



Firestone Asphalt Roofing Systems
Guide for Applicators and Designers

September 2017

SBS Membranes	Compound	Surface	Reinforcement	Thickness	
				inch	mm
SBS Cap	SBS	Granule	Polyester with Glass Strands	0.15	3.8
SBS Torch	SBS	Granule	Polyester with Glass Strands	0.15	3.8
SBS FR	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.15	3.8
SBS FR Torch	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.16	4.1
SBS Glass FR	Fire Retardant SBS	Granule	Glass Fiber Mat	0.15	3.8
SBS Glass FR Torch	Fire Retardant SBS	Granule	Glass Fiber Mat	0.15	3.8
SBS Smooth	SBS	Smooth	Polyester with Glass Strands	0.14	3.7
SBS Premium	SBS	Granule	Polyester with Glass Strands	0.16	4.1
SBS Premium FR	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.16	4.1
SBS Premium FR Torch	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.16	4.1
SBS Metal Flash-AL	SBS	Aluminum	Glass Fiber Mat	0.15	3.8
SBS Base	SBS	Smooth	Glass Fiber Mat	0.09	2.3
SBS Glass Torch Base	SBS	Smooth	Glass Fiber Mat	0.12	3.0
SBS Glass Torch Base 1.5	SBS	Smooth	Glass Fiber Mat	0.09	2.3
SBS Premium Base	SBS	Smooth	Fiberglass Scrim/Mat Bi-laminate	0.16	4.1
SBS Premium Poly Base	SBS	Smooth	Polyester with Glass Strands	0.16	4.1
SBS Poly Base	SBS	Smooth	Polyester with Glass Strands	0.09	2.3
SBS Poly Torch Base	SBS	Smooth	Polyester with Glass Strands	0.12	3.0
BASEGARD SA	SBS	Smooth	Glass Fiber Mat	0.06	1.5
APP Membranes	Compound	Surface	Reinforcement	inch	mm
APP160	APP	Smooth	Polyester with Glass Strands	0.15	3.8
APP160 Cool	APP	Smooth	Polyester with Glass Strands	0.15	3.8
APP170	APP	Smooth	Polyester with Glass Strands	0.165	4.2
APP170 Cool	APP	Smooth	Polyester with Glass Strands	0.165	4.2
APP180	APP	Granule	Polyester with Glass Strands	0.165	4.2
APP180 Cool	APP	Granule	Polyester with Glass Strands	0.165	4.2
APP180 FR	Fire Retardant APP	Granule	Polyester with Glass Strands	0.165	4.2
APP180 FR Cool	Fire Retardant APP	Granule	Polyester with Glass Strands	0.165	4.2
APP Premium FR	Fire Retardant APP	Granule	Fiberglass/Polyester-Tri-laminate	0.17	4.3
APP 80 Glass Base	APP	Smooth	Glass Fiber Mat	0.08	2.0
APP Premium Base	APP	Smooth	Glass Fiber Mat	0.08	2.0
BUR Membranes	Compound	Surface	Reinforcement	inch	mm
MB Base	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.045	1.1
Ply IV (4)	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.035	0.9
Ply VI (6)	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.035	0.9
Channel Venting Base	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.03	0.8

1) INTRODUCTION	6
a) General Considerations – All Firestone Roofing Systems	6
b) Building Codes & Approvals	7
c) Drainage	7
d) Vapor Retarders and Air Barriers	7
e) Warranty	8
f) Quality Assurance	9
2) ROOF DECKS & SUBSTRATE REQUIREMENTS	9
a) General	9
b) Classification	9
c) Steel Decks	10
d) Structural Concrete Decks	10
e) Wood Decks – Plywood, OSB, and Wood Plank	11
f) Cementitious Wood Fiber Decks	12
g) Gypsum Decks	12
h) Lightweight Insulating Concrete Roof Decks	13
3) TEMPORARY ROOFS	13
a) General	13
b) Phased Construction	14
4) VAPOR RETARDERS	14
a) General	14
b) Examples of common vapor retarder applications	15
c) Considerations and Cautions	15
5) AIR BARRIERS	16
a) General	16
6) COMMON ROOF SYSTEM ACCESSORIES	16
a) Cant Strips	16
b) Wood Nailers	17
c) Expansion Joints	17
d) Area Dividers and Control Joints	17
7) MATERIALS	18
a) Caution	18
b) Insulation	18
c) Base Sheets and Smooth Plies	19
d) Cap Sheets	21
8) HOT ASPHALT ATTACHMENT OF INSULATION AND ROOFING PLIES	21
a) Cautions and Guidelines	21
b) Insulation and Cover Boards	22
c) Roof Membranes	23

9) MECHANICAL ATTACHMENT OF INSULATION AND ROOFING PLIES	23
a) Pullout Tests.....	23
b) Fasteners: General.....	24
c) Insulation Fastening Requirements.....	25
d) Base Sheet Fastening Requirements	27
10) ADHESIVE ATTACHMENT OF INSULATION AND ROOFING PLIES	28
a) Insulation Adhesion Requirements	28
b) Base Sheet, Inter-Ply and Cap Sheet Adhesion Requirements	29
11) SELF-ADHERED MEMBRANES	29
a) BASEGARD SA.....	29
b) V-Force Vapor Barrier Membrane.....	30
12) SPECIAL CONSIDERATIONS	30
a) Moisture in Existing Roof	30
b) Drainage.....	30
c) Back-Nailing and Insulation Stops – Slopes Greater than ½" (4.2%).....	31
13) FLASHINGS	34
a) General.....	34
b) UltraFlash Liquid Flashings.....	35
c) Base Flashing.....	35
d) Counter-flashing.....	35
e) Cap flashing	35
f) Wall/Curb Flashing Materials and Requirements.....	35
g) Penetrations (Pipes, Conduits, Etc.).....	35
h) Curbs and Terminations.....	36
i) Sheet Metalwork.....	36
14) ROOF COATINGS	36
a) General.....	36
b) Firestone AcryliTop PC-100 Base Coat for Asphalt Systems and AcryliTop Coating	37
c) Firestone Aluminum Fibered Roof Coating.....	37
d) Gravel Surfacing.....	37
15) WARRANTIES	37
a) General.....	37

Table 1: Structural Deck Classification	9
Table 2: Insulation Attachment for Steel Decks	10
Table 3: Base Sheet and Insulation Attachment for Structural Concrete Roof Decks	11
Table 4: Base Sheet and Insulation Attachment for Plywood, OSB, and Wood Plank Decks	Error! Bookmark not defined.
Table 5: Base Sheet and Insulation Attachment for Cementitious Wood Fiber Decks	12
Table 6: Base Sheet and Insulation Attachment for Gypsum Decks	12
Table 7: Base Sheet and Insulation Attachment for Lightweight Insulating Concrete Decks	13
Table 8: Insulation / Cover Board Attachment Options by Deck	19
Table 9: Insulation / Cover Board Attachment to Insulation Options by Insulation Type	19
Table 10: Allowable Base Sheet Attachments	20
Table 11: Base Sheet Seam / Lap Width Requirements	21
Table 12: Approved Substrates for Hot Asphalt Attachment of Insulation	23
Table 13: Minimum Fastener Pullout	23
Table 14: Allowable Fastener and Substrate Configurations	24
Table 15: Acceptable Fasteners	25
Table 16: Insulation Mechanical Attachment Options	26
Table 17: Minimum Number of Fasteners and Plates Per Insulation Board	27

1) INTRODUCTION

This section is intended to serve as the preface to the Design Guides for all Firestone Building Products roofing systems. Additional technical information is available at the Firestone Building Products Website, <http://firestonebpco.com/>.

Firestone is pleased to offer job-specific technical assistance for our roofing contractors and for the design community. Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 to discuss the technical needs of your project, including meeting specification requirements, application techniques, codes, warranty eligibility of systems, and any other technical questions.

Purpose of this Guide to General Design Criteria

The information contained in this guide is intended to assist Firestone Licensed Contractors in meeting the requirements necessary to obtain a warranty from Firestone Building Products (FSBP).

Architects, engineers, roof consultants, and other specifiers may also use this information in their design of warranty-eligible Firestone roofing systems. Firestone does not engage in roof design.

a) General Considerations – All Firestone Roofing Systems

i) Design

- (1) Always consult a design professional, architect, engineer, roof consultant, etc., before making any design decisions.
- (2) Firestone does not practice architecture or engineering.

ii) Structural Loads

- (1) Concentrated loads from rooftop equipment may cause deformation of insulation/underlayment and damage to the membrane if proper protection is not provided. Sleepers are recommended to protect the roofing system.
- (2) The building must be able to support the loads created by the staging, installation, and in-place service of the roofing system.
- (3) It is the responsibility of the design professional to determine loads and load capacities.

iii) Projects with Extreme Design Considerations

- (1) Contact Firestone prior to bid to ensure that Firestone minimum warranty requirements are met whenever any of the following are present:
 - (a) Buildings with positive air pressure, canopies, and/or any building where the total wall openings exceed 10% of the total wall area on which the openings are located (airport hangars, warehouses, etc.).
 - (b) Cold storage buildings and freezer facilities.
 - (c) Buildings where mold or fungi are present.
 - (d) Projects over 250' in height.

iv) Projects Requiring Enhancements or Specific Components

- (1) Contact Firestone prior to bid, should any of the following be required:
 - (a) Projects with extended wind speeds greater than 55 mph.
 - (b) Projects that require coverage for leaks caused by incidental cuts and punctures.

v) Projects with Potential for Chemical Incompatibility

- (1) Petroleum-based products, incompatible chemicals, animal fats/greases/oils, and other products can be harmful to roofing membranes and accessories, and should not come into direct contact with roofing materials.
- (2) Contact Firestone prior to bid to determine the potential effects of chemical reaction should any substances be present which may be harmful to the roofing system, and to determine if additional protection of the roofing membrane may be needed.

vi) Coordination with Other Trades

- (1) Work and traffic by other construction trades can cause roofing membrane damage, insulation crushing or displacement, and accessory/flashing failure. Coordination between various trades is essential to avoid unnecessary rooftop traffic over completed sections of the roof and to prevent subsequent damage to the roofing system.
- (2) Protect the roofing system from damage during construction.

b) Building Codes & Approvals

- i) It is the responsibility of the specifier to review all applicable building codes to determine their impact on the specified Firestone roofing system. To locate code-complaint Firestone roofing systems, consult the Firestone Code Approval Guide for the appropriate system type, at: <http://firestonebpc.com/technical-information/codes-2/>.
- ii) Authorities Having Jurisdiction
 - (1) Local building codes and building owner insurance requirements directly impact the design of a roofing system. The Authorities Having Jurisdiction (AHJ) – local, state, or regional building code authorities – should be consulted prior to designing the roofing system. Where building code or insurance requirements differ from those of Firestone, Firestone requirements should be followed as the minimum acceptable for warranty purposes.
- iii) FM Global/FM Approvals
 - (1) Where FM Global wind uplift and/or fire ratings (such as “1A-90”) are specified as Performance Requirements, it is important to first determine if the building is insured by FM Global, or if the requirements have instead been chosen by the specifier. If the building is insured by FM Global, it is recommended that you contact the local FM Engineer prior to specifying or bidding a project, to understand any job-specific requirements which may be imposed by FM Global on the project.
 - (2) Firestone roofing materials carry the FM seal, and hundreds of FM Approvals-rated Firestone roofing systems may be found in the Firestone Code Approval Guide.
- iv) UL/Underwriters Laboratories
 - (1) Where UL fire resistance codes (such as “Class A”) are specified, it is important to determine whether the deck is classified as Combustible [C] or Non-Combustible [NC]. Next, determine the rating – A, B, or C – that is required. Last, locate rated roofing systems that comply with the specified code.
 - (2) Firestone metal roofing systems that have been tested and rated by UL for wind uplift resistance may be found in the Firestone Code Approval Guide for metal roofing systems.

c) Drainage

- i) Drainage and slope are design considerations, and should be evaluated by the specifier in accordance with all applicable building codes and industry standards.
- ii) The National Roofing Contractors Association (NRCA) recommends that a roofing assembly be designed to drain any ponding water within 48 hours of a rain event.
- iii) It is recommended that a minimum roof slope of ¼"/ft (2.1 cm/m) be obtained to facilitate proper drainage and maximize long-term performance of the roof system.
- iv) Good roofing practice dictates proper drainage to prevent possible excessive live loads and, in the event of a roof leak, to minimize potential interior damage to the roofing assembly and to the interior of the building.
- v) Slope may be achieved by tapering the structure or using tapered ISO 95+GL™ or RESISTA™ polyiso insulation; an adequate number of roof drains should also be specified and properly located to allow for positive drainage.
- vi) Tapered insulation formed into edges, saddles or crickets is recommended to alleviate incidental areas of ponding water.
- vii) Firestone is not responsible for the performance of the drainage or slope of an installed roofing system. The presence of ponding water does not void the Firestone warranty.

d) Vapor Retarders and Air Barriers

- i) The need for a vapor retarder or air barrier is the decision of a design professional.
- ii) Buildings with high moisture content, vapor drive or other conditions that could drive moisture into the roofing system are often specified with vapor and/or air barriers as part of the roofing system.
- iii) Firestone V-Force™ Vapor Barrier Membrane should be used whenever a vapor barrier is specified in a Firestone roofing system.

iv) Construction Generated Moisture (CGM)

- (1) CGM typically occurs to increased moisture created during construction by several possible sources. The heating of interior spaces during construction in cold weather, enclosing the space above concrete foundations and floors before the concrete has sufficiently dried, and many other means, including perimeter tilt-up panels, the heating and air-conditioning return air system, immediate occupancy of the building, etc., all may have significant contributions to the amount of moisture within the building's initial air content. Perhaps the most common cause, however, is a concrete foundation and/or floors. While the moisture present within new concrete will likely dissipate over time, its initial content enhances the potential for condensation water drips when the building is heated during its initial cold weather cycle.
- (2) A design professional should review the potential initial moisture content of the building's interior when preparing the roof specification, and recommend specific design enhancements.
- (3) The following are design enhancements that may be applied to help mitigate CGM:
 - (a) Multiple layers of staggered insulation joints.
 - (b) The presence of a vapor barrier like the Firestone V-Force Vapor Barrier Membrane within the roofing assembly.
 - (c) Enhancing the "R" value of the installed insulation to reposition the "dew point" to a level within the roof assembly to where condensation will not be allowed to form.
 - (d) Specifying a fully adhered roof assembly.

e) Warranty

- i) The following Firestone warranties include the Firestone brand materials and the workmanship of the Firestone Licensed Contractor, when the system is installed in compliance with all technical specifications per the Firestone Website <http://firestonebpc.com/>.
 - (1) The Firestone Red Shield™ Warranty
 - (a) 5 – 25 years
 - (b) Covers repair of any leak warrantable in nature
 - (c) No Dollar Limit (NDL), non-prorated, no limit to work hours necessary to perform repairs
 - (d) Includes all Firestone roofing products used in the roofing system
 - (2) Extended Warranty Coverage

The Firestone Red Shield Warranty is eligible for the following extended coverage, within specific design limitations. Contact your Firestone Building Systems Advisor regarding design limitations.

 - (a) Increased Wind Speed (72-120 mph, depending on system criteria)
 - (b) Incidental Cuts & Puncture (reinforced single-ply membranes only)
 - (3) The Firestone Platinum™ Warranty
 - (a) 30 years
 - (b) Covers repair of any leak warrantable in nature
 - (c) No Dollar Limit (NDL), non-prorated, no limit to work hours necessary to perform repairs
 - (d) Includes all Firestone roofing products used in the roofing system
 - (4) Firestone Membrane Warranties
 - (5) The Firestone Membrane Limited Warranty
 - (a) 10, 15, or 20 years
 - (b) Covers leaks caused by manufacturing defect or premature aging
 - (c) Prorated and limited to cost of replacement membrane
 - (6) Other Firestone Warranties
 - (a) AcryliTop PC-100 Adhesion Warranty
 - (b) AcryliTop PC-100 Reflectance Warranty
 - (c) ISO 95+ Thermal Resistance Warranty
 - (d) Paint Finish Warranty for all Firestone metal roofing products, including edge metal

f) Quality Assurance

i) Materials

(1) Firestone brand products must be used exclusively in Firestone warranted roofing systems. The performance or integrity of products by others is not included in the Firestone Warranty.

ii) Technical Deviations

(1) Any deviation from Firestone technical specifications, warranty criteria, or detail drawings must be approved by a Firestone Building Systems Advisor.

iii) Inspection

(1) Completed installations will be inspected by a FSBP Quality Building Services (QBS) Technical Representative to verify that the roofing system has been installed per current Firestone technical standards. This inspection is solely for the determination of warranty eligibility by Firestone.

2) ROOF DECKS & SUBSTRATE REQUIREMENTS

a) General

- i) The Firestone roof system depends on a suitable substrate to perform its intended function of weatherproofing the building.
- ii) Structural roof decks should be designed and constructed to provide sufficient strength to support the anticipated dead and live loads. These include the loads anticipated from construction traffic and rooftop equipment that cannot be moved or shut down and ice and snow accumulation on the roof surface.
- iii) The suitability of a deck for roofing activities (such as structural) is the responsibility of the building owner or their design professional. It is the roofing contractor's responsibility to ensure that the substrate is acceptable for the Firestone roof system to be warranted. The substrate to which the Firestone roof system is installed must:
 - (1) Be structurally sound.
 - (2) Be dry, smooth, flat and clean.
 - (3) Be free of sharp fins or foreign materials that could damage the membrane.
 - (4) Meet the minimum requirements for the system.
 - (5) Deteriorated decks should be repaired or replaced. All holes, deformations, depressions, etc. must be reinforced and/or smoothed prior to the roof application.
- iv) The deck should provide a minimum of ¼"/ft (2.1%) slope to drain.
- v) Phenolic insulation must be removed prior to reroofing.
- vi) Sprayed-In-Place Polyurethane Foam (PUF) roof systems require a COMPLETE TEAROFF of the foam system prior to reroofing.

b) Classification

- i) Structural decks can be classified as nailable or non-nailable for purposes of mechanically attaching or nailing insulation and base sheets. Nailable decks include wood, gypsum and lightweight insulating concrete. These decks are soft enough so that the above-deck components can be secured with fasteners. Cementitious wood fiber and poured or precast structural concrete decks have been referred to as non-nailable.
- ii) Structural decks can be classified as combustible or non-combustible for purposes of fire ratings and code requirements.

Structural Deck Classification		
Deck	Nailable or Non-Nailable	Combustible or Non-Combustible
Steel	Non-Nailable	Non-Combustible
Structural Concrete	Non-Nailable	Non-Combustible
Wood	Nailable	Combustible
Cementitious Wood Fiber	Non-Nailable	Non-Combustible
Gypsum	Nailable	Non-Combustible
Lightweight Insulated Concrete	Nailable	Non-Combustible

Table 1: Structural Deck Classification

c) Steel Decks

- i) Firestone recommends that the steel deck be a minimum 22 gage.
- ii) FM Approved steel decks are currently available in 22, 20, and 18 gage sheets with 1½" (3.8 cm) deep corrugations. The corrugations (ribs) are cold rolled in the sheets. The deck has a 6" (1.5 cm) module, that is, the ribs are 6" (1.5 cm) on center. All fastening approvals and recommendations are based on this profile. Approved and recommended spacing is such that the fasteners will engage the top flange of the deck. Another common configuration is 3" (7.6 cm) deep deck, which usually has an 8" (20 cm) module.
- iii) When mechanically attaching insulation, steel decks are required to have minimum fastener pullout strength of 300 lb (1.8 kN) per fastener.
- iv) The Firestone roofing plies may not be adhered directly to a steel deck. They must be adhered to an acceptable insulation or cover board.
 - (1) Only when used as a vapor retarder (not a roofing ply), BASEGARD™ SA or V-Force Vapor Barrier Membrane may be adhered directly to a steel deck. The deck must be free of processing oils and be primed with SA Primer (primer is not required when adhering V-Force Vapor Barrier Membrane to a steel deck). BASEGARD SA may never be used as a temporary roof.
- v) The edges of insulation boards running parallel with the steel deck are required to be supported by the top flange of the deck. The board should have a minimum 1½" (3.8 cm) bearing on the steel deck flange. Cantilevering insulation boards over deck flutes can fracture insulation boards, reducing the support for the membrane, and making it susceptible to puncture.

Insulation Attachment for Steel Decks	
Acceptable Insulation Fasteners <i>¾" (1.9 cm) min penetration through deck</i>	Acceptable Insulation Adhesives <i>New decks may require cleaning to remove processing oils</i>
<ul style="list-style-type: none"> • All-Purpose Fastener • Heavy Duty (HD) HailGard™ Fastener • Heavy Duty Fastener • IsoFast™ #12 Belted Fastener • IsoFast™ #15 Belted Fastener 	<ul style="list-style-type: none"> • I.S.O. Fix™ II Adhesive • ISO Spray R Adhesive • I.S.O. Twin Pack™ Adhesive • I.S.O. Stick™ Insulation Adhesive • LiquiGard™ Adhesive

Table 2: Insulation Attachment for Steel Decks

d) Structural Concrete Decks

- i) To avoid blister formation roof substrates must be clean, dry and free of debris.
- ii) Firestone recommends that the structural concrete deck have a minimum strength of 3,000 Psi (20,684 KPa).
- iii) Concrete decks must cure for a minimum of 28 days.
- iv) Concrete may contain latent amounts of moisture that may affect the insulation and the roof system. To help protect the components, Firestone V-Force Vapor Barrier Membrane, Channel Venting Base, or other vapor retardant material should be installed in accordance with Firestone requirements. The installation of a vapor retarder should be considered regardless of the type of attachment of the insulation and the membrane system.
- v) Moisture Tests
 - (1) Condensation Dryness Test for surface moisture detection: Place an 18" x 18" (46 x 46 cm) piece of window glass in contact with the deck and seal/secure it with gun-grade silicon sealant. If moisture droplets appear after exposure to the midday sun for two (2) hours, additional dry time is required.
 - (2) Hot Bitumen Test for surface moisture detection: Pour a small amount of hot Type III or Type IV adhesion asphalt that has been heated to 400 °F (204 °C) onto the surface of the deck. Look for bubbles or spatters, which indicate the presence of heavy moisture. Allow it to cool. If the deck surface is dry, the asphalt cannot be peeled up in one piece and must be chipped off. If the deck surface is more wet, the asphalt can be peeled up in one piece.
 - (3) A less subjective option is ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes," which the NRCA finds increasingly useful in roofing applications. In the flooring industry, acceptable relative humidity values are typically 75% or lower.
- vi) Verify with the building owner or their design professional about the suitability of mechanical fastening into pre-stressed and post-tensioned structural concrete.

- vii) When mechanically attaching insulation, structural concrete roof decks require minimum fastener pullout of 300 lb. (1.8 kN) per fastener.
- viii) When adhering or heat welding approved insulation or membrane to a structural concrete substrate, the concrete must be primed with an ASTM D 41 asphalt primer. The primer is applied at a rate of 1½ to 2 gallons per 100ft² (0.61 to 0.82 L/m²) and allowed to fully dry prior to the application of insulation or roof membrane.
- ix) The Firestone roofing plies may be adhered directly to a primed, poured-in-place structural concrete deck using adhesion asphalt, Firestone Multi-Purpose MB Cold Adhesive, or by heat welding. The concrete must be finished to provide a substrate that is structurally sound, smooth, flat, clean, dry, and free of sharp fins or foreign materials that could damage the material.
- x) Concrete additives can have a negative impact on the adhesion of asphaltic membranes and insulation products. Thus, Firestone does not accept freshly poured concrete decks that contain concrete additives or curing compounds for warranted systems.
- xi) Firestone does not accept for warranty any concrete substrates that have been sealed with chemical sealers or silicon surface treatments.
- xii) The application of Firestone roofing plies to a structural concrete plank deck, such as a pre-cast concrete deck, may not be an acceptable application. Should the deck not require grouted joints, precautions must be taken to prevent bitumen from dripping into the building. Pre-cast concrete panels may not always be a suitable substrate to receive insulation due to the potential for irregularities, even if the joints are grouted. It may sometimes be necessary to consider pouring a leveling layer of structural concrete over the panels prior to roofing.

Base Sheet and Insulation Attachment for Structural Concrete Roof Decks					
Acceptable Fasteners for Insulation and Base Sheet Attachment		Acceptable Insulation Adhesives		Acceptable Base Sheet Adhesives	
<ul style="list-style-type: none"> • Heavy Duty Fastener • Heavy Duty (HD) HailGard Fastener 	Penetrate 1" (2.5 cm) min. into the structural concrete deck	<ul style="list-style-type: none"> • I.S.O. Fix II Adhesive • ISO Spray R Adhesive • I.S.O. Twin Pack Adhesive 		<ul style="list-style-type: none"> • LiquiGard Adhesive* • Multi-Purpose MB Cold Adhesive 	
<ul style="list-style-type: none"> • Concrete Drive Fastener 	Penetrate 1¼" (3.3 cm) min. into the structural concrete deck	<ul style="list-style-type: none"> • I.S.O. Stick Insulation Adhesive • LiquiGard Adhesive* 		<ul style="list-style-type: none"> • Hot asphalt* 	
*Not for use with APP membranes					
NOTE: Hot asphalt cannot be used with ISOGARD™ HD or RESISTA Insulation.					

Table 3: Base Sheet and Insulation Attachment for Structural Concrete Roof Decks

e) Wood Decks – Plywood, OSB, and Wood Plank

- i) Minimum thicknesses:
 - (1) Plywood must have a minimum thickness of ½" (1.2 cm).
 - (2) OSB must have a minimum thickness of 7/16" (1.1 cm).
 - (3) Wood planks must have a minimum thickness of 1" (2.5 cm).
- ii) When mechanically-attaching insulation, wood decks are required to have a fastener pullout of 300 lb (1.8 kN) per fastener.
- iii) When nailing a base sheet, wood decks are required to have a fastener pullout of 40 lb (24 N) for cap nails per fastener.
- iv) Firestone roofing plies may not be adhered directly to a wood substrate. They must be adhered to an acceptable insulation, cover board, or mechanically-attached base sheet. If the membrane is to be attached to a nailed base sheet with Multi-Purpose MB Cold Adhesive or adhesion asphalt, a layer of sheathing paper is required under the nailed base to help prevent adhesive or asphalt from dripping into the building.

Base Sheet and Insulation Attachment for Plywood, OSB, and Wood Plank Decks		
Acceptable Fasteners for Insulation and Base Sheet Attachment		Acceptable Insulation Adhesives
<ul style="list-style-type: none"> All-Purpose Fastener Heavy Duty (HD) HailGard Fastener Heavy Duty Fastener IsoFast #12 Belted Fastener IsoFast #15 Belted Fastener 	Penetrate 1" (2.5 cm) min. into or through deck	<ul style="list-style-type: none"> I.S.O. Fix II Adhesive ISO Spray R Adhesive I.S.O. Twin Pack Adhesive I.S.O. Stick Insulation Adhesive Hot asphalt* <p>*Not for use with APP membranes</p>

Table 4: Base Sheet and Insulation Attachment for Plywood, OSB, and Wood Plank Decks

- f) Cementitious Wood Fiber Decks
- Firestone requires that cementitious wood fibers deck have a minimum thickness of 2" (5 cm).
 - When mechanically attaching insulation, cementitious wood fiber decks are required to have fastener pullout of 300 lb (1.8 kN) for each fastener.
 - Firestone roofing plies may not be adhered directly to a cementitious wood fiber deck. They must be adhered to an acceptable insulation, cover board or a mechanically-attached base sheet.

Base Sheet and Insulation Attachment for Cementitious Wood Fiber Decks	
Fastener for Insulation and Base Sheet Attachment	Insulation Adhesives
<ul style="list-style-type: none"> Polymer Fastener: Penetrate 2" (5 cm) min. into deck. Pre-drilling is not required. 	<ul style="list-style-type: none"> I.S.O. Fix II Adhesive ISO Spray R Adhesive I.S.O. Twin Pack Adhesive I.S.O. Stick Insulation Adhesive

Table 5: Base Sheet and Insulation Attachment for Cementitious Wood Fiber Decks

- g) Gypsum Decks
- Firestone recommends that the gypsum roof deck have a minimum thickness of 2" (5 cm).
 - When attaching insulation to a gypsum roof deck, a fastener pullout value of 300 lb (1.8 kN) per Firestone Polymer Fastener is required.
 - When mechanically attaching a base sheet to a gypsum roof deck, a fastener pullout value of 40 lb (24 N) is required for each 1.2" (3 cm) LWC Base Ply Fastener.
 - Firestone roofing plies may not be adhered directly to a gypsum deck. The roofing plies must be adhered to an acceptable insulation, cover board, or mechanically-attached base sheet.

Base Sheet and Insulation Attachment for Gypsum Decks		
Insulation Fastener	Base Sheet Fastener	Insulation Adhesives
<ul style="list-style-type: none"> Polymer Fastener <p>Penetrate 2" (5 cm) min. into deck. Pre-drilling IS required.</p>	<ul style="list-style-type: none"> 1.2" (3 cm) LWC Base-Ply Fastener 	<ul style="list-style-type: none"> I.S.O. Fix II Adhesive ISO Spray R Adhesive I.S.O. Twin Pack Adhesive I.S.O. Stick Insulation Adhesive Hot asphalt* <p>*Not for use with APP membranes</p>

Table 6: Base Sheet and Insulation Attachment for Gypsum Decks

h) Lightweight Insulating Concrete Roof Decks

- i) Firestone recommends that the lightweight insulating concrete have a minimum thickness of 2" (5 cm).
- ii) When mechanically attaching insulation through lightweight insulating concrete into a structural deck, a fastener pullout value of 300 lb (1.8 kN) per fastener is required.
- iii) When mechanically attaching a base sheet to lightweight insulating concrete using 1.7" LWC Base Ply Fasteners, a fastener pullout of 40 lb (24 N) per fastener is required.
- iv) A vapor retarder is required under new systems with insulation.
- v) Firestone roofing plies may not be adhered directly to a lightweight insulating concrete roof deck. The roofing plies must be adhered to an acceptable insulation, cover board, or mechanically-attached base sheet.

Base Sheet and Insulation Attachment for Lightweight Insulating Concrete Decks		
Acceptable Fastener into Steel Pan		Adhesives Not Permitted
• Heavy Duty Fastener	Penetrate ¾" (2 cm) min. into the steel pan	
Acceptable Fasteners into Structural Concrete Substrate		
• Heavy Duty Fastener	Penetrate 1" (2.5 cm) min. into structural concrete deck	
• Concrete Drive Fastener	Penetrate 1¼" (3.3 cm) min. into structural concrete deck	
Acceptable Fastener for Attaching Base Sheet to Lightweight Insulating Concrete		
• 1.7" (4.3 cm) LWC Base-Ply Fastener		

Table 7: Base Sheet and Insulation Attachment for Lightweight Insulating Concrete Decks

3) TEMPORARY ROOFS

a) General

- i) If the installation of the Firestone roof system is required during unsuitable weather, before completion of wood blocking, curbs, or penetrations, or prior to the erection of walls, a temporary roof may be necessary.
- ii) The base ply for the Firestone roof system is not to be considered a temporary roof as the base ply is an integral component of the roof system.
- iii) If a temporary roof is needed to meet construction requirements, Firestone recommends installing a modified asphalt base sheet or two (2) fiberglass roofing plies in an appropriate adhesive over an approved substrate. Firestone V-Force Vapor Barrier Membrane may also be used as a temporary roof for up to 90 days. This temporary roof can serve to protect the interior of the building during the early stages of construction. It may then be removed or repaired, if necessary, and can be left as a vapor retarder prior to the installation of the finished Firestone roofing system.
- iv) If roof insulation is installed under the temporary roof, the insulation shall be inspected for wet or damaged areas, so that such areas may be removed and replaced prior to installation of the Firestone roof system.
- v) When a temporary roof is specified as a vapor retarder, precaution shall be exercised in protecting the temporary roof from other construction trades. Damage to the temporary roof may impair its effectiveness as a vapor retarder. If the vapor retarder is installed as a temporary roof during construction, the vapor retarder shall be examined, and if necessary, repaired to ensure watertight integrity prior to installation of the remainder of the roof system.
- vi) The determination of the necessity and location for a vapor retarder or an air barrier are project-specific requirements, which are the responsibility of the building owner or their design professional. The proper assessment of the building, the need for, and the proper design of, an air barrier and vapor retarder are critical to the long-term operation of the roofing system

b) Phased Construction

- i) Phased Construction refers to the installation of roof plies over separate time intervals (e.g. 2 or more days).
 - (1) A final surfacing such as a flood coat and gravel application or a roof coating is not considered a phase and may be delayed in its application.
 - (2) A cap sheet is integral to the roofing system and should not be delayed in its application.
- ii) Firestone does not recommend phased construction. Phased construction results in unprotected roof sections, which can allow moisture into the roofing plies or trap moisture, dust, or debris between the plies of the roof system. These application defects may increase the incidence of blistering in the Firestone roof system.
 - (1) Modified Bitumen base sheets may not be exposed for more than 60 days. Base sheets left exposed for more than 48 hours must be primed with ASTM D 41 primer prior to the completion of the roof assembly. In all cases, base sheets to receive a cap sheet or covering ply must be clean, dry and free of debris.
- iii) A better option than phased construction is the installation of a temporary roof, as described above. This allows for the delayed installation of the roof system until more suitable weather, or until other trades can complete their projects. A temporary roof can be designed and installed in the same way as a vapor retarder, and becomes a vapor retarder in the final construction.

4) VAPOR RETARDERS

a) General

- i) The determination of the necessity and location for a vapor retarder is a project-specific requirement, and is the responsibility of the building owner or their design professional. The proper assessment of the building, the need for and the proper design of a vapor retarder are critical to the long-term operation of the roofing system.
- ii) A vapor retarder is a building envelope element that limits diffusion of moisture into an assembly. Diffusion is water vapor migration in a material. Its rate depends on two factors:
 - (1) Water vapor pressure difference across the roof assembly.
 - (2) Resistance of materials along the migration path.
- iii) The main property requirement of a vapor retarder is low water vapor permeance – the time of water vapor transmission through a unit area of flat materials or construction induced by a unit vapor pressure difference between two specified surfaces, under specified temperature and humidity conditions.
- iv) A vapor retarder may be necessary when high interior humidity is of concern. High interior relative humidity is present in natatoriums, gyms, laundry facilities, paper mills, and bottling plants. In these cases, vapor drive may form a dew point under the roof membrane or in the insulation.
 - (1) In these types of environments, the vapor drive can be substantial and the potential exists for moisture accumulation within the roof assembly if an effective vapor retarder is not included in the roof assembly. This movement is reversed in some air-conditioned buildings in humid summer conditions.
- v) Vapor retarders are installed to prevent several types of roof assembly failures:
 - (1) Wet insulation becomes a conductor of heat rather than an insulator and reduces insulation R-value.
 - (2) Moisture promotes the deterioration of the roof membrane, insulation, structural deck, and associated building components.
 - (3) Moisture promotes delamination of roof components by freeze/thaw cycling, eventually causing blisters and delamination when vapor pressure results from solar heating.
- vi) The following is a partial list of situations which can influence the need for a vapor retarder:
 - (1) Building usage as related to vapor drive.
 - (2) External temperature in relation to internal temperature.
 - (3) The humidity of the interior and/or exterior air.
 - (4) Building code requirements.
 - (5) Construction generated moisture, particularly during winter construction.
- vii) A vapor retarder's effectiveness generally depends upon the following factors:
 - (1) The vapor retarder's perm (permeance) rating which should be as close to zero as possible.
 - (2) The location of the vapor retarder within the system.
 - (3) The integrity of the vapor retarder's seals at perimeters and penetrations.
 - (4) The integrity of the vapor retarder's membrane after other tradesmen finish their projects.

b) Examples of common vapor retarder applications

- i) Firestone V-Force Vapor Barrier Membrane self-adhered over a properly-prepared and primed deck. Refer to TIS 604 for specific application requirements.
- ii) Ply Felts
 - (1) 2 plies of Firestone Ply IV (4) or Ply VI (6) mopped over a nailed Firestone MB Base sheet.
 - (2) A mechanically-attached Firestone Venting Base or Channel Venting Base sheet with 18" (4.5 cm) side and end laps covering the fasteners, topped with a mopping of ASTM D 312 adhesion asphalt.
 - (3) An existing dry and sound non-insulated built-up roof system (all splits and blisters repaired).
 - (4) A Firestone Ply IV (4) or Ply VI (6) sheet mopped over an existing dry and sound non-insulated built-up roof system. If gravel surfaced, the gravel must be removed by power brooming, vacuuming and spudding.
 - (5) 2 plies of Firestone Ply IV (4) or Ply VI (6) mopped over an acceptable mechanically-attached barrier board.
 - (6) 2 plies of Firestone Ply IV (4) or Ply VI (6) mopped over properly prepared and primed structural concrete deck.
- iii) APP Sheets
 - (1) A fully-adhered Firestone APP base sheet set in Firestone Multi-Purpose MB Cold Adhesive or heat fused over an acceptable mechanically-attached barrier board.
 - (2) A fully-adhered Firestone APP base sheet set in Firestone Multi-Purpose MB Cold Adhesive or heat fused over a properly prepared and primed structural concrete deck.
- iv) SBS Sheets
 - (1) A fully-adhered Firestone SBS base sheet set in ASTM D 312 adhesion asphalt, Firestone Multi-Purpose MB Cold Adhesive, or heat fused over an acceptable mechanically attached barrier board.
 - (2) A fully-adhered Firestone SBS base sheet set in ASTM D 312 adhesion asphalt, Firestone Multi-Purpose MB Cold Adhesive, or heat fused over a properly prepared and primed structural concrete deck.

c) Considerations and Cautions

- i) Construction roof traffic shall be restricted to prevent damage to the vapor retarder. In the event damage does occur, repair the vapor retarder damage with the same roof components and quantities as specified for the vapor retarder installation.
- ii) The roof system designer is responsible for the design requirements of the roof deck, vapor retarder, and rigid insulation along with the roof system. This is especially important when specifying roof systems over high humidity buildings. A professional architect or engineer should determine the need for a vapor retarder, as well as the type, placement and location of the vapor retarder. The inclusion of an air barrier or vapor retarder may affect the UL or FM Approvals rating including the attachment of the Firestone roof system.
 - (1) It is the roof system designer's responsibility to:
 - (a) Ensure that the methods of attachment of the roof system to the vapor retarder selected are approved by Firestone and compatible with the roof system.
 - (b) Ensure that the approved vapor retarder will extend continuously and evenly throughout the roof plane to provide a complete seal against the intrusion of moist air from the building interior. Integration of the wall and roof air retarder systems is essential.
 - (c) Take the appropriate steps necessary to deal with the effect of construction-generated moisture on a new roofing system, particularly during winter, when temporary propane heat may be required.
- iii) Firestone does not review or calculate dew point analyses and therefore does not accept responsibility for damage due to recurrence rate or location of the dew point. Although not all projects require a vapor retarder, a design review should be considered for all projects.
- iv) Contact one of the following agencies for help in determining the need for a vapor retarder.
 - (1) National Roofing Contractors Association (NRCA)
 - (2) U.S. Army Corps of Engineering Cold Regions Research and Engineering Laboratory (CRREL)
 - (3) American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - (4) Oak Ridge National Laboratory (ORNL)

5) AIR BARRIERS

a) General

- i) While some Firestone roof systems may require an air barrier to receive a Firestone warranty, a professional architect or engineer must determine the need for an air barrier, as well as the type, placement, and location of the air barrier.
- ii) Air barriers are a component of building envelope systems that control the movement of air into and out of buildings.
- iii) An air barrier may consist of a single material or of two or more materials which, when installed as a system, make up an air impermeable, structurally adequate barrier.
- iv) Air barrier systems are generally comprised of building components and materials that have an air permeability not exceeding 0.004 cfm/ft² (0.02 L/s • m²) under a pressure differential of 0.3" water (75 Pa) when tested in accordance with ASTM E 2178.
- v) No single component or material has the capability to provide a complete air barrier system for a building, therefore air barrier systems include many components and materials that interface with each other. Firestone recommends that the individual manufacturers of these products provide written certification that their products will function as needed when used together.
- vi) If the air barrier is to perform its intended role, it must meet several requirements:
 - (1) Continuity: The assembly must be linked together to ensure that there is no break in the air tightness of the envelope.
 - (2) Structural Integrity: The air barrier must be capable of resisting the imposed load or must be supported by one that can. It must be capable of resisting the strongest wind load acting as either a pressure or suction without rupturing or breaking away from its support. The air barrier and its support must be sufficiently rigid to resist displacement.
 - (3) Air Impermeability: A major requirement of an air barrier is that it offers a high resistance to airflow.
 - (4) Durability: Durability depends largely on how a material reacts to a specific environment such as moisture, temperature, ultra-violet radiation, and to the presence of other materials (incompatibility).

6) COMMON ROOF SYSTEM ACCESSORIES

a) Cant Strips

- i) Cant strips are a means by which the angle between deck to wall and other types of transitions are reduced so that the roof membrane and flashings can conform better to the adhesion surface.
- ii) Cant Strips are required at all angle changes greater than 45° between the vertical and horizontal plane.
- iii) Acceptable Cant Strip materials
 - (1) Wood or preservative-treated wood
 - (2) Wood fiber
 - (3) Perlite
 - (4) Concrete (primed with ASTM D 41 primer)
- iv) Depending on the cant strip material, cant strips may be set in adhesion asphalt, Firestone Multi-Purpose MB Flashing Cement, or mechanically attached with acceptable fasteners and plates.
- v) Caution: Cant strip materials may be combustible. Proper precautions must be taken to prevent exposure of combustible cant materials to the open flame of a roofing torch or other sources of ignition.

b) Wood Nailers

- i) For new construction projects, wood nailers must be kiln-dried (Southern Pine, Douglas Fir) structural grade #2 or better.
- ii) Make Firestone specifications and details available when others will install nailers. Work that compromises the integrity of the system may jeopardize the warranty.
- iii) For re-cover projects and new construction projects where a poured-in-place deck will be used, wood nailers must be pressure treated for rot resistance. Asphaltic or creosote-treated lumber is not acceptable. Lumber treated with other wood preservatives such as Pentachlorophenol, Copper Naphthenate or Copper 8-quinolinolate will adversely affect the membrane when in direct contact and are, therefore, unacceptable.
- iv) Treatments for lumber may be highly corrosive to fasteners. Contact the fastener manufacturer for their recommendations on fasteners if attaching nailers that have been treated with corrosive materials.
- v) Chemical treating for fire resistance or other purposes (other than pressure treating for rot resistance, e.g. CCA, ACZA, CBA, ACQ or other copper treatments) may affect the performance of the Firestone membrane and accessories. Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 when using chemically-treated lumber that will encounter the membrane.
- vi) Firestone requires wood nailers at the following locations:
 - (1) All roof edges.
 - (2) Metal penetration pockets.
 - (3) Sheet metal flanges.
 - (4) Refer to Firestone details for other location requirements.
 - (5) The wood nailer may be omitted when metal flanges are less than 12" (30.5 cm) on a side or when metal flanges are placed and secured directly to the deck.
- vii) The building owner or their design professional must specify a wood nailer attachment system that will resist a minimum force of 200 lb/ft (2.9 N/m) in any direction. Firestone fasteners are required for all roofing applications. For further clarification, please refer to Factory Mutual Loss Prevention Data Sheet 1-49.

c) Expansion Joints

- i) The determination of the necessity and location for expansion joints is a project specific requirement, which is the responsibility of building owner or their design professional. Typical consideration for selection criteria may be one or more of the following:
 - (1) Where expansion or contraction joints are provided in the building structural system.
 - (2) Roof expansion joints must be located to accommodate movements caused by thermal expansion and building structural movement.
 - (3) Where structural framing elements such as joists, rafters, purlins, or steel decking change direction.
 - (4) Deck material changes (e.g. from steel to concrete deck).
 - (5) Where additions are connected to existing buildings.
 - (6) At junctions where interior heating conditions change, such as a heated space abutting an unheated space.
 - (7) Where movement between vertical walls and the roof deck is anticipated.
 - (8) Roof areas greater than 200' (61 m) in any direction.
- ii) Coordination and sequencing of expansion joint closure systems and their continuity, compatibility and function of seal is the responsibility of the design team.
- iii) Expansion joints must not restrict the flow of water.

d) Area Dividers and Control Joints

- i) Area dividers or control joints are raised, double wood members attached to a properly flashed wood base plate that is anchored to the roof deck.
- ii) Large open expanses can create large thermal stresses. Area dividers can help minimize this by dividing the roof system into smaller sections. The determination of the necessity and location for area dividers is a project specific requirement, which is the responsibility of the building owner or their design professional.
- iii) The areas of the roof should be rectangular and uniformly spaced where possible.

- iv) Roof area dividers are recommended for the following conditions:
 - (1) Roof areas greater than 200' (61 m) on any direction.
 - (2) Roofs with H, L, E, T, and U shapes should be subdivided by area dividers into rectangular areas that can be roofed one area at a time.
 - v) Where expansion joints are not provided in the building structure, area dividers may be used to help control thermal stresses within the roof assembly.
 - vi) Area dividers and control joints must not restrict the flow of water or cross roof areas considered for expansion joints.
- e) Walkway Pads
- i) Walkways help protect the membrane from damage due to necessary rooftop service traffic.
 - ii) Walkways may consist of an additional layer of Firestone modified bitumen cap sheet adhered in cold adhesive, hot asphalt, or heat welded, as is appropriate for the membrane being used.
 - (1) Do not use black granule surfaced products when installing walkways in cold adhesive.
 - (2) Do not heat seal the edges of walkways installed in cold adhesive.
 - iii) Walkway runs must not be longer than 10' (3 m) so as not to interfere with roof drainage.
 - iv) Walkway systems must be installed on roofs:
 - (1) Subjected to traffic more frequently than once per month.
 - (2) At all access points (ladders, hatches, doorways, etc.) to the roof.
 - (3) Around all serviceable rooftop units.
 - v) If protection of the insulation system is required, additional measures must be specified (e.g., concrete pavers, pre-fabricated walkways).
 - vi) The owner is responsible for maintaining walkways.

7) MATERIALS

a) Caution

- i) The information in this Guide is not intended to be comprehensive. Refer to the Technical Information Sheet (TIS) and Safety Data Sheet (SDS) for each product for critical information. These may be found on the FSBP website at <http://firestonebpco.com> or by calling your Building Systems Advisor at 1 (800) 428-4511.

b) Insulation

- i) Only Firestone insulation can be included in a Firestone warranty.
- ii) Insulation must provide a suitable substrate for the proposed roof system in addition to its function as insulation for the building.
- iii) Insulation may be installed by various methods including fasteners and approved adhesives. It is acceptable to combine fastener and approved adhesive attachment methods in multi-layer applications.
- iv) Where overall insulation thickness is 2" (5 cm) or greater, Firestone recommends installing the insulation in two (2) or more layers with staggered joints.
- v) Insulation may be installed in one (1) or multiple layer applications for the Firestone warranty. If installed in multiple layers, the joints of each succeeding and adjoining layer must be staggered from the joints of previous layers by a minimum of 6" (15 cm) in each direction.
 - i) Refer to specific Firestone Technical Information Sheets (TIS) for installation requirements.
 - ii) Insulation thickness requirements may vary for code compliance. Contact local code and/or insurance officials before contacting your Firestone Building Systems Advisor.
 - iii) Refer to the Firestone Attachment Guide for adhesion pull test requirements for I.S.O. Fix II, ISO Spray R, I.S.O. Stick and I.S.O. Twin Pack.
 - iv) When installing HailGard Composite Board, or ISOGARD HD Composite, install the ISO 95+ GL side down to the deck.
 - v) The following is a chart showing the types and minimum thickness of Firestone insulation/cover boards acceptable for use as a direct contact substrate for Firestone roof systems when applying a fully adhered base sheet or fiberglass ply sheet. Other approved insulations may be allowed below the immediate substrate insulation.

Insulation / Cover Board Attachment Options by Deck					
Substrate to Which Insulation Will Be Attached	Attachment Method				
	Mechanically Attached	I.S.O. Fix II	ISO Spray R	I.S.O. Twin Pack	Adhesion Asphalt
Adhesive attachment may require an adhesive pull test.					
Deck					
Steel	✓	✓	✓	✓	
Structural Concrete	✓	✓	✓	✓	✓
Plywood or OSB	✓	✓	✓	✓	
Wood Plank	✓	✓	✓	✓	
Poured or Pre-Cast Gypsum	✓	✓	✓	✓	
Cementitious Wood Fiber	✓	✓	✓	✓	
Lightweight Insulating Concrete Decks	✓				
Existing Roof with Phenolic Insulation	Complete tear-off required. When Phenolic insulation is removed, a visual inspection of the deck condition and other components is required; all deteriorated components must be replaced as necessary.				

Table 8: Insulation / Cover Board Attachment Options by Deck

Insulation / Cover Board Attachment to Insulation Options by Insulation Type					
Base Layer to which Insulation/Cover Board will be Adhered	Insulation / Cover Board to Insulation Attachment Method				
	I.S.O. Fix II	ISO Spray R	I.S.O. Twin Pack	LiquiGard	Hot Asphalt
Adhesive attachment may require an adhesive pull test.					
Insulation					
ISO 95+ GL	✓	✓	✓	✓	
ISOGARD HD	✓	✓	✓	✓	
RESISTA	✓	✓	✓	✓	
DensDeck® Prime, Securock, Structodek HD	✓	✓	✓	✓	✓
FiberTop™	✓	✓	✓		✓
Asphalt Base Sheet	✓	✓	✓	✓	✓

Table 9: Insulation / Cover Board Attachment to Insulation Options by Insulation Type

c) Base Sheets and Smooth Plies

i) General

- (1) Depending on the substrate, base sheets may be attached with fasteners, Multi-Purpose MB Cold Adhesive, Firestone LiquiGard Adhesive, adhesion asphalt (not permitted for APP), or heat fusing. Refer to the membrane's TIS to ensure the specific membrane is appropriate for the intended installation method.
- (2) Firestone BUR and modified bitumen systems must be installed so that all laps shed water.
- (3) Base sheets, base plies, or ply sheets must not be glaze coated when used as a substrate for any base or cap sheet.
- (4) When adhesion asphalt is used as the method of attachment for BUR or SBS sheets, Firestone requires that only Firestone SEBS Mopping Asphalt or ASTM D 312 Type IV asphalt be used:
 - (a) In all multi-ply SBS systems
 - (b) In all 20+ year SBS systems
 - (c) Where the slope exceeds ½" (4.2%).
- (5) All sheets must be unrolled and allowed to "relax" for at least 30 minutes prior to installation.

Base Sheet Attachment Options by Deck					
Substrate to Which the Base Sheet Will Be Attached	Attachment Method				
	Mechanically Attached	Heat Welded	Multi-Purpose MB Cold Adhesive	LiquiGard Adhesive	Adhesion Asphalt*
Decks					
Structural Concrete (primed if applicable)	✓	✓	✓	✓	✓
Plywood or OSB	✓				
Wood Planking	✓				
Poured or Pre-Cast Gypsum	✓			✓	
Cementitious Wood Fiber	✓				
Lightweight Insulating Concrete Decks	✓				
Recover					
Smooth Surface BUR, Uncoated		✓	✓	✓	✓
Mineral Surface BUR	New insulation or cover board is required.				✓
Mineral Surface Modified Bitumen					
Gravel Surfaced BUR					
Coal Tar Pitch BUR					
Existing Single-Ply Systems					
New Insulation					
ISO 95+ GL			✓		
RESISTA			✓	✓	
HailGard	✓				
FiberTop					✓
Structodek® HD			✓	✓	✓
DensDeck Prime	✓	✓	✓	✓	✓**
SECUROCK® Gypsum Fiber	✓	✓	✓	✓	✓**
SECUROCK Glass Mat	✓				
ISOGARD HD			✓	✓	
Perlite Insulation					✓
Asphalt Base Sheet		✓	✓	✓	✓
* Hot asphalt is not for use with APP membranes					
** DensDeck and SECUROCK to be applied in hot asphalt must be completely dry. The max asphalt temperature must not exceed 450 °F (232 °C).					

Table 10: Base Sheet Attachment Options by Deck

Base Sheet Seam / Lap Width Requirements			
Sheet	Interply Adhesive	Seam / Lap Width Requirements	End Lap Width Requirements
Appropriate SBS or APP Base Sheet	<ul style="list-style-type: none"> Heat Fused Mechanically Attached Multi-Purpose MB Cold Adhesive LiquiGard Firestone-Approved Hot Asphalt (except APP) 	3" (7.6 cm)	6" (15.2 cm)
BASEGARD SA	<ul style="list-style-type: none"> Self-Adhered with heat applied over the top 		
MB Base Sheet	<ul style="list-style-type: none"> Mechanically Attached 		
MB Base Sheet	<ul style="list-style-type: none"> Adhered with Hot Asphalt Adhered with Multi-Purpose MB Cold Adhesive Adhered with LiquiGard 	2" (5 cm)	

Table 11: Base Sheet Seam / Lap Width Requirements

d) Cap Sheets

i) General

- (1) Firestone cap sheets have a granular surface for enhanced protection from UV degradation, rooftop traffic, etc.
- (2) Cap sheets may be attached with Multi-Purpose MB Cold Adhesive, Firestone LiquiGard Adhesive, adhesion asphalt (not permitted for APP), or heat fusing. Refer to the membrane's TIS to ensure the specific membrane is appropriate for the intended installation method.
- (3) Firestone BUR and modified bitumen systems must be installed so that all laps shed water.
- (4) When adhesion asphalt is used as the method of attachment for BUR or SBS sheets, Firestone requires that only Firestone SEBS Mopping Asphalt or ASTM D 312 Type IV asphalt be used:
 - (a) In all multi-ply SBS systems
 - (b) In all 20+ year SBS systems
 - (c) Where the slope exceeds ½" (4.2%)
- (5) All sheets must be unrolled and allowed to "relax" for at least 30 minutes prior to installation.

8) HOT ASPHALT ATTACHMENT OF INSULATION AND ROOFING PLIES

DISCLAIMER:

Applicators are directed to handle and process adhesion asphalt in accordance with the requirements of this guide to protect the aging properties of the adhesion asphalt. Adhesion asphalt must provide continuous coverage between Firestone products.

Please refer to the National Roofing Contractors Association (NRCA) and Asphalt Roofing Manufacturers Association (ARMA) guidelines for adhesion asphalt type requirements, handling, and use. Follow all OSHA and other applicable safety regulations.

a) Cautions and Guidelines

- i) The information in this Guide is not intended to be comprehensive. Refer to the Technical Information Sheet (TIS) and Safety Data Sheet (SDS) for each product for critical information. These may be found on the FSBP website at <http://firestonebpc.com> or by calling your Building Systems Advisor at 1 (800) 428-4511.
- ii) Ensure that all health and safety measures are followed when installing hot asphalt to protect the installers as well as occupants of the building and passers nearby. Ensure compliance with OSHA, building codes, and contractor/jobsite/misc. safety regulations when using hot asphalt.
- iii) Use only ASTM D 312 Type III or IV adhesion asphalt or Firestone SEBS Asphalt, as appropriate for project conditions.

- iv) Asphalt primer must meet the requirements of ASTM D 41. Structural concrete decks must always be primed with ASTM D 41 primer; refer to Firestone details and application instructions for other requirements.
- v) Adhesion asphalt must be properly applied in accordance with NRCA and ARMA requirements and the requirements of this guide for the following:
 - (1) Between layers of Firestone insulation designated for adhesion with hot asphalt.
 - (2) Firestone SBS and BUR products designed for asphalt attachment.
- vi) Adhesion asphalt must provide continuous inter-ply coverage.
- vii) Adhesion asphalt must NEVER be heated above the flash point.
- viii) Asphalt properties may change when stored at high temperatures for long periods of time. Asphalt may become softer or may experience what is known as "fallback". Fallback is the degradation of the asphalt to the point that its physical properties (e.g. softening point) deteriorate which could then cause roof slippage. To reduce the chances for fallback, the following recommendations should be implemented:
 - (1) Decrease the kettle temperature as much as possible, while maintaining the minimum application temperature.
 - (2) Use material as quickly as possible, thus reducing exposure time.
 - (3) Insulate all lines and equipment used to transport asphalt.

b) Insulation and Cover Boards

- i) The proposed insulation or cover board must be compatible with the roof substrate, the proposed bitumen and the requirements of the Firestone roof system.
- ii) Firestone SEBS Mopping Asphalt or ASTM D-312 Type III or Type IV must be utilized.
- iii) ISO 95+ GL Insulation boards, when applied using hot asphalt, require approximately 30 pounds (14 kg) of asphalt per 100 square feet (9.3 square meters) nominal application rate. A guideline for asphalt application temperature to install insulation board is the asphalt EVT less 25 to 30 °F (14 to 17 °C).
 - (1) Porous and irregular substrates generally require additional quantities of asphalt to assure positive adhesion of the insulation boards.
- iv) When using adhesion asphalt for insulation attachment:
 - (1) The insulation must be no larger than 4' X 4' (1.2 m X 1.2 m).
 - (2) All insulation joints must be staggered from adjoining and adjacent boards and adjacent layers.
 - (3) Follow all health and safety measures when installing adhesion asphalt to protect the installers and occupants of the building.
 - (4) Refer to slope restrictions.
- v) Take special care when installing DensDeck products in hot asphalt:
 - (1) Georgia-Pacific Gypsum recommends maximum asphalt application temperatures of 425°F (218°C) to 450 °F (232 °C). Application temperatures above these recommended temperatures may adversely affect roof system performance.
 - (2) DensDeck Prime may be flood mopped to a substrate followed by a flood mopped application of membrane (encapsulated) using these guidelines:
 - (a) DensDeck Prime Roof Boards and substrate must be dry.
 - (b) Asphalt used to install DensDeck Prime should be allowed to cool after installation of the DensDeck and prior to mopping base sheet to top of DensDeck boards.
 - (c) Allow base ply to cool before mopping additional plies or cap sheet to limit the amount of direct heat that is applied to boards.
- vi) ISOGARD HD and RESISTA can NOT be adhered with hot asphalt.
- vii) Expanded or extruded polystyrene insulation (EPS or XPS) must not be attached with hot asphalt.

Approved Substrates for Hot Asphalt Attachment of Insulation

<ul style="list-style-type: none"> Approved base sheets that have been mechanically attached in accordance with Firestone requirements Approved base plies that have been adhered in accordance with Firestone requirements 	
<ul style="list-style-type: none"> Compatible insulations 	ISO 95+ GL
<ul style="list-style-type: none"> Compatible Cover Boards 	Approved DensDeck Products. See guidelines for encapsulating DensDeck Prime in hot asphalt above.
	SECUROCK Gypsum-Fiber
	Firestone FiberTop
	Structodek HD Fiberboard
<ul style="list-style-type: none"> Poured-in-place or pre-cast structural concrete deck that has been primed with ASTM D 41 primer 	
<ul style="list-style-type: none"> Existing properly prepared asphalt membrane roof systems 	Uncoated smooth BUR
	Granule surfaced modified asphalt roof systems
	Gravel surface built-up roof systems

Table 12: Approved Substrates for Hot Asphalt Attachment of Insulation

c) Roof Membranes

- i) Never use hot asphalt to adhere APP products.
- ii) BUR/SBS base sheets, base plies, or ply sheets must not be glaze coated when used as a substrate for any APP base or cap sheet.
- iii) Do not mop a roof membrane directly to polyiso.

9) MECHANICAL ATTACHMENT OF INSULATION AND ROOFING PLIES

a) Pullout Tests

- i) Substrates for membrane and/or insulation are required to provide sufficient pullout resistance for the fasteners and the roof system.

System	Minimum Fastener Pullout
Insulation Mechanically Attached to Deck	300 lb (136 kg)
Base Sheet Mechanically Attached to Deck	300 lb (136 kg)
Base Sheet Nailed to Deck	40 lb (18 kg)
<i>Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 when the structural deck does not meet the minimum fastener pullout requirements.</i>	

Table 13: Minimum Fastener Pullout

- ii) Due to the variety of physical conditions that can affect pullout resistance, Firestone recommends that on-site tests be conducted by an independent testing laboratory or the fastener manufacturer's representative, to determine actual pullout values. The following deck types are those which are most likely to not provide sufficient pullout resistance:
 - (1) Steel decks thinner than 22 gauge (0.76 mm).
 - (2) Concrete less than 3,000 psi (20,684 kPa).
 - (3) Plywood or OSB less than 7/16" (1.1 cm) thickness.
 - (4) Wood plank less than 1" (2.5 cm) thickness.
 - (5) Poured or pre-cast gypsum, cementitious wood fiber and lightweight insulating concrete decks.
 - (6) Existing masonry or brick.
 - (7) Any other substrate that does not have a published pullout capacity greater than the minimum required for the applicable roof system.
- iii) The sections of the substrate where integrity is most in question should be used for testing. Test areas should include corners, drain areas, and perimeters. The recommended minimum number of pullout tests is as follows:
 - (1) Less Than 10,000 ft² (930 m²): 6 pullout tests
 - (2) 10,000 ft² - 50,000 ft² (930 m² – 4,645 m²): 10 pullout tests
 - (3) 50,000 ft² - 100,000 ft² (4,645 m² – 9,290 m²): 20 pullout tests
 - (4) Over 100,000 ft² (9,290 m²): 1 test per 5,000 ft² (465 m²)

- iv) When new construction or other conditions prevent preliminary on-site pullout tests, the fastener manufacturer should supply estimated pullout values for design and bid purposes. On-site verification of the pullout capacity must be confirmed prior to system installation. (Consider requesting a unit price for potential increased fastening requirement).

b) Fasteners: General

- i) Refer to the Technical Information Sheet (TIS) that references the specific fastener being used and for the deck penetration requirements of that fastener. All fasteners must be suitable for the existing deck type.
- ii) Roof systems rely on the attachment of the components to the deck substrate to perform as required. Wind creates uplift forces on the roof, making the overall holding power of the fasteners critical. Firestone recommends that the use of any fastener be investigated should there be concerns about the structural integrity of the deck. Some of the items to be considered include:
- (1) How the fastener(s) might affect the deck.
 - (2) The capability of the deck to hold the fasteners and roof system in place in a wind related event.
 - (3) In existing construction, the structural integrity of the deck may have weakened over time, thus the choice of fastener and roof attachment methods should be considered in determining the best solution to the given deck and situation.
- iii) For retrofit roof systems, Firestone HD Fasteners must be used for 15-year or greater Red Shield Warranty when mechanically fastening insulation using fasteners and plates.
- iv) For new and replacement roofing, Firestone HD Fasteners must be used for a 20-year or greater Red Shield Warranty when mechanically fastening insulation using fasteners and plates.
- v) Cap Nails
- (1) Cap nails must be FM Approved and have 1" (2.5 cm) diameter steel heads. Shank must be a minimum of 11-gauge (2.3 mm) annular ring or spiral.
 - (2) Cap nails cannot be used to attach insulation or for 20+ year systems except for lightweight insulating concrete and wood decks where a base sheet must be mechanically fastened prior to the installation of the roof assembly.
 - (3) Firestone insulation plates and fasteners may be used in lieu of cap nails.

Allowable Fastener and Substrate Configurations								
Firestone Fastener	Acceptable for 20-year Warranty	Steel Decks	Structural Concrete Decks	Plywood or OSB Decks	Cementitious Wood Fiber	Gypsum Decks	Lightweight Insulating Concrete Decks	
							Steel Pan	Concrete
All-Purpose Fastener*	*	✓		✓				
Heavy-Duty Fastener	✓	✓	✓	✓			✓	✓
Concrete Drive Fastener	✓		✓					✓
Polymer Fastener	✓				✓	✓		
Firestone AccuTrac Kit		✓		✓				
HD Plus Fastener	✓	✓						
LWC Base Ply Fastener	✓					✓	✓	✓
For the attachment of base sheets only. Insulation may not be attached with LWC Base Ply Fastener.								
#12 Belted Fastener		✓		✓				
#15 Belted Fastener	✓	✓		✓				
Nail Driver				✓				
For the attachment of base sheets only. Insulation may not be attached with nails of any kind.								
HailGard Fastener	✓	✓	✓	✓			✓	✓
For the attachment of OSB and Firestone HailGard Insulation. No insulation plate is required.								

* The All-Purpose Fastener is only eligible for a 20yr warranty when used on a wood deck.

Table 14: Allowable Fastener and Substrate Configurations

Acceptable Fasteners					
Firestone Fastener		For the attachment of the following materials:			
		Roofing Insulation (Requires Firestone Insulation Plate)	Base Sheet (Requires Firestone Insulation Plate)	Termination Bar	Other Accessories
TIS #	Fastener	<i>See the specific fastener TIS for specific application data.</i>			
1001	All-Purpose Fastener	✓	✓	✓	✓
1002	Heavy Duty Fastener	✓	✓	✓	✓
1005	Concrete Drive Fastener	✓	✓	✓	✓
1006	Polymer Fastener	<i>Do not use with polymer batten strips.</i>			
		✓	✓		
1007, 1016	AP/HD AccuTrac™ Kit	<i>Special battens/plates are required (see TIS 1102, 1107, 1204, 1207). Not for use with heat welded systems.</i>			
		✓	✓		
1012	LWC Base-Ply Fastener	<i>Insulation to steel and wood roof decks with AccuTrac installation equipment. A kit consists of both fasteners and insulation plates for the AccuTrac tool.</i>			
			✓		
1013	IsoFast #12 Belted Fastener	<i>For the attachment of base sheets only. Insulation may not be attached with LWC Base Ply Fastener.</i>			
		✓	✓		
1014	IsoFast #15 Belted Fastener	<i>Insulation to steel (18-24 gage) and wood. Belted fasteners must be installed with the IF160 or IF240 automatic installation tool available from SFS intec.</i>			
			✓		
1019	Heavy Duty (HD) HailGard Fastener	<i>Use for insulation attachment with the Firestone IFC/PH 2.75" x 2.75" (7 cm x 7 cm) square plate.</i>			
		✓	✓		
1019	Heavy Duty (HD) HailGard Fastener	<i>Insulation and membrane to steel (18-24 gage) and wood. The #15 Belted fasteners must be installed with the IF160 automatic installation tool available from SFS INTEC.</i>			
			✓		
1019	Heavy Duty (HD) HailGard Fastener	<i>Use for membrane attachment with the Firestone 2³/₈" (6 cm) diameter round plate.</i>			
		✓			
1019	Heavy Duty (HD) HailGard Fastener	<i>For use with Firestone HailGard Insulation and OSB to approved decks. No insulation plate required.</i>			
		✓			

Table 15: Acceptable Fasteners

c) Insulation Fastening Requirements

i) General

- (1) Mechanically-fastened Insulation must be fastened with appropriate Firestone fasteners and insulation plates.
- (2) Firestone All Purpose (AP) fasteners are not acceptable for any 20-year systems or 15-year re-cover or partial tear off applications, unless the substrate is a wood deck.
- (3) Insulation must be installed in accordance with the fastening rate and pattern for the applicable system.
- (4) Fastening rates and patterns may vary for code compliance. Contact your Building Systems Advisor at 1 (800) 428-4511 for specific FM Approvals and code compliance requirements.

ii) Multiple Layers of Insulation

- (1) Where overall insulation thickness is 2" (5 cm) or greater, Firestone recommends installing the insulation in two (2) or more layers with staggered joints.
- (2) Insulation may be installed in one (1) or multiple layer applications for the Firestone warranty. If installed in multiple layers, the joints of each succeeding and adjoining layer must be staggered from the joints of previous layers by a minimum of 6" (15 cm) in each direction.
- (3) When a composite of two (2) insulation layers is installed, the fastening pattern required is dependent on the top board type and thickness. A common fastener may be used to simultaneously fasten all layers to the structural deck.
- (4) Tapered insulation less than the 1" (2.5 cm) minimum thickness must be fastened at a rate of one (1) fastener and plate per two (2) sqft (0.18 sq. m) = 16 fasteners and plates per 4' X 8' board. If possible, install the tapered insulation first, covered by the flat stock.
- (5) It is acceptable to combine fastener and approved adhesive attachment methods in multi-layer applications.

Insulation Mechanical Attachment Options							
Structural Deck	Firestone Fastener and Plate						Minimum penetration of fastener into/through deck
	All Purpose (AP)	Heavy Duty (HD)	Heavy Duty Plus (HD+)	Polymer	Concrete Drive	Belted	
Steel	✓	✓	✓			✓	¾" (2 cm)
Structural Concrete		✓	✓		✓		Heavy Duty (HD) 1" (2.5 cm)
							Concrete Drive 1 ¼" (3.1 cm)
Plywood or OSB	✓	✓	✓			✓	1" (2.5 cm)
Wood Plank	✓	✓	✓			✓	1" (2.5 cm)
Gypsum				✓			1½" (3.8 cm)
Cementitious Wood Fiber					✓		1½" (3.8 cm)
Lightweight insulating concrete over steel deck		✓	✓				¾" (2 cm) through steel pan
Lightweight insulating concrete over concrete deck		✓	✓				1.2" (3 cm) into structural concrete deck

Table 16: Insulation Mechanical Attachment Options

iii) Minimum number of fasteners and plates per insulation board

- (1) See Firestone TIS 950 "Insulation Attachment Patterns" for the required patterns for the proper placement of approved fasteners and plates for insulation on Firestone roof systems. These fastening patterns apply to flat or tapered insulations. The most common fastener density and pattern requirements are shown. For non-standard fastener densities, contact your Building Systems Advisor at 1 (800) 428-4511.

Minimum Number of Fasteners and Plates Per Insulation Board

Insulation Type and Thickness		Minimum Number of Fasteners Required	
		4' x 4' Boards	4' x 8' Boards
ISO 95+ GL, RESISTA, HailGard Composite, ISOGARD HD Composite	0.5" – 1.4"	8	16
	1.5" – 1.9"	6	12
	2" or Greater	4	8
ISOGARD HD Cover Board	0.5" – 1.0"	6	12*
DensDeck or SECUROCK Gypsum Fiber Board	0.25" or Greater	6	12
FiberTop, Structodek HD	0.5" – 1"	8	16
DensDeck Prime	0.25" or Greater	4	8
<i>*FM GLOBAL 1-90 FASTENING PATTERN FOR ISOGARD HD</i>			
<i>For more information, see Firestone TIS Sheet 950 Insulation Attachment Patterns</i>			

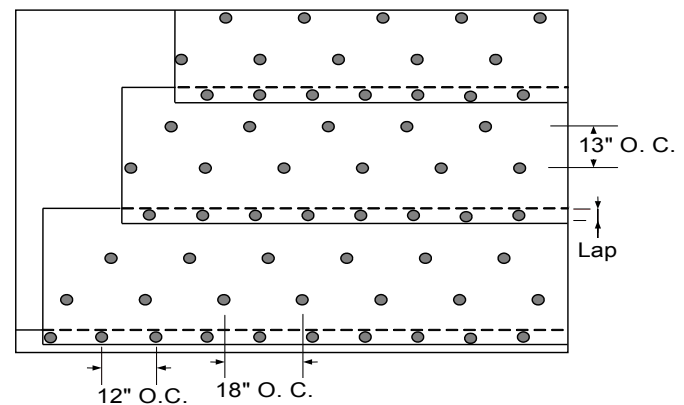
Table 17: Minimum Number of Fasteners and Plates Per Insulation Board

- iv) Base Sheet Fastening Requirements: the base sheet must be fastened with appropriate Firestone fasteners or Firestone fasteners and insulation plates and installed in accordance with the fastening rate and pattern for the applicable system.
- v) Fastening rates and patterns may vary for code compliance. Contact the local code or insurance officials before contacting your Firestone Building Systems Advisor at 1 (800) 428-4511.
- vi) Base sheets can be mechanically attached through insulation to deck where appropriate. Adhere to Firestone base sheet seam and lap width requirements.

Firestone Fasteners and Plates or Concrete Drive Fasteners

Two (2) rows staggered at 18" (45 cm) o.c., each approximately 13" (33 cm) in from edge of sheet and in side laps at 12" (30 cm) o.c.

Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 when the deck system will not provide a minimum of 300 lbf (1.3 kN) of pullout resistance per fastener.



Cap Nails or Firestone LWC Base Ply Fasteners

Two (2) rows staggered at 18" (45 cm) o.c., each approximately 12" (30 cm) in from edge of sheet and in side laps at 9" (45 cm) o.c. Attachment pattern, plate/head size, and frequency may be different to meet code requirements.

Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 when the deck system will not provide a minimum of 40 lbf (177.9 N) of pullout resistance per fastener.

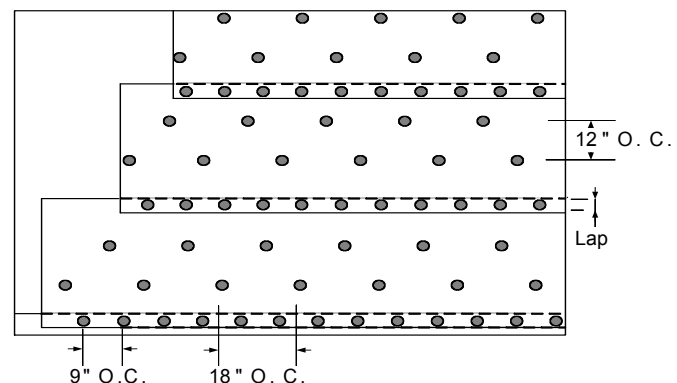


Figure 1: Base Sheet Mechanical Attachment Options

10) ADHESIVE ATTACHMENT OF INSULATION AND ROOFING PLIES

a) Insulation Adhesion Requirements

- i) Firestone ISO SPRAY R, I.S.O. FIX II, I.S.O. Stick, I.S.O. Twin Pack and LiquiGard Adhesive:
 - (1) The insulation must be no larger than 4' x 4' (1.2 m x 1.2 m).
 - (2) Stagger all insulation joints from adjoining and adjacent boards and adjacent layers.
 - (3) Adhesion pull tests may be required for ISO SPRAY R, I.S.O. FIX II, I.S.O. Stick, I.S.O. Twin Pack. Refer to the "Firestone Attachment Guide".
 - (a) Prepare an area large enough to allow a 4' x 4' insulation board to be laid in place. Follow the appropriate Firestone TIS guidelines for surface preparation and list of acceptable substrates.
 - (b) Apply the adhesive to the deck per required application rates and methods. Allow the adhesive a minimum of 60 minutes to cure.
 - (c) After the adhesive, has been allowed to cure, pull up on the adhered board by placing a hand under the corner or end of the board in the same direction as the ribbons. Make sure that the board is lifted by hand. Using tools to scrape the board sometimes dis-bonds the adhesive from the deck. This will not show whether the adhesive is performing under uplift considerations.
 - (d) Observe the insulation and deck. The desired result is a delamination of the surface or board facer with adhesive and facer residue remaining on the deck or the board breaks apart remaining adhered to the deck at the ribbons. If the board is lifted and the adhesive pulls/peels off the deck or decking is pulled up with the board, contact your Building Systems Advisor at 1 (800) 428-4511.
- ii) Firestone insulation adhesives must be applied in accordance with the installation instructions and Technical Information Sheets (TIS).
- iii) Assure that all safety measures are followed when installing insulation adhesives to protect the installer as well as the occupants of the building.
- iv) Existing decks containing residual asphalt must be cleaned and scraped as smooth as possible.
- v) Existing decks shall be smooth, flat, clean, dry, free of sharp fins, or foreign materials

Allowable Adhesive Attachment of Insulation / Cover Board

Structural Deck to Which Insulation or Cover Board Will Be Adhered	I.S.O. FIX II			ISO Spray R			I.S.O. Twin Pack			LiquiGard			Notes
	Acceptable	Adhesion Test Required	Not Acceptable	Acceptable	Adhesion Test Required	Not Acceptable	Acceptable	Adhesion Test Required	Not Acceptable	Acceptable	Adhesion Test Required	Not Acceptable	
Steel	✓			✓			✓					✗	New steel decks may require
New Structural Concrete	✓			✓			✓			✓			New poured decks must have a minimum 28-day cure time.
Existing Structural Concrete		✓		✓				✓			✓		Existing concrete containing residual asphalt must be
Plywood, OSB, Wood Plank	✓			✓			✓			✓			
Cementitious Wood Fiber	✓			✓			✓			✓			
Poured or Pre-Cast Gypsum		✓		✓				✓			✓		
Lightweight Insulating Concrete			✗			✗			✗			✗	
New Insulation or Base Sheet to Which Insulation or Cover Board Will Be Adhered													Notes
ISO 95+	✓			✓			✓			✓			Maximum 4' x 4' (1.22 m x 1.22 m) boards only on approved insulations ISO FIX Maximum slope: 2:12 Do not apply ISOGARD HD in hot asphalt.
ISOGARD HD	✓			✓			✓			✓			
HailGard	✓			✓			✓			✓			
DensDeck Products	✓			✓			✓					✗	
SECUROCK Gypsum-Fiber	✓			✓			✓					✗	
Perlite Insulation			✗			✗			✓			✗	
New Base Sheet	✓			✓			✓			✓			

Table 18: Allowable Adhesive Attachment of Insulation / Cover Board

- b) Base Sheet, Inter-Ply and Cap Sheet Adhesion Requirements
- i) Application of sand-backed modified bitumen rolls in Firestone Multi-Purpose MB Cold Adhesive
 - (1) Unroll and relax all sheets for at least 30 minutes prior to installation.
 - (2) Apply Firestone Multi-Purpose Cold Adhesive to the substrate using a ¼" (6.4 mm) notched squeegee or airless sprayer at a rate of 1½ to 2½ gallons per 100 ft² (0.6 to 1.0 L/m²). The adhesive may be left open no more than 10 minutes prior to installing the sheet.
 - (3) Broom the sheet into place.
 - (4) Complete the side and end laps of the sheet by sealing with Multi-Purpose MB Cold Adhesive applied to both sides of the lap, or by heat fusing. Corners of the sheet should be cut at a 45° which will help them lay flat.
 - (5) Firestone recommends that granules be applied to areas of adhesive bleed-out on the cap sheet as the installation progresses. Areas of adhesive bleed-out at inside and outside corners require the application of granules to protect exposed areas from UV exposure.
 - ii) Modified Bitumen Membranes installed with Firestone Multi-Purpose MB Cold Adhesive must be exposed for a minimum of 30 days at a minimum of 60 °F before Acrylic Base Coat for Asphalt and AcryliTop PC-100 can be applied. Roof systems must be inspected by a Firestone representative prior to the application of an AcryliTop system.
 - iii) Three-ply systems installed with Firestone Multi-Purpose MB Cold Adhesive must have the bottom two (2) plies exposed for 7 – 30 days at a minimum of 60 °F before the cap sheet is applied. This will allow the cold adhesive to cure properly.
 - (1) This is the only time phasing is acceptable, and the second ply should be cleaned, inspected and primed prior to the application of the cap sheet.
 - iv) Attachment of base sheets with cold adhesives to expanded or extruded polystyrene insulation (XPS or EPS) is not acceptable.
 - v) Wood fiber insulation is not an acceptable substrate for use with Multi-Purpose MB Cold Adhesive or LiquiGard Adhesive, except for STRUCTODEK HD High Density Wood Fiber Insulation.
 - vi) Torch base and torch cap sheets, backed with polyethylene burn-off film, cannot be applied with cold adhesive, except for Metal Flash-AL for flashings.
 - vii) Flashings must be installed in Firestone Multi-Purpose MB Flashing Cement.
 - (a) When applying flashings in Firestone Multi-Purpose MB Flashing Cement, both the substrate and the back of the sheet must be coated with the flashing cement.

11) SELF-ADHERED MEMBRANES

a) BASEGARD SA

- i) BASEGARD SA is an SBS base sheet membrane which may be directly adhered to a variety of approved surfaces as the first ply of a Firestone modified bitumen roofing system, or as a vapor retarder underneath the Firestone roofing system. It may not be used as a temporary roof.
- ii) When applying BASEGARD SA, one of the following heat sources should immediately be applied to the top surface of BASEGARD SA to activate the adhesive. If this is not possible, the BASEGARD SA must be applied over Firestone SA Primer.
 - (1) A heat-welded Firestone torch cap sheet
 - (2) A Firestone SBS sheet installed in hot asphalt
 - (3) Firestone insulation adhered to the BASEGARD SA with I.S.O. Fix II Adhesive, I.S.O. Stick Insulation Adhesive, I.S.O. Twin Pack Adhesive, or ISO Spray R Adhesive
- iii) BASEGARD SA may NOT be used as a temporary roof.

b) V-Force Vapor Barrier Membrane

- i) V-Force Vapor Barrier Membrane is a vapor barrier which may be directly adhered to a variety of approved surfaces that have been primed with SA Primer.
- ii) V-Force Vapor Barrier Membrane must be rolled in with a 75 lb (34 kg) roller to ensure adhesion throughout the membrane and at all laps.
- iii) Do not apply hot asphalt directly to the membrane.
- iv) V-Force Vapor Barrier Membrane may be used as a temporary roof and exposed for up to 90 days. It must be inspected and repaired before insulation and/or roofing plies are installed to ensure its integrity as an effective vapor barrier.
- v) Refer to TIS 604 for specific application requirements.

12) SPECIAL CONSIDERATIONS

a) Moisture in Existing Roof

- i) The roofing contractor is responsible for ensuring that the substrate is suitable to receive a Firestone roof system. All damaged and/or wet insulation or substrate must be removed and replaced prior to the application of the Firestone roof system.
- ii) A moisture survey should be conducted to determine the moisture content of any existing roof system component. Any damaged and/or wet components of the existing system must be removed prior to the installation of the new Firestone roofing system.
- iii) The best diagnostic technique for evaluating moisture in existing roofs is by taking and evaluating a series of roof cores.
 - (1) Techniques such as infrared scans are available to evaluate the roof by non-invasive means. These techniques provide measurements of factors that can be associated with the presence of moisture. Results of these studies should be confirmed with roof cores.
- iv) Failure to remove any existing system components that could cause damage to the new Firestone roofing system may void the warranty.

b) Drainage

- i) Firestone requires a minimum of ¼" (6.4 mm) per 12" (30.5 cm) slope to facilitate proper drainage and maximize long-term performance of the roof system.
- ii) Ponding water is defined as a condition existing on any area of the roof where water remains more than forty-eight (48) hours after precipitation.
- iii) Adequacy of drainage provisions, placement, sizing and/or number of drains required is the responsibility of the building owner or their design professional. Drainage conditions should meet the requirements of applicable codes as well as standard industry recommendations.
- iv) In reroofing or re-cover situations, analysis of the existing drainage conditions is the responsibility of the building owner and/or their design professional. Existing deck deflection or ponding water may necessitate the upgrade of drainage provisions including the relocation of existing drains, the addition of new drains, increased bar joist support, etc. Firestone does not design roof drainage systems nor assume any liability for the adequacy (or lack thereof) of roof drainage systems or facilities.
- v) Proper and adequate drainage of the roof surface is required to assure the long-term performance of the roofing system. Drains should be of sufficient number and size, and located to provide satisfactory and rapid drainage of the entire roof surface (within 24 to 48 hours of precipitation). A minimum roof slope of ¼" (6.4 mm) per foot is the industry standard.

- vi) Tapered ISO 95+ GL provides an effective and economical solution where substrate slope will not permit efficient drainage. When properly installed, it can extend the life of the roof assembly by eliminating problems associated with ponded water. Tapered ISO 95+ GL is available in slopes from 1/16" per foot (.5%) to 1/2" per foot (4%). Firestone provides a variety of technical support services for the installation of tapered insulation through the Firestone Tapered Engineering Design Department.
- vii) The following are some of the reasons why proper roof drainage is important:
- (1) Standing water can result in deck deflection and possible structural damage.
 - (2) Water on the roof can promote vegetation, fungi and bacterial growth.
 - (3) In the event of an opening in the roof membrane, standing water can significantly worsen the damage to the roof system, the building itself, and the interior contents.
 - (4) It is required by many, if not all, building codes.
 - (5) Proper drainage of the roof system prevents premature deterioration of the roof membrane and roof components.
- c) Back-Nailing and Insulation Stops – Slopes Greater than 1/2" (4.2%)
- i) General Guidelines
- (1) Back-nailing nailing strips are required on all roofs with slopes greater than 1/2" (4.2%).
 - (2) Insulation stops are recommended on all roofs with slopes greater than 1/2" (4.2%).
 - (3) When the slope of the roof exceeds 1/2":12" (4.2%) and hot asphalt attachment is specified, Firestone requires that only Firestone SEBS Mopping Asphalt or ASTM D 312 Type IV (4) asphalt be used.
 - (4) Roof slopes over 3":12" (25%) are generally not suitable for the application of asphaltic roof systems.
 - (5) Insulation stops and back-nailing nailing strips are not needed when system is applied directly to a wood deck or a similar nailable substrate. The cap sheet can be back-nailed directly to a wood deck or similar nailable substrates when back-nailing is required.
 - (6) The building owner or design professional intending to specify back-nailing should consider geographic location, specific job conditions, accepted area application practices, and the type and grade of materials specified when creating an actual specification for a project.

Back-Nailing Requirements for Sloped Roofs		
Slope	Back-Nailing	Notes
≤ 1/2" (4.2%)	None required	
> 1/2" ≤ 2" (4.2% - 16.7%)	End laps of roll	Not to exceed 33' (10 m)
> 2" ≤ 3" (16.7% - 25%)	Every 10' (3 m)	
Refer to Firestone detail MB-LS-9 for detailed back-nailing requirements.		

Table 19: Back-Nailing Requirements for Sloped Roofs

- ii) Installation:
- (1) For roof slopes up to and including 1/2": 12" (4.2%), the side laps can be installed parallel or perpendicular to the slope.
 - (2) For roofs slopes greater than 1/2": 12" (4.2%), the membrane must run parallel to the slope.
 - (3) Back-nailing nailing strips and insulation stops shall be a minimum of 3 1/2" (8.9 cm) wide and the same thickness as the roof insulation.
 - (4) Back-nailing nailing strips and insulation stops must be attached to resist a force of 200 lbf (2.9 kN/m) minimum.
 - (5) Cap nails must have 1" (2.5 cm) diameter steel heads. Plastic heads are not allowed. The shank must be minimum 11-gauge (2.3 mm) annular ring or spiral shank. Nails must be FM Approved.
 - (6) End laps must extend a minimum of 6" (15.2 cm) beyond the edge of the fastener. For example, when fasteners and 3" (7.6 cm) plates are used (as shown below), each end lap must be a minimum of 9" (22.8 cm).

- (7) Non-nailable decks and nailable decks with insulation:
- Cut the cap sheet to conform to nailer spacing.
 - Using capped nails or Firestone fasteners and plates, nail the end lap into the wood nailer across the width of the sheet, with the first nail spaced $\frac{3}{4}$ " (1.9 cm) from the leading edge of the sheet. The remaining nails are to be spaced approximately 3" (7.6 cm) on center.
 - The nails should be staggered across the width of the nailer.
 - When Firestone fasteners and plates are used in lieu of cap nails, four (4) per end lap are required.
 - Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 for information regarding back-nailing requirements when utilizing approved insulation less than 1" (2.5 cm).
- (8) Nailable decks with no insulation:
- Using capped nails or Firestone fasteners and plates, nail the end lap into the nailable deck across the width of the sheet, with the first nail spaced $\frac{3}{4}$ " (1.9 cm) from the leading edge of the sheet. The remaining nails are to be spaced approximately 3" (7.6 cm) on center.
 - When Firestone fasteners and plates are used in lieu of cap nails, four (4) per end lap are required.

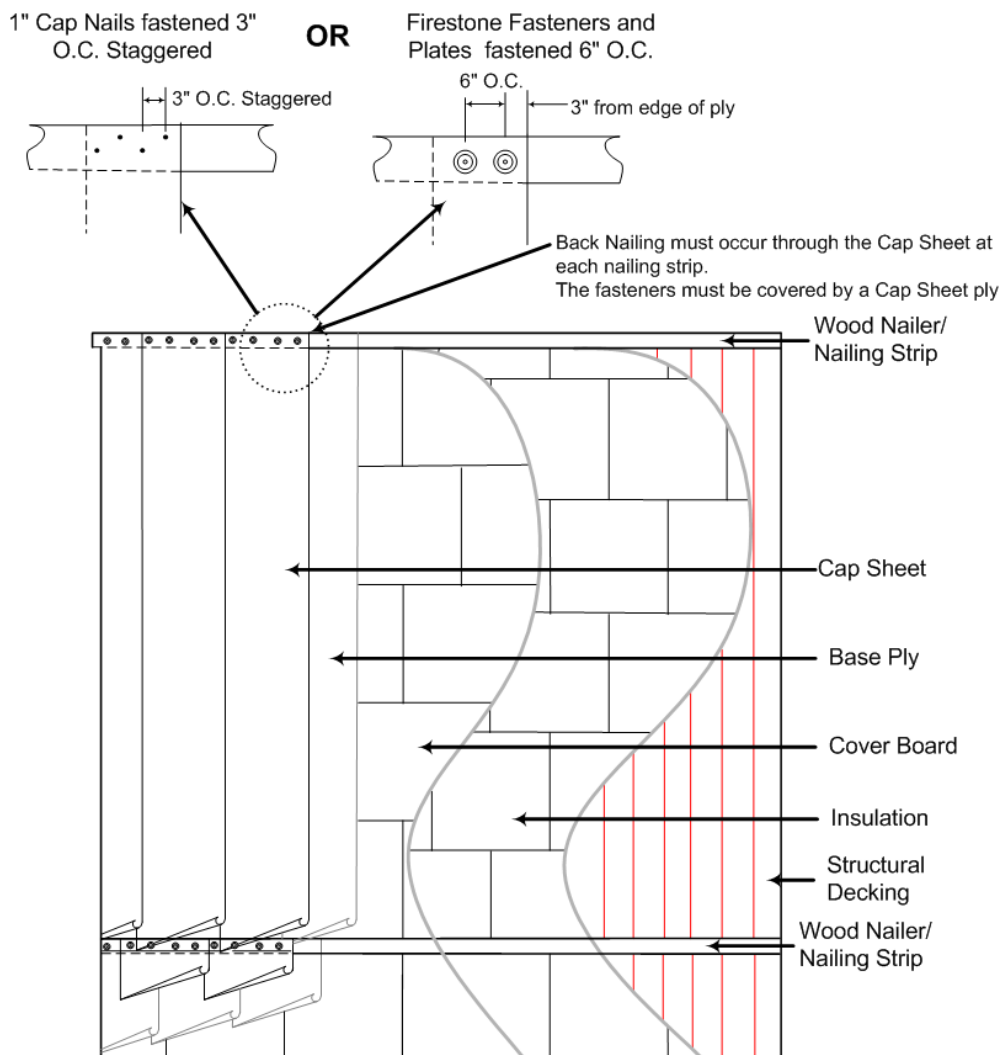


Figure 2: Back-nailing

d) Partial Tear-off and Re-cover Applications

- i) Existing roof components are not included in the Firestone warranty.
- ii) It is the responsibility of the building owner and/or their agents to verify that the existing roof system is sound and intact.
 - (1) Confirm the structural integrity of the existing deck and specify repair or replacement as required.
- iii) When using fasteners, verify that the substrate has sufficient fastener pullout resistance to meet system requirements.
- iv) Refer to the Firestone Attachment Guide for adhesion pull test requirements for Firestone insulation adhesives.
- v) The effect of existing moisture on the performance of the new system may be significant depending upon the roofing components selected. Therefore, a moisture survey should be conducted to determine the presence of moisture in the existing roof system components. All components of the existing system that would be detrimental to the new Firestone roof system must be removed and replaced prior to its installation.
- vi) Limitations in flashing heights may be encountered. Existing building features (e.g., door or window locations, weeps or through-wall flashings) may not allow sufficient clearance to provide proper termination above the potential water level. Detailed consideration of this condition is critical to the integrity of the roofing system. Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 for assistance.
- vii) Partial tear-off is the removal of the existing membrane, installing a new layer of insulation over the existing in place insulation and a new membrane over the new insulation. Partial tear-offs are not eligible for a 20+ year warranty.
 - (1) New insulation or cover board is always required.
 - (2) The existing insulation must be suitable for use as a component of the new roof system. The existing insulation must be:
 - (a) Dry and free of trapped moisture.
 - (b) Re-secured as necessary to meet Firestone, local code, and/or other specified wind uplift requirements.
 - (c) An acceptable substrate for the new insulation and the new membrane.
 - (d) If existing insulation is to remain, all damaged or wet components must be replaced prior to installing the new roof system.
- viii) Re-cover is the installation of a new roof system over an existing roof system.
 - (1) All damaged or wet components must be removed and replaced prior to installing the new roof system.
 - (2) All re-cover or retrofit systems using adhesives for insulation attachment require a pull test to verify adhesion.
 - (3) Loose gravel, if present, must be removed until the roof surface is smooth enough to provide a suitable substrate for the insulation. All loose gravel must be removed by vacuuming and/or power brooming. Spud any remaining gravel smooth to provide a level surface.
 - (4) New insulation or a cover board is required except when installing an appropriate Firestone roof membrane directly to an existing smooth surfaced BUR or Modified Bitumen roof. The warranty period for direct attachment to an approved existing roof is limited to 10-12 years. The existing smooth asphalt roof must not have been coated or re-saturated and must be primed with ASTM D 41 primer prior to the installation of a new asphalt or modified bitumen membrane.
 - (a) Verify that the attachment of the existing roof system is acceptable. If existing insulation is not mechanically fastened, contains fasteners that may be corroded or loose, or the attachment may not be sufficient, re-attachment of the roof system is required prior to the installation of new insulation.
 - (5) Coal Tar Pitch Built-Up Roofs
 - (a) New, mechanically-attached insulation or a cover board is required to isolate the new roof from the existing coal tar bitumen.
 - (b) Flow of existing coal tar into the building may occur when new fasteners penetrate an existing coal tar pitch membrane
 - (6) Sprayed-in-place polyurethane foam (PUF) roof systems require a COMPLETE TEAR-OFF of the PUF system.
 - (7) Existing roofs over phenolic insulation require a COMPLETE TEAR OFF of the entire roof system to the structural deck.
 - (a) When Phenolic insulation is removed, a visual inspection of the deck condition and other components is required; all deteriorated components must be replaced as necessary.
 - (8) Existing Single-Ply Systems
 - (a) A mechanically attached insulation or cover board is required.
 - (b) Re-cover over single-ply roof systems will require that all existing base tie-ins and flashings be removed prior to the installation of a new roof.

Special Attachment Considerations for Partial Tear Off and Re-cover Applications

Deck	Special Considerations
Steel and Nailable Decks (Wood plank, plywood, OSB, gypsum, cementitious wood fiber, poured-in-place concrete)	If the existing system is not sound and intact mechanical attachment of the system may be necessary.
Non-Nailable Decks (Poured-in-place, precast, and post-tension concrete)	If the existing roof system is not sound and intact, additional securement may be necessary.

Table 20: Special Attachment Considerations for Partial Tear Off and Re-cover Applications

Insulation / Cover Board Attachment Options by Re-cover / Retrofit

Substrate to Which Insulation / Cover Board Will Be Attached	Attachment Method				
	Mechanically Attached	I.S.O. Fix II	I.S.O. Spray R	I.S.O. Twin Pack	Hot Asphalt
		Adhesive attachment may require an adhesive pull test. See the <i>Firestone Attachment Guide</i> .			
Existing Un-Coated Smooth Surface BUR or Modified Bitumen Roof	✓	✓	✓	✓	✓
Coal Tar Built-Up Roofs	✓	X	X	X	X
Asphalt Gravel Surfaced BUR	✓	X	X	X	X
Granule Modified Bitumen Roof	✓	✓	✓	✓	✓
Sprayed Urethane Roof (PUF)	Complete tear off required				
Existing Roof with Phenolic Insulation	Complete tear off required. When Phenolic insulation is removed, a visual inspection of deck condition and other components is required, all deteriorated components must be replaced as necessary.				

Table 21: Insulation / Cover Board Attachment Options by Re-cover / Retrofit

13) FLASHINGS

a) General

- i) A flashing is a roofing element used to seal the roof system at areas where the roof covering is interrupted or terminated. For example, pipes, curbs, walls, etc. all have special components that, when correctly installed, will help prevent moisture entry into the roof system or building. Flashings divert the water to the membrane. The membrane then carries it to the roof drains. Typically, flashing intercepts water flowing down parapets, down walls of higher adjacent construction and down roof penetrations. There are four typical locations where a flashing is needed:
 - (1) Terminations
 - (2) Junctions
 - (3) Projections
 - (4) Joints
- ii) In any flashing detail, there are up to three different flashing components:
 - (1) Base flashing
 - (2) Counter-flashing
 - (3) Cap flashing
- iii) Many factors affect the performance of the flashing system. Design drawings for several common applications are available from the Firestone Web Site.
- iv) Extended warranties may require special flashing applications.

b) UltraFlash Liquid Flashings

- i) UltraFlash Two-Part Liquid Flashing is required on all 30-year Platinum Warranty systems.
- ii) UltraFlash Two-Part Liquid Flashing is not approved for use on APP membranes.
- iii) UltraFlash One-Part Liquid Flashing may be used on SBS, APP, and BUR roofing systems, however its warranty coverage is limited to 20 years.

c) Base Flashing

- i) An extension of the roofing membrane or a different material that is bonded to the roof to form a waterproof joint. It extends upward along the vertical surface to divert water onto the membrane. The base flashing should reach a higher level than that reached by water on the roof. In some situations, water may temporarily accumulate on the roof. This may occur during heavy rainfalls, where the drain size is inadequate, where local building regulations require controlled flow drains, or where ice and snow restrict drainage.

d) Counter-flashing

- i) Counter-flashing is used, in some situations, to carry water onto the base flashing and the membrane. This may be the case where a wall rises above a roof and masonry or concrete wall cladding is carried down to the roof surface. It covers the vertical face of the base flashing. It provides protection for the base flashing and may serve to shed water. Where required, the counter-flashing is secured to the parapet or wall cladding. Counter-flashing may not be required where single-ply membranes are used for the base flashing. If not required, it should not be used, since it will cover defects and hinder maintenance.

e) Cap flashing

- i) Cap flashings are horizontal coverings for parapets and expansion joints. Cap flashing should be sloped toward the roof and secured to allow differential movement. Failure to provide for adequate flashing height at the design stage may result in serious problems that cannot be subsequently corrected.

f) Wall/Curb Flashing Materials and Requirements

- i) Refer to the QuickSpecs and Detail Drawings at: www.firestonebpc.com
- ii) Extended warranties require special flashing applications.
- iii) All Firestone modified membranes may be used in flashing assemblies, per warranty requirements.
- iv) SBS Metal Flash-AL is a high-performance, foil-clad, flashing membrane which can be heat-welded or adhered with Firestone All-Purpose MB Flashing Cement (even though it has a polyethylene burn-off film).

g) Penetrations (Pipes, Conduits, Etc.)

- i) Pipe Flashings
 - (1) Whenever possible, all round rigid pipe penetrations from 1" (2.5 cm) outside diameter to 6½" (16.5 cm) outside diameter should be flashed with Firestone QuickSeam Universal Pipe Flashing or lead flashing. If it is not possible to fit a lead flashing onto the pipe due to site conditions, a penetration pocket should be installed, and flashed in accordance with Firestone Details.
- ii) Penetration Pockets
 - (1) The following types of penetrations require the installation of a penetration pocket:
 - (a) Rigid pipes with an outside diameter less than 1" (2.5 cm).
 - (b) Clusters of pipes.
 - (c) Unusual shapes, e.g., structural beams, channels or angles.
 - (2) A minimum clearance of 1" (2.5 cm) between penetrations, pipes, conduits, etc., and on all sides of the penetration pocket, is required to assure adequate space for the application of Pourable Sealer around each penetration.
- iii) Flexible penetrations (electrical and braided cable, etc.) must be installed in a sheet metal gooseneck.

h) Curbs and Terminations

- i) Where possible, provide a minimum design height of at least 8" (20.3 cm) for all flashing terminations (except penetration pockets).
- ii) Minimum flashing height must be 3" (7.6 cm) above the highest water level that could be reached during a deluging rain. Wherever a vertical termination height is 5" (12.7 cm) or less, contact your Firestone Building Systems Advisor at 1 (800) 428-4511.
- iii) Do not flash over existing through-wall flashings, weep holes and overflow scuppers.
- iv) Terminations must be made directly to a sound, watertight, rigid, vertical substrate. For retrofit conditions, existing loose flashing materials must be removed, or overlaid with 5/8" exterior grade plywood. Terminations are not acceptable directly to gypsum or wooden substrates.
- v) When using a surface-mounted termination, ensure a consistent seal at the wall interface. The surface above the termination must be waterproof.
- vi) Gypsum board, used as a substrate for flashings, must be moisture resistant exterior grade with laminated fiberglass facers, which is recommended for this application by the gypsum board manufacturer.
- vii) Stucco, cobblestone, textured masonry, corrugated metal panes or any uneven surface is not a suitable substrate to receive conventional flashing materials. Such surfaces must be prepared to provide an acceptable substrate by attaching minimum 5/8" (1.6 cm) exterior grade or pressure treated plywood. Attach as required for structural integrity.
- viii) UltraFlash Liquid Flashings may be used with textured masonry, corrugated metal panes and most uneven surfaces.

i) Sheet Metalwork

- i) Coping, gravel stops, counter-flashings etc., must be supplied by Firestone for warranty inclusion.
- ii) If Firestone is not able to supply a given sheet metal product or design, it must be installed in accordance with current Firestone details but will not be included as part of the warranty.
 - (1) All sheet metalwork not supplied by Firestone should be fabricated and installed in accordance with the recommendations of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - (a) Some specific roofing details in Firestone's Technical Specifications may exceed SMACNA recommendations. For such details, the Firestone requirements must be used.
 - (2) All sheet metalwork not supplied by Firestone should have a quality weather resistant coating that will not corrode or weather to the point of failure during the warranty period.
 - (3) It is the owner's responsibility to maintain non-Firestone sheet metal in a watertight condition.
- iii) Metalwork which is not in conformance with Firestone specifications and details or that compromises the integrity of the system may jeopardize issuance of the warranty for the entire project. Firestone does not warrant the performance of products which are not supplied by Firestone.
- iv) Counter-flashings, copings, and other perimeter or penetration metalwork must be properly fastened and sealed by the roofing contractor or others.
- v) Refer to ANSI/SPRI ES-1 for information on wind design and metal edge treatments.
- vi) Extended wind speed warranties require enhanced edge details. Contact your Firestone Building Systems Advisor at 1 (800) 428-4511 for specific information
- vii) Make these specifications available to the sheet metal fabricator/contractor.

14) ROOF COATINGS

a) General

- i) Coatings are considered a maintenance item. Firestone recommends that coatings be adequately and regularly maintained.
- ii) Periodic maintenance and recoating may be required to maintain the Underwriters Laboratories, Factory Mutual or other ratings.
- iii) The use of aluminum roof coating prevents fully adhered attachment of a new membrane during retrofit. A new substrate may be mechanically attached to receive the retrofit membrane.
- iv) Proper preparation of the roof surface is important to assure the best possible adhesion of the roof coating. The Asphalt Roofing Manufacturers Association publishes a brochure entitled "Evaluating and Preparing Modified Bitumen Membrane Roofing for Surface Coating Applications". This information can be obtained by contacting ARMA (Asphalt Roofing Manufacturers Association).

b) Firestone AcryliTop PC-100 Base Coat for Asphalt Systems and AcryliTop Coating

- i) Firestone AcryliTop PC-100 Base Coat for Asphalt systems and AcryliTop Coating may be applied to further protect the Firestone membrane and flashing surfaces from the effects of weathering or for aesthetic reasons. It is only required for issuance of specific Firestone warranties.
- ii) AcryliTop PC-100 is highly reflective.
- iii) Modified Bitumen Membranes installed with Firestone Multi-Purpose MB Cold Adhesive must be exposed for a minimum of 30 days at a minimum of 60 °F before Acrylic Base Coat for Asphalt and AcryliTop PC-100 can be applied. This requirement applies only to Modified Bitumen roof systems installed in cold adhesive. New roof systems must be inspected by a Firestone representative prior to the application of an AcryliTop system.
- iv) Refer to the Technical Information Sheets and Safety Data Sheets for AcryliTop PC-100, AcryliTop PC-100 Base Coat for additional information on application, storage and safety.
- v) Never apply Firestone AcryliTop PC 100 or Firestone Base Coat for Asphalt to Owens Corning PermaMop® asphalt.

c) Firestone Aluminum Fibered Roof Coating

- i) Firestone Aluminum Fibered Roof Coating may be applied to further protect the Firestone membrane and flashing surfaces from the effects of weathering or for aesthetic reasons.
- ii) Aluminum Fibered Roof Coating is highly reflective.
- iii) Modified Bitumen Membranes installed with Firestone Multi-Purpose MB Cold Adhesive must be exposed for a minimum of 30 days at a minimum of 60 °F before Firestone Aluminum Fibered Roof Coating can be applied. This requirement applies only to Modified Bitumen roof systems installed in cold adhesive. New roof systems must be inspected by a Firestone representative prior to the application of a Firestone Aluminum Fibered Roof Coating.
- iv) Refer to TIS 1604 and the Safety Data Sheet for AcryliTop PC-100, AcryliTop PC-100 Base Coat for additional information on application, storage and safety.

d) Gravel Surfacing

- i) Firestone Multi-Purpose MB Cold Adhesive
 - (1) For every 100 ft² (9.3 m²) of roof surface, apply approximately 400 lb (181 kg) of roofing gravel in a 4 gal/100 ft² (15 L / 9.3 m²) flood coat of Firestone Multi-Purpose Cold MB Adhesive.
 - (2) No more Firestone Multi-Purpose MB Adhesive may be spread or poured at one time than can be covered immediately with gravel to ensure proper embedment of the aggregate.
- ii) Hot Asphalt
 - (1) For every 100 ft² (9.3 m²) of roof surface, install approximately 500 lb (227 kg) of roofing gravel applied directly over a 60 lb/100 ft² (27 kg / 9.3 m²) flood coat of Type III or Type IV asphalt or Firestone SEBS Mopping Asphalt. No more asphalt must be spread or poured at one time than can be covered with gravel before the asphalt cools.
- iii) Gravel other accepted surfacing material shall comply with ASTM D 1863 and be ¼" (6.4 mm) to ¾" (19.1 mm) in diameter, substantially opaque, dry, and free from dust or other foreign materials.

15) WARRANTIES

a) General

- i) Only Firestone-supplied components are eligible to be covered as part of the Firestone Warranty.
- ii) Firestone does not warrant Firestone roof system tie-ins to other roofing systems.
- iii) Warranted Firestone roof systems are to be installed only on commercial, industrial, institutional or multi-family commercial housing buildings in the United States and Canada.
 - (1) Issuance of a warranty for projects outside the US and Canada must be submitted to Firestone Solutions Group for consideration prior to bidding.
 - (2) Individual residential construction does not qualify for a Firestone warranty.
- iv) Upon Firestone's inspection and acceptance of the installed roof system, the requested warranty can be issued. Firestone's inspection is not intended as an inspection for benefit of the owner or design professional with respect to contract, building codes or compliance with specifications other than Firestone's.

- v) Failure of a flashing terminated to an intermediate element (e.g., metal flashing, insulation, surface treatment, etc.), which itself could fail and admit moisture beneath the membrane is beyond the limits of the Firestone warranty.
- vi) It is the owner's responsibility to expose the membrane if warranty service is required when access is impaired. Such impairment includes, but is not limited to:
- (1) Design features, such as window washer systems, which require the installation of traffic surface units in excess of 80 lb (36.3 kg) per unit.
 - (2) Any equipment, ornamentation, building service units and other rooftop surfacing materials that are not defined as part of the membrane assembly.
 - (3) Intricately placed or multicolored ballast configurations.
 - (4) Individual pavers utilized as ballast, which weigh more than 80 lb (36.3 kg) per unit, unless otherwise required by Firestone for wind uplift resistance.
 - (5) Interlocking paver systems that utilize mechanical clips, strapping, adhesive, etc.
 - (6) Rooftop equipment that does not provide Firestone with reasonable access to the membrane.
 - (7) Ponded water, snow, ice, and other materials.

Overview of Firestone Warranty Requirements				
<i>(Please refer to Quick Specs or ask your Building Systems Advisor for specifics and additional components)</i>				
Years	Base	Cap	Coating	Flashing
10	<ul style="list-style-type: none"> Any APP base sheet, BASEGARD SA, MB Base, or Channel Venting Base May be mechanically fastened, self-adhered, heat welded, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Any APP cap sheet May be heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any APP cap sheet Fully adhered One ply <li style="text-align: center;">-or- UltraFlash One-Part Liquid Flashing
	<ul style="list-style-type: none"> Any SBS base sheet, BASEGARD SA, MB Base, or Channel Venting Base May be mechanically fastened, self-adhered, heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Any SBS cap sheet May be heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any SBS cap sheet Fully adhered One ply <li style="text-align: center;">-or- UltraFlash Liquid Flashing
	<ul style="list-style-type: none"> MB Base, Ply IV, or Ply VI May be mechanically fastened or hot mopped 	<ul style="list-style-type: none"> Any modified bitumen cap sheet May be heat welded, hot mopped (SBS only), or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any modified bitumen cap sheet Fully adhered One ply <li style="text-align: center;">-or- UltraFlash Liquid Flashing
15	<ul style="list-style-type: none"> Any APP base sheet or BASEGARD SA May be heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Any APP cap sheet May be heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any APP base and cap sheet Fully adhered Two (2) plies <li style="text-align: center;">-or- UltraFlash One-Part Liquid Flashing
	<ul style="list-style-type: none"> Any SBS base sheet or BASEGARD SA May be self-adhered, heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Any SBS cap sheet May be heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any SBS base and cap sheet Fully adhered Two (2) plies <li style="text-align: center;">-or- UltraFlash Liquid Flashing

Continued:

Overview of Firestone Warranty Requirements				
<i>(Please refer to Quick Specs or ask your Building Systems Advisor for specifics and additional components)</i>				
Years	Base	Cap	Coating	Flashing
	<ul style="list-style-type: none"> Two (2) plies of Ply IV, or Ply VI Hot mopped 	<ul style="list-style-type: none"> Any modified bitumen cap sheet May be heat welded, hot mopped (SBS only), or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any modified bitumen base and cap sheet Fully adhered Two (2) plies -or- UltraFlash Liquid Flashing
20	<ul style="list-style-type: none"> BASEGARD SA, APP Premium Base, APP 160 or 170 series base sheet May be self-adhered, heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> APP Premium FR or APP 180 series cap sheet May be heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Equal-or-better APP base and cap sheet Fully adhered Two (2) plies -or- UltraFlash One-Part Liquid Flashing
	<ul style="list-style-type: none"> Any SBS base sheet, or BASEGARD SA May be self-adhered, heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Any SBS cap sheet May be heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Equal-or-better SBS base and cap sheet Fully adhered Two (2) plies -or- UltraFlash Liquid Flashing
	<ul style="list-style-type: none"> Three (3) plies of Ply IV, or Ply VI Hot mopped 	<ul style="list-style-type: none"> Any modified bitumen cap sheet May be heat welded, hot mopped (SBS only), or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> Not required on granule-surface cap sheets 	<ul style="list-style-type: none"> Any modified bitumen base and equal-or-better cap sheet Fully adhered Two (2) plies -or- UltraFlash Liquid Flashing
25	<ul style="list-style-type: none"> BASEGARD SA or APP 160 or 170 series base sheet May be self-adhered, heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> APP Premium FR or APP 180 series cap sheet May be heat welded or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> UltraWhite cap sheet, or AcryliTop PC 100 roof coating 	<ul style="list-style-type: none"> Equal-or-better APP base and cap sheet Fully adhered Two (2) plies -or- UltraFlash One-Part Liquid Flashing
	<ul style="list-style-type: none"> BASEGARD SA, SBS Smooth, SBS Poly series base sheet, SBS Glass Torch series base sheet, or SBS Premium Base May be self-adhered, heat welded, hot mopped or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> SBS Premium or SBS Premium FR May be heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> UltraWhite cap sheet, or AcryliTop PC 100 roof coating 	<ul style="list-style-type: none"> Equal-or-better SBS base and cap sheet Fully adhered Two (2) plies -or- UltraFlash Liquid Flashing

Continued:

30-year Platinum Warranty systems have stringent requirements in addition to the basic membrane requirements outlined below. Please contact your Building Systems Advisor for verification prior to bid.					
30	<ul style="list-style-type: none"> BASEGARD SA, SBS Poly series base sheet, SBS Glass Torch series base sheet, or SBS Premium Base 	<ul style="list-style-type: none"> SBS Poly series base sheet, SBS Glass Torch series base sheet, or SBS Premium Base 	<ul style="list-style-type: none"> SBS Premium FR or SBS Premium FR Torch May be heat welded, hot mopped, or fully adhered in cold adhesive as appropriate 	<ul style="list-style-type: none"> UltraWhite cap sheet is required 	<ul style="list-style-type: none"> UltraFlash Two-Part Liquid Flashing
	<ul style="list-style-type: none"> May be self-adhered, heat welded, or fully adhered in cold adhesive as appropriate 				
NOTES: <ul style="list-style-type: none"> All materials by Firestone Never use hot asphalt in an APP system Except for 10-year warranties, a mechanically-fastened base sheet must be followed by two (2) fully-adhered plies (heat welded, hot mopped, or cold adhesive) MB Base is only eligible for a 10-year warranty. If a longer warranty duration is desired, use an approved APP or SBS base sheet, or two (2) plies of BUR felts. Do not use UltraFlash Two-Part Liquid Flashing on APP Systems. 					

Table /: Overview of Firestone Warranty Requirements

Firestone Warranty Summary

(This chart is only a summary of the general warranty coverage. Please review each warranty for exact language.)

WARRANTY NAME	SPECIFICATION	ELIGIBLE CONTRACTOR	COVERAGE
Red Shield Limited Warranty	Firestone Asphalt specifications for the term requested	Red Shield	Repair leaks in the roofing system caused by Firestone-supplied materials or the workmanship used to install them. No dollar limit to Firestone expenditures to honor the warranty.
Standard Limited Warranty	Firestone Asphalt specifications for the term requested	Red Shield Registered	Repair leaks in the roofing system caused by Firestone-supplied materials or the workmanship used to install them up to the owner's original cost.
Membrane-Only Warranty	Firestone Asphalt specifications for the term requested	Red Shield	Provide replacement membrane materials sufficient to replace any area of Firestone Roofing Membrane ("Membrane") which leaks as a result of ordinary exposure to the elements or any manufacturing defect in the Membrane. Prorated
MB Membrane Warranty	Firestone Asphalt specifications for the term requested	Red Shield or Registered	Repair any leak in the Firestone Modified Bitumen Roofing Membrane ("Membrane") as a result of weathering due to ordinary exposure to the elements or any manufacturing defect in the Membrane up to the owner's original cost.
MB Product Warranty	Firestone Asphalt specifications for the term requested	Red Shield or Registered	Provide replacement Membrane material or a prorated credit (based upon the remaining months of the un-expired warranty) sufficient to replace any area of Firestone Modified Bitumen Membrane ("Membrane") which leaks as a result of ordinary exposure to the elements or any manufacturing defect in the Membrane up to owner's original cost.
Ply Sheet Warranty	Firestone Asphalt specifications for the term requested	Red Shield or Registered	Re-supply Firestone Ply Sheets to repair or replace the affected area or issue a credit towards the purchase of new materials. The quantity of supplied material or the amount of the credit will be reduced by the amount of usage received prior to notice of failure. At no time, will Firestone's costs exceed the original cost of the Ply Sheets.
AcryliTop PC-100 Coating Limited Warranty	Firestone Asphalt specifications for the term requested	Red Shield or Registered	Provide the owner with replacement AcryliTop PC-100 Coating to repair the area should the coating come loose.
Manufacturer's Insulation Warranty	Firestone Asphalt specifications for the term requested	Red Shield	Provide owner with free Firestone ISO 95+ GL to repair the affected roof area if the Firestone ISO 95+ GL warps, bows or destabilizes to the point of causing a roof leak as a result of any manufacturing defect in the ISO 95+ GL.
10 Year ISO 95+ GL Thermal Insulation Warranty	Firestone Asphalt specifications	Red Shield	Provide replacement insulation should the Firestone ISO 95+ GL fail to retain 80% of its published R-value.

Table 22: Firestone Warranty Summary