seams of the existing metal panels. Flute filler insulation thickness should be equivalent to the height of the metal panel seams

A. Structural Concrete Deck

1. Minimum Min. 2,500 psi compressive resistance (98,066 kilogram-force/square centimeter)
2. The deck must be smooth, level and cannot be wet or frozen. If deck is determined to be wet, it must be allowed to dry.

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3. Only poured in place concrete decks that provide bottom side drying are acceptable. Decks that are installed over non-vented metal decks or pans that remain in place may trap moisture in the deck beneath the roof system and are not acceptable.
 4. The roof deck shall be properly cured prior to application of the roofing system; twenty-eight (28) days is normally required for proper curing. Curing agents must be checked for compatibility with roofing materials. Prior to the installation of the roof assemblies, GAF® recommends the evaluation of the surface moisture and deck's dryness through the use of ASTM D-4263 or hot bitumen test.
 5. Treat cracks greater than 1/8" (3 mm) in width in accordance with the deck manufacturer's recommendations.
 6. Sumps for the roof drains shall be provided in the casting of the deck.
 7. In all retrofit roof applications, it is required that deck be inspected for defects. Any defects are to be corrected per the deck manufacturer's recommendations prior to the new roof application.
 8. For Pre-Cast Concrete Decks
 - a) Minimum 2" (51 mm) deck thickness
 - b) 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 adhered insulated assemblies.
 - c) 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.
 9. For Pre-Stressed Concrete Decks
 - a) 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.
 - b) 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.
 10. For Poured Structural Concrete Decks
 - a) Minimum 4" (102 mm) deck thickness
 - b) Must be poured over removable forms or must provide for bottom side drying. Poured-in-place structural concrete decks that are poured over non-vented metal decks or pans that remain in place not acceptable.
- B. Wood Deck (Plank / Heavy Timber)**
1. Wood boards must be minimum 2" (51 mm) nominal thickness and have a nominal width of 4'-6". Tongue and groove or shiplap lumber is preferred to square edge material since subsequent shrinkage or warping of square edge planks may cause ridging of the roof system above adjacent boards.
 2. All boards must have a bearing on rafters at each end and be securely fastened.
 3. Lumber shall be kiln dried.
 4. Preservatives or fire retardants used to treat decking must be compatible with roofing materials.
 5. Decking shall be kept dry and roofed promptly after installation.
 6. Knotholes or large cracks in excess of 1/4" (6 mm) shall be covered with securely nailed sheet metal.
 7. Tape and staple fastening systems may be used on wood decks when they comply with local building codes and agencies
 8. In all retrofit roof applications, it is required that deck be inspected for defects. Any defects are to be corrected per the deck manufacturer's recommendations and standards of the APA/Engineered Wood Association prior to new roof application
- C. Plywood Deck**

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1. Plywood sheathing must be exterior grade, minimum 4 ply, and not less than 3/4" (19 mm) 19/32" (Miami Dade County) thick.
2. Preservatives or fire retardants used to treat the decking must be compatible with roofing materials.
3. The deck must be installed over joists that are spaced 24" (610 mm) o.c. or less.
4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking. The panels must be secured in accordance with APA–The Engineered Wood Association recommendations "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within 1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.
7. Deck shall be attached with approved fasteners at required spacing. Consult local building codes for specific requirements

D. Oriented Strand Board (OSB) Deck

1. Oriented Strand Board must carry a Structural 1 rating if it is to be used as a decking material.
2. Preservatives or fire retardants used to treat decking must be compatible with roofing materials.
3. The deck must be installed over joists that are spaced 24" (610 mm) o.c. or less.
4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking; the APA/Engineered Wood Association (APA) recommendations. "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within (1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.
7. Oriented strand board (OSB) decks are not acceptable unless the RhinoBond® fasteners are fastened into joists per GAF requirements.

E. Lightweight Insulating Concrete Deck

1. Insulating concrete decks are required to have a minimum thickness of 2" (52 mm), a minimum compressive strength of 125 psi (9 kg/cm) and a minimum density of 22 pcf (208 g/m³). Individual deck manufacturer's standards apply when their specifications exceed the minimum thickness, compressive strength, or density requirements.
2. The insulating deck/fill must be installed by an applicator approved by the deck manufacturer.
3. The roof system shall be installed immediately following deck curing to prevent damage from exposure to precipitation. The deck manufacturer determines the minimum curing time and maximum exposure limitations.
4. LWIC should not be poured during rainy periods. Deck areas that have frozen before they have cured must be removed and replaced. Decks which receive precipitation prior to installation of the roof membrane must be checked for moisture content and dryness.
5. 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.
6. Cellular lightweight insulating concrete decks can be installed over non-slotted, galvanized metal decking designed for cellular lightweight insulating concrete or structural concrete.

F. Cementitious Wood Fiber

1. Minimum 2" (51 mm) thickness
2. Tongue & groove panel edges required
3. Decks must be protected from the weather during storage and application; any wet or deformed decking should be removed and replaced.
4. Cementitious wood fiber decks should not be installed over high humidity occupancies.
5. Cementitious wood fiber decks must have a minimum design load as recommended by the manufacturer.

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6. All cementitious wood fiber deck panels must be anchored against uplift and lateral movement.
7. The deck must be installed level. Any deflection, irregularities, or otherwise damaged panels must be corrected or replaced.
8. All structural wood fiber deck panels must be anchored against uplift and lateral movement.

G. Gypsum

1. Gypsum decks must be smooth and free from deflections or ridges.
2. When installing base sheet fasteners, an average fastener withdrawal resistance as recommended by the fastener manufacturer must be obtained; however, at no time shall it be less than 40 lbs. (178 N) per fastener.
3. Wet or frozen poured gypsum decks are not suitable to receive a roof.
4. Poured-in-place gypsum roof decks contain a large percentage of moisture. All necessary precautions must be taken to avoid the entrapment of moisture under the roofing system. In addition to ventilation of the underside to allow for proper curing, topside and perimeter venting shall be implemented.

H. Loadmaster Decks

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

3.02 NAILER INSTALLATION

A. Acceptable Material

1. Solid Blocking: Non-pressure treated wood as required, #2 Grade or better, nominal 1 1/4" (30 mm) x 4" (102 mm) with a minimum thickness of 3 1/2" (88 mm).
2. Shim Material: Plywood, 1/2" (13 mm) x width to match solid blocking.
3. Verify the condition of existing roof nailers and anchor to resist 250 lb. per ft. (550 kg) load applied in any direction. New nailers should meet same load requirements.
4. DRILL-TEC™ HD screws 18" (457 mm) o.c. attachment to structural wood, steel decks with a 1" (25 mm) thread embedment.
5. DRILL-TEC™ spikes or HD screws 18" (457 mm) o.c. attachment to concrete decks. Min. 1" (25 mm) shank or thread penetration.
6. Wood nailers attached to gypsum, concrete, cellular concrete and cementitious wood fiber must be fastened 12" (305 mm) o.c., through the nailer into the substrate with substrate approved DRILL-TEC™ fasteners.
7. Three anchors per length of wood nailer minimum.

B. Metal Blocking

1. 20 Ga. galvanized steel box with pre-punched holes and supplied with corrosion-resistant fasteners.
2. Closure and finish strip required for metal decking.
3. Secure in place using provided #14 x 1½-in. universal fasteners through pre-punched holes to roof edge.
4. Install end cap and top of box section with #14 x 1½-in. universal fasteners.

3.03 INSTALLATION - GENERAL

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- A. Install GAF®'s EverGuard® TPO roofing system according to all current application requirements in addition to those listed in this section.
- B. GAF® EverGuard® TPO Specification #:
- C. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.03 AIR/VAPOR BARRIER

A. GENERAL

- 1. Air/vapor retarder components must typically be installed when required by design professional to address internal building air pressure or humidity conditions on the structural deck or directly over a minimal layer of EnergyGuard™ insulation or fire barrier.
- 2. EnergyGuard™ insulation must be installed over the vapor retarder to raise the location of the dew point temperature above the level of the vapor retarder.
- 3. Designers should consider requiring air retarders:
 - a) On all air porous decks, with openings in the walls or area directly below the roof deck that exceeds 10% of the total wall area.
 - b) When the internal pressurization of the building is in excess of 5 lbs. per sq. ft. (239 Pa).
 - c) When the building height exceeds 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—otherwise, the roofing system may fail due to pressure impact.
- 4. Refer to FM Global Loss Prevention Data Sheets 1-28 and 1-29 for specific installation procedures for all roofs with large openings.
- 5. For roofs to be guaranteed by GAF:
 - a) Air retarders are required for all extended-length guarantees on buildings where large wall openings greater than 10% of the total wall area can be open during a windstorm, including opening due to storm damage.

B. APPLICATION – LOOSE-APPLIED

- 1. Install air/vapor barrier sheet loose-applied to the deck or fire board so that wrinkles and buckles are not formed.
- 2. Overlap air/vapor barrier sheets a minimum of 6" for side and end laps. Tape laps together with duct tape or double sided tape.
- 3. Seal perimeter and penetration areas with foam sealant.
- 4. Seal all perimeter nailers with adhered roof membrane placed over the nailer and covering the exterior face of the nailer by 1" (25 mm).
- 5. Install insulation boards over the air/vapor retarder and mechanically attach the boards to the deck.

C. APPLICATION – ADHERED

- 1. Apply compatible adhesive to the structural deck or fire barrier board per air vapor retarder manufacturers' recommendations.
- 2. Install the air/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 air/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 air/vapor barrier and mechanically attach the boards to the deck or adhere the boards to the air/vapor retarder with compatible adhesive to achieve the desired roof system uplift resistance.

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D. APPLICATION

1. In cold storage and freezer facilities the moisture drive is generally downward where the roofing membrane serves as a vapor barrier.
2. In new construction, when working in colder temperatures, curing of concrete floors and the use of propane heaters to accelerate dehydration will cause construction-generated moisture to be driven upward into the roofing assembly due to the lack of ventilation. In this case, the use of a vapor retarder/barrier beneath the roofing insulation is strongly recommended to reduce the potential for condensation and the possible phenomenon of frozen blocks of insulation that may occur during temperature pull down.
3. If a vapor retarder is specified to safeguard against construction generated moisture, GAF Air and Vapor retarder may be used
4. A continuous vapor seal is essential around roof edges, parapets, roof-to-wall transitions, and directly above interior dividers/partitions separating between cold and warmer controlled environments.
5. Where applicable, ensure the insulated wall panel cap is set in EverGuard® Water Block Sealant and secured to the wall panel at 6" on center maximum.
6. Fill panel lows with trowel grade polyurethane sealant to achieve a level, smooth surface approximately 4" to 6" from the top of the panel.
7. Secure cured membrane flashing through the area of the panel that was leveled using generous application of EverGuard® Water-Block Sealant and the DRILL-TEC™ Termination Bar fastened to achieve constant compression against the panel.
8. The transition vapor seal can be completed by turning the cured flashing over the roofing membrane setting each layer in generous beads of EverGuard® Water-Block Sealant as outlined in the applicable GAF detail.
9. Refer to applicable Cold Storage Details for alternative methods by which a vapor seal can be achieved.

3.04 FIRE BARRIER/PROTECTION LAYER

A. GENERAL

1. Slip sheet protection layer must typically be installed when required by design professional or code authority to address code or approval requirements.
2. Fire resistant fiberglass sheet protection layer shall typically be installed when required by design professionals or code authority to address code or approval requirements or as a separator layer.
3. Install fiberglass sheet or polymat protection layer loose-applied over substrate surface so that wrinkles and buckles are not formed.
4. Overlap sheets a minimum of 6" (152 mm) for side and end laps.
5. Install VersaShield Solo loose-applied over substrate surface so that wrinkles and buckles are not formed.
6. GAF VersaShield® Solo™ protection layer should be installed perpendicular to the direction of the TPO membrane
7. Overlap membrane a minimum 2" (52 mm) at the side laps and minimum 4" (102 mm) at the end laps.
8. Use corrosive resistant nails with 1" (25.4 mm) diameter metal head or plastic caps to fasten in place. Only use enough fasteners to hold in place until primary roof covering is in place.
9. Do not install more VersaShield Solo than can be covered in one day.
10. The substrate must be clean, dry, and free of foreign matter.
11. Install GAF FireOut™ Fire Barrier coating at an application rate of one gallon per 100 sq. ft. (9.2 sq. m) via spray, brush, or roller.

3.04 INSULATION

A. GENERAL

1. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly

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with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.

2. Do not install wet, damaged or warped insulation boards.
 3. Install insulation boards with staggered board joints in one direction (unless taping joint).
 4. Install insulation boards snug. Gaps between board joints must not exceed ¼" (6 mm). All gaps in excess of ¼" (6 mm) must be filled with like insulation material.
 5. Wood nailers must be 3-1/2" (89 mm) minimum width or 1" (25.4 mm) wider than metal flange. They shall be of equal thickness as the insulation, and be treated for rot resistance. All nailers must be securely fastened to the deck.
 6. Do not kick insulation boards into place.
 7. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
 8. Insulation should not be installed over new lightweight insulating concrete.
 9. Roof tape, if required over insulation joints, must be laid evenly, smoothly and embedded in a uniform coating of hot steep asphalt with 4" (102 mm) end laps. Care must be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.
 10. Do not install any more insulation than will be completely waterproofed each day.
 1. Overlay/re-cover boards may be installed using all full-size overlay boards in a staggered pattern. Overlay/re-cover boards include gypsum, DensDeck® and SECUROCK® roof board. If plywood or OSB is specified, it must be a minimum thickness of ¾" (19 mm). Overlay/re-cover boards are required when using EPS or XPS as the insulation system.
 2. When installing the DRILL-TEC™ RhinoBond® Attachment System over tapered insulation, RhinoBond® plates are to be flat or flush against the insulation surface to ensure proper welding of the plate to the membrane. For this reason, it is preferable to install the tapered insulation first and cover the tapered system with an overlay/re-cover board.
 3. Do NOT install insulation boards that are wet, warped, or buckled; they must be discarded. Insulation boards that are broken, cracked, or crushed shall not be installed unless the damaged area is first removed and discarded.
 4. Remove and replace insulation boards that become wet or damaged after installation.
 5. Install no more insulation than can be properly covered by the end of each day with roofing membrane.
 6. Do not align seams with rows of plates, as the step-down that is created will cause an incomplete weld of the DRILL-TEC™ RhinoBond® Fastening Plate. Keep a 2" (51 mm) separation between the DRILL-TEC™ RhinoBond® Fastening Plate and membrane seam.
 7. Do not straddle plates over insulation joints, as the gaps will create an incomplete weld of the RhinoBond® Plate.
- B. INSULATION PLACEMENT AND ATTACHMENT

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Suggested Minimum R-values for Roof Insulation*

Cold Storage Type	Interior Temperature Range °F (°C)	Minimum R-value for Roof Insulation
Coolers	40 to 50 (4.4 to 10)	30 to 35
Chill Coolers	25 to 35 (-3.8 to 1.6)	35 to 40
Holding Freezers	-10 to -20 (-23.3 to -28.9)	45 to 50
Blast Freezers	-40 to -50 (-40 to -45.5)	50 to 60

*2018 edition of the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE Handbook—Refrigeration

1. The type of insulation used should be suitable and compatible for use in a cold storage building. Additionally, roof penetrations, such as mechanical curbs or roof hatches, should be appropriately insulated and sealed.
2. Efforts shall be made so the top layer of insulation is at least 2" thick polyiso or an approved ½" minimum cover board in order to reduce the number of fasteners without jeopardizing the performance of the roofing assembly.
3. Where the steel deck flutes are perpendicular to the perimeter wall, fill the flutes minimum 12" away from the wall with spray foam insulation.

C. THERMAL SHORTS/THERMAL BRIDGING

1. To reduce the effects of thermal shorts, roof insulation should be installed in at least two layers with offset joints to minimize air leakage and movement.
2. To reduce the effects of thermal bridging, the roof membrane and upper layer(s) of rigid board insulation should be adhered. Mechanical fasteners as the securement method for a roof membrane or the upper layer(s) of rigid board insulation allows thermal bridging to occur and is less energy efficient.
3. When the substrate is a steel roof deck, the first layer of insulation (i.e., the layer in direct contact with the roof deck) may be mechanically attached. Subsequent layers should be installed with adhesives.

B. INSULATION APPLICATION

1. The insulation must be securely attached to the roof deck. A minimum FMRC 1-60 attachment is recommended. Refer to FMRC Approval Guide for FM fastening patterns. Factory Mutual requires fastener density increased in corner areas for FM 1-60 as well as perimeter and corner area fastener density increases for FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, and 1-49.
2. Use only fasteners with a minimum 3 inch (76 mm) stress plate when mechanically attaching insulation. Do not attach insulation with nails.
3. Apply LRF O Adhesive directly to the substrate using a ribbon pattern. Space beads as required by job specification, typically 6" or 12" (152 mm or 305 mm) o.c.
4. LRF O Adhesive should be approximately 70°F (22°C) when being dispensed. As adhesive is applied, allow the adhesive to begin rising, then place board.

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5. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
6. OlyBond 500 must be applied using the specially designed PaceCart dispenser. OlyBond 500 SpotShot shall be applied using one of the specially designed dual cartridge dispensers.
7. Install insulation layers applied with bands of OlyBond 500 spaced 12" o.c. Approximate coverage rate is ½ to 1 gallon per 100 square feet, depending on the substrate. Allow the foam to rise ¾" to 1" (25.4 mm). Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (152 mm) to eliminate continuous vertical gaps.
8. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
9. Install insulation layers applied with ¾" beads of Insta-Stik spaced 12" o.c. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (152 mm) to eliminate continuous vertical gaps.
10. Loose apply the base layer of insulation for subsequent layers to be simultaneously attached or for ballast applications. Minimal fastening should be performed to avoid movement of the boards.
11. Fill all flutes with a loose applied base layer of insulation. Insulation must be of equal height as metal ribs, seams or flutes to allow for subsequent layers to be applied without interference. Minimal fastening should be performed to avoid movement of the boards.
12. If subsequent layers of insulation are to be attached with insulation adhesive, the base layer must be mechanically attached with a minimum fastener density of 1 fastener every 2 square feet.

B. INSULATION APPLICATION

1. Install new insulation, overlay/re-cover board, staggering a minimum 6" (152 mm) to prevent continuous vertical joints through the full new insulation thickness. Butt the insulation and overlay/re-cover boards tightly together with no more than a ¼" (6.3 mm) gap between boards
2. Butt insulation boards together with a ¼" (6.3 mm) maximum space between adjoining boards. Fit insulation boards around penetrations and perimeter with a ¼" (6.3 mm) maximum space between board and penetration. Do not kick insulation boards into place.
3. 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.
4. Insulation boards installed in multiple layers must have the joints between boards staggered in all directions a minimum of 6" (152 mm) between layers.
5. Insulation boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over flute surface for bearing support.
6. Install tapered insulation to provide a sump area a minimum area of 36" x 36" (910 mm x 910 mm) where applicable.
7. 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.
8. Remove and replace insulation boards that become wet or damaged after installation.
9. Install no more insulation than can be properly covered by the end of each day with roofing membrane.
10. EPS, XPS, or polyiso insulation may be used to fill in flutes of steel decking. Cover board required for EPS/XPS.
11. Re-covering over an existing single-ply roof with *no additional insulation* or overlay/re-cover board specified, the existing membrane must be cut. Cut the field of the roof into 10' x 10' (3 m x 3 m) sections and cut all base flashings at their transitions
1. For new construction over a metal deck or tear-off down to a metal deck, install insulation boards so that all edges are supported by the high flutes of the decking with no more than ¼" (6.3 mm) gap between adjoining boards. Butt the insulation and overlay/re-cover boards tightly together with no more than a ¼" (6.3 mm) gap between boards.

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2. Use appropriate type and length of DRILL-TEC™ RhinoBond® Fastening Plates and Screws for structural deck type.
3. Install fastener so as to firmly imbed the plate to the insulation surface without overdriving or underdriving

3.02 MEMBRANE APPLICATION

A. GENERAL

1. Substrates must be inspected and accepted by the contractor as suitable to receive and hold roof membrane materials.
2. Place roof membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent securement.
3. Membrane that has been exposed for more than 12 hours or has become contaminated will require additional cleaning methods.
 - a) Light Contamination - Membrane that has been exposed overnight up to a few days to debris, foot traffic, or dew or light precipitation can usually be cleaned with a white cloth moistened with EverGuard® TPO Cleaner (or EverGuard® CleanWeld™ Conditioner, a low-VOC cleaner) for TPO membranes.
 - b) Dirt-Based Contamination - Membrane that is dirt encrusted will require the use of a low-residue cleaner, such as Formula 409® and a mildly abrasive scrubbing pad to remove the dirt. This must be followed by cleaning with a white cloth moistened with EverGuard® TPO Cleaner (or EverGuard® CleanWeld™ Conditioner) for TPO membranes. Be sure to wait for solvent to flash off prior to welding.
 - c) Exposure-Based Contamination - Membrane that is weathered or oxidized will require the use of EverGuard® TPO Cleaner, EverGuard® CleanWeld™ Conditioner, and a mildly abrasive scrubbing pad to remove the weathered/oxidized top surface layer. This must be followed by cleaning with a white cloth moistened with EverGuard® TPO Cleaner (or EverGuard® CleanWeld™ Conditioner) for TPO membranes. Unexposed membrane left in inventory for a year or more may need to be cleaned as instructed above. Be sure to wait for solvent to flash off prior to welding.
 - d) 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. These membranes should be removed and replaced.

A. DRILL-TEC™ RHINOBOND® ATTACHMENT SYSTEM

1. Use the appropriate length and type of DRILL-TEC™ RhinoBond® Fasteners and Plates for the structural deck.
2. Mechanical attachment for the three distinct areas or zones of a roof; corners (either inside or outside); roof perimeter; and the field of the roof.
 - a) These zones or areas have to be determined before the insulation, cover, or overlay board's fasteners are installed. A building's perimeter edges and corner areas or zones are determined by the height and width and other conditions referenced by ASCE 7-10 and FM Global 129.
3. Snap chalk lines to lay out prescriptive grid pattern for field, perimeters, and corners.
4. Install the fasteners into the substrate using the appropriate grid pattern conforming to established fastening patterns.
5. Fasteners must be tight enough that the DRILL-TEC™ RhinoBond® Fastener Plate doesn't turn or rock. Overdriven fasteners must be removed and discarded. A new DRILL-TEC™ RhinoBond® Fastener and Plate must be reinstalled next to the original, but not into the same space and hole.
6. The area should be blown or broomed clean to remove any dirt or debris from the substrate surface or contaminates from the plate's bonding surface.
7. Place roof membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent securement.

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8. Full-width rolls can be installed throughout the field and perimeter of the roof. Half sheets are not necessary.
9. Overlap roof membrane a minimum of 3" (76 mm) for end laps. Membranes are provided with lap lines along the side laps; the red line is for the DRILL-TEC™ RhinoBond® Attachment System. PVC does not have an adhered line.
10. Best practice is to install membrane so that the side laps run across the roof slope lapped toward drainage points.
11. All exposed sheet corners must be rounded a minimum of 1" (25 mm).
12. Roof membrane must be mechanically secured at the perimeter, at the base of internal walls and curbs, and at all penetrations with DRILL-TEC™ RhinoBond® Plates and Fasteners at 12" (152 mm) o.c. maximum spacing.
13. Membrane may be heat-welded to coated metal flanges. A minimum of 4 fasteners per penetration is required.
14. Plates must be placed no closer than 4.5" (113 mm) from vertical flashings and a maximum of 6" (152 mm) away to facilitate the proper placement of the RhinoBond® induction welder. Alternatively, standard mechanical base attachment can be used 12" (152 mm) o.c.
15. The metal plates must be placed within ¼" – ¾" (6.3 mm – 19 mm) of the membrane edge.
16. DRILL-TEC™ RhinoBond® Plates and Fasteners must not be placed closer than ¼" (6.3mm) to the membrane edge.
17. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
18. Weld shall be a minimum of 1" (25.4 mm) in width for automatic machine welding and a minimum 2" in width for hand welding.
19. Install membrane using RhinoBond® Portable Bonding Machine. Ensure that the tool receives the recommended amount of current for its proper operation. Damage could result from both overload (surge), as well as a low-voltage situation. No other electrical devices can be run at the same time as the RhinoBond® Portable Bonding Machines.
20. Insert approved insulation fill the same size of the existing metal standing seam roof panel to provide a level substrate for installation of the approved cover board or insulation boards. For FM Global insured buildings where insulation is being applied directly to a steel deck, refer to FM Global specifications.
21. The selection of insulation type, thickness, and configuration is the responsibility of the architect, engineer, owner, or roof consultant. GAF reserves the right to accept or reject any roof insulation as an acceptable substrate for GAF roof systems. GAF EnergyGuard™ insulations must be used in roofing systems to be guaranteed by GAF.
22. The fasteners are installed into the purlins for maximum uplift resistance without being placed in the seams of the membrane. 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. For installation of DRILL-TEC™ insulation fasteners and plates, refer to the insulation attachment table in this Manual.
23. Fastener pull-out testing must be conducted by the roof fastener manufacturer.
24. Mechanical attachment for the three distinct areas or zones of a roof; corners (either inside or outside); roof perimeter; and the field of the roof.
25. These zones or areas have to be determined before the insulation, cover, or overlay board's fasteners are installed. A building's perimeter edges and corner areas or zones are determined by the height and width and other conditions referenced by ASCE 7-10 and FM Global 129.
26. Snap chalk lines to lay out prescriptive grid pattern for field, perimeters, and corners.
27. Install the fasteners into the substrate using the appropriate grid pattern conforming to established fastening patterns.
28. Fasteners must be tight enough that the DRILL-TEC™ RhinoBond® Fastener Plate doesn't turn or rock. Overdriven fasteners must be removed and discarded. A new DRILL-TEC™ RhinoBond® Fastener and Plate must be reinstalled next to the original, but not into the same space and hole.

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29. The area should be blown or broomed clean to remove any dirt or debris from the substrate surface or contaminates from the plate's bonding surface.
30. Place roof membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent securement.
31. Full-width rolls can be installed throughout the field and perimeter of the roof. Half sheets are not necessary.
32. Overlap roof membrane a minimum of 3" (76 mm) for end laps. Membranes are provided with lap lines along the side laps; the red line is for the DRILL-TEC™ RhinoBond® Attachment System. PVC does not have an adhered line.
33. Best practice is to install membrane so that the side laps run across the roof slope lapped toward drainage points.
34. All exposed sheet corners must be rounded a minimum of 1" (25 mm).
35. Roof membrane must be mechanically secured at the perimeter, at the base of internal walls and curbs, and at all penetrations with DRILL-TEC™ RhinoBond® Plates and Fasteners at 12" (152 mm) o.c. maximum spacing.
36. Membrane may be heat-welded to coated metal flanges. A minimum of 4 fasteners per penetration is required.
37. DRILL-TEC™ RhinoBond® Plates and Fasteners must be placed no closer than 4.5" (113 mm) from vertical flashings and a maximum of 6" (152 mm) away to facilitate the proper placement of the RhinoBond® induction welder. Alternatively, standard mechanical base attachment can be used 12" (152 mm) o.c.
38. The metal plates must be placed within ¼"– ¾" (6.3 mm – 19 mm) of the membrane edge. Plates must not be placed closer than ¼" (6.3mm) to the membrane edge.
39. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
40. Weld shall be a minimum of 1" (25 mm) in width for automatic machine welding and a minimum 2" (51 mm) in width for hand welding.
41. Install membrane using RhinoBond® Portable Bonding Machine. Ensure that the tool receives the recommended amount of current for its proper operation. Damage could result from both overload (surge), as well as a low-voltage situation. No other electrical devices can be run at the same time as the RhinoBond® Portable Bonding Machines.

3.02 FLASHINGS

A. GENERAL

1. All penetrations must be at least 24" (610 mm) from curbs, walls, and edges to provide adequate space for proper flashing.
2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
4. Heat-weld all flashing membranes, accessories, and coated metal. A minimum 2" (52 mm) wide hand weld or minimum 1" (25 mm) to 1-1/2" (39 mm) automatic machine weld is required.
5. Consult the EverGuard® *Application and Specifications Manual* or GAF® Technical Support Services for more information on specific construction details, or those not addressed in this section.
6. EverGuard Extreme® flashings and accessories are required for use with EverGuard Extreme® membranes.
7. Prior to placement of insulation boards, completely fill transition space between roof and any penetrations with foam pack a minimum of 12" from transition and up to level of cover board as shown in cold storage details to seal against moisture vapor drive

B. COATED METAL FLASHINGS

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1. Coated metal flashings shall be formed in accordance with current EverGuard® construction details and SMACNA guidelines.
2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a ¼" (7 mm) gap to allow for expansion and contraction. Heat-weld a 6" (152 mm) wide reinforced membrane flashing strip to both sides of the joint, with approximately 1" (25.4 mm) on either side of the joint left un-welded to allow for expansion and contraction. 2" (52 mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Heat-weld a 6" (152 mm) wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.
4. Provide a ½" (13 mm) hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
5. Provide a ½" (13 mm) hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

C. REINFORCED MEMBRANE FLASHINGS

1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
2. Membrane flashing may either be installed loose or fully adhered to the substrate surface in accordance with "Construction Detail Requirements".
3. Apply the adhesive only when outside temperature is above 40°F. Recommended minimum application temperature is 50°F to allow for easier adhesive application. Water-based adhesives are approved for use with smooth TPO membranes for flashings only
4. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.
5. Please note that solvent-based adhesives must be allowed to dry until tacky to the touch before mating flashing membrane. Water-based adhesive must be allowed to flash off completely.
6. Heat-weld all laps in EverGuard® smooth-reinforced flashing membrane in accordance with heat-welding guidelines. All seams in fleece-back membrane and smooth field sheet must be stripped in with 8" (203 mm) flashing strip.
7. For extended length guarantees, separate counter flashing is required; exposed termination bars are not acceptable

D. UN-REINFORCED MEMBRANE FLASHINGS

1. Un-reinforced membrane is used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.
2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.
3. Apply the adhesive only when outside temperature is above 40°F. Recommended minimum application temperature is 50°F to allow for easier adhesive application. Water-based adhesives are approved for use with smooth TPO membranes for flashings only
4. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.

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5. Please note that solvent-based adhesives must be allowed to dry until tacky to the touch before mating flashing membrane. Water-based adhesive must be allowed to flash off completely.

E. ROOF EDGES

1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.
2. Flash roof edges with coated metal flanged edging with a minimum 3" (76 mm) wide flange nailed 4" (102 mm) on center to wood nailers, and heat weld 8" (203 mm) membrane strip to metal flanges.
3. When the fascia width exceeds 4" (102 mm), coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12" (305 mm) o.c.
4. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.
5. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8" (152 mm) on center prior to installing a snap-on fascia.
 - a) Submit design drawings for review and approval to Architect or Specifier before fabrication.
 - b) Installing contractor shall check as-built conditions and verify the manufacturer's roof edging details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the roof edging manufacturer's installation guide when setting edging.

F. PARAPET AND BUILDING WALLS

1. Flash walls with EverGuard® TPO membrane adhered to the substrate with bonding adhesive, loose applied or with coated metal flashing nailed 4" (102 mm) on center to pressure-treated wood nailers.
2. Maximum flashing height without intermediate fastening is 24" (610 mm) for loose-applied flashing and 54" (1.4 m) for adhered flashing
3. Secure membrane flashing at the top edge with a termination bar. EverGuard® Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 6" (152 mm) on center for guarantees less than 20 years and 12" (305 mm) on center for guarantees greater than 20 years or that are counter-flashed.
4. Exposed termination bars must be sealed with Flexseal™ Caulk Grade Sealant.
5. Roof membrane must be mechanically attached along the base of walls with screws and plates 12" (305 mm) on center [6" (152 mm) on center for Ballasted Systems]
6. 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.
7. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.
8. Roof Transition Anchor (R.T.A.) Strip may be installed as the alternate method of base securement for a RhinoBond® non-penetrating base attachment detail

G. CURBS AND DUCTS

1. Flash curbs and ducts with EverGuard® TPO membrane adhered to the curb substrate with bonding adhesive, loose applied or with coated metal flashing nailed 4" on center to pressure-treated wood nailers.
2. Maximum flashing height without intermediate fastening is 24" (610 mm) for loose-applied flashing and 54" (1.4 m) for adhered flashing
3. Secure membrane flashing at the top edge with a termination bar. EverGuard® Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 6" (152 mm) on

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center for guarantees less than 20 years and 12" (305 mm) on center for guarantees greater than 20 years or that are counter-flashed.

4. Exposed termination bars must be sealed with Flexseal™ Caulk Grade Sealant.
5. Roof membrane must be mechanically attached along the base of walls with screws and plates 12" (305 mm) on center [6" (152 mm) on center for Ballasted Systems]
6. Metal counterflashing may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with Flexseal™ Roofing Cement.
7. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings

H. ROOF DRAINS

1. Roof drains must be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.
2. Roof drains must be provided with a minimum 36" x 36" (914 mm x 914 mm) sump if applicable. Slope of tapered insulation within the sump shall not exceed 4" in 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 ½" (13 mm) of 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 on the drain flange prior to securement with the compression clamping ring. Typical application is one 10.5 ounce cartridge of FlexSeal™ Caulk Grade Sealant per drain.
5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate smooth membrane drain flashing a minimum of 12" (305 mm) larger than the sump area must be installed. The membrane flashing must be heat-welded to the roof membrane. Alternately, if the seam does not run under the clamping ring, it can be covered with a 6" (152 mm) wide reinforced-membrane strip heat-welded to the membrane.
6. Tighten the drain compression ring in place.

I. EXPANSION JOINTS

1. Any prefabricated expansion joint metal nailing strips must be fastened to wood nailers, curbs or secured to walls with appropriate nails or EverGuard® DRILL-TEC™ Fasteners.
2. Roof membrane must be mechanically attached along the base of raised curb-expansion joints with screws and plates a minimum of 12" (305 mm) o.c. The expansion joint cover bellows shall be at least 2 times the expansion joint opening.
3. Metal nailing strip must be set in FlexSeal™ Caulk Grade Sealant and secured with fasteners and neoprene washers fastened 6" (152 mm) o.c
4. Expansion joints may be field fabricated. Reference appropriate Construction Detail.

J. SCUPPERS

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

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and terminate on the outside wall face with a termination bar and FlexSeal™ Caulk Grade sealant.

7. EverGuard® TPO has prefabricated scuppers in standard and custom sizes available.

K. WOOD SUPPORT BLOCKING

1. Wood support blocking, typically 4" x 4" (102 mm x 102 mm), is usually installed under light-duty or temporary roof-mounted equipment, such as electrical conduit, gas lines, 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.

3.03 TRAFFIC PROTECTION

- A. Install walkway pads at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.
- B. Walkway rolls or pads must be spaced 6" (152 mm) apart to allow for drainage between the pads.
- C. Heat-weld walkway rolls or pads to the roof membrane surface continuously around the perimeter of the pad/roll.

3.04 ROOF PROTECTION

- A. Protect all partially and fully completed roofing work from other trades until completion.
- B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.
- C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
- D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.05 CLEAN-UP

- A. All work areas are to be kept clean, clear and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
- F. Clean and restore all damaged surfaces to their original condition.

3.06 MAINTENANCE

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- A. Inspections to the roof shall be performed annually by a GAF® **Master Select™** contractor.
- B. An annual roofing system maintenance program shall be performed by a Master **Select™** contractor in accordance with GAF®'s 10 Point Maintenance Program provided with your Diamond Pledge™ guarantee.
- C. Submit copies of the roof inspection form, accompanying photographs (a minimum of 6 photos showing the condition of the roof and critical details), and a record of all roofing system maintenance to the GAF® Technical Support Services Department within sixty (60) days of the anniversary date of the completion of the roofing system. Annual roof inspections must be started within the first two (2) years of the guarantee term.

END OF SECTION