Firestone APP
Design and Application Guide

March, 2013

Table of Contents

Graphs and Tables

Firestone
BUILDING PRODUCTS

Modified Bitumen Product Information

SBS Membranes	Code	Compound	Surface	Reinforcement	Thickness	
					inch	mm
SBS	30	SBS	Granule	Polyester with Glass Strands	0.150	3.8
SBS Torch	40	SBS	Granule	Polyester with Glass Strands	0.150	3.8
SBS FR	31	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.150	3.8
SBS FR Torch	41	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.160	4.1
SBS Glass FR	50	Fire Retardant SBS	Granule	Glass Fiber Mat	0.150	3.8
SBS Glass FR Torch	51	Fire Retardant SBS	Granule	Glass Fiber Mat	0.150	3.8
SBS Smooth	32	SBS	Smooth	Polyester with Glass Strands	0.145	3.7
SBS Premium	33	SBS	Granule	Polyester with Glass Strands	0.160	4.1
SBS Premium FR	36	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.160	4.1
SBS Premium FR Torch	48	Fire Retardant SBS	Granule	Polyester with Glass Strands	0.160	4.1
SBS Metal Flash Al	43	SBS	Aluminum	Glass Fiber Mat	0.150	3.8
SBS Base	S	SBS	Smooth	Glass Fiber Mat	0.090	2.3
SBS Glass Torch Base	46	SBS	Smooth	Glass Fiber Mat	0.120	3.0
SBS Premium Base	X	SBS	Smooth	Fiberglass Scrim/Mat Bi-laminate	0.160	4.1
SBS PolyBase	44	SBS	Smooth	Polyester with Glass Strands	0.090	2.3
SBS Poly Torch Base	45	SBS	Smooth	Polyester with Glass Strands	0.120	3.0
BASEGARD SA	48	SBS	Smooth	Glass Fiber Mat	0.060	1.5
APP Membranes	**Code**	**Compound**	**Surface**	**Reinforcement**	inch	mm
APP160	16	APP	Smooth	Polyester with Glass Strands	0.150	3.8
APP160 Cool	16C	APP	Smooth	Polyester with Glass Strands	0.150	3.8
APP170	17	APP	Smooth	Polyester with Glass Strands	0.165	4.2
APP170 Cool	17C	APP	Smooth	Polyester with Glass Strands	0.165	4.2
APP180	18	APP	Granule	Polyester with Glass Strands	0.165	4.2
APP180 Cool	18C	APP	Granule	Polyester with Glass Strands	0.165	4.2
APP180 FR	18FR	Fire Retardant APP	Granule	Polyester with Glass Strands	0.165	4.2
APP180 FR Cool	18FRC	Fire Retardant APP	Granule	Polyester with Glass Strands	0.165	4.2
APP Premium FR	T	Fire Retardant APP	Granule	Fiberglass/Polyester-Tri-laminate	0.170	4.3
APP 80 Glass Base	80	APP	Smooth	Glass Fiber Mat	0.080	2.0
APP 80 Glass Base Cool	80C	APP	Smooth	Glass Fiber Mat	0.080	2.0
APP Premium Base	Q	APP	Smooth	Glass Fiber Mat	0.080	2.0
BUR Products	**Code**	**Compound**	**Surface**	**Reinforcement**	inch	mm
MB Base M	M	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.045	1.1
Ply IV (4)	F	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.035	0.9
Ply VI (6)	FP	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.035	0.9
Venting Base	VB	Oxidized Asphalt	Smooth	Glass Fiber Mat	0.115	2.9

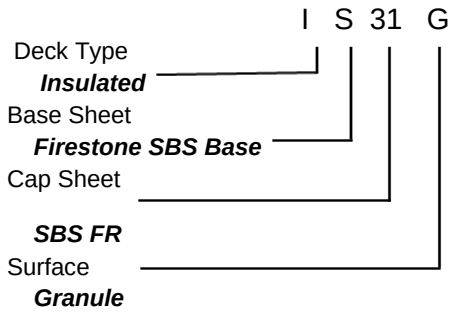
Deck Type

I = Insulated
S = Steel
C = Concrete
P = Primed
N = Nailable
-Plywood
-Oriented Strand Board
-Gypsum
-Cementitious Wood Fiber
L = Lightweight Concrete
E = Existing Smooth Uncoated BUR

Surfacing

G = Granule
GR = Flood Coat and Gravel
AC = AcryliTop Coating
AL = Aluminum Coating
P = PMR

Specification Numbering System



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1.01 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 Technical Database, http://technicaldatabase.fsbp.com.

A. Firestone is pleased to offer job-specific technical assistance for our roofing contractors, and for the design community. **Contact your Firestone Roof Systems Advisor at 1-800-428-4511** to discuss the needs of your project, how our products can meet specification requirements, application techniques, codes, warrantability of systems, and any other technical question.
B. Purpose of this Guide to General Design Criteria
    1. The information contained in this guide is intended to assist **Firestone Red Shield Licensed Applicators** in meeting the requirements necessary to obtain a Warranty from Firestone Building Products (FSBP).
    2. Architects, engineers, roof consultants, and other specifiers may also use this information in their design of warrantable Firestone roofing systems.

1.01.1 General Considerations

A. 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.

B. 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. To protect the roofing system, sleepers are recommended.
    2. The building must be able to support the load created by the staging, installation, and in-place service of the roofing system.
    3. It is the responsibility of the design professional to determine these loads and load capacities.

C. 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. APP Modified Bitumen projects over 250’ in height.
D. 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 damage from hail.
        c. Projects that require coverage for leaks caused by incidental cuts and punctures.
E. 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 harmful to the roofing system, and to determine if additional protection of the roofing membrane may be needed.

F. 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.

G. Building Codes
   1. 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://technicaldatabase.fsbp.com/guides/CodeApprovalGuides/.
   2. Authorities Having Jurisdiction.
      a. 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 codes – 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.
   3. FM Global/FM Approvals
      a. 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, in order to understand any job-specific requirements which may be imposed by FM Global on the project.
      b. Firestone roofing materials carry the FM seal, and hundreds of FM Approvals-rated Firestone roofing systems may be found in the Firestone Code Approval Guides.
   4. UL/Underwriters Laboratories
      a. 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.
      b. 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.

H. Drainage
   1. Drainage and slope are design considerations, and should be evaluated by the specifier in accordance with all applicable building codes and industry standards.
   2. 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.
   3. The NRCA and prevailing building codes recommend that a minimum roof slope of ¼" (6.4 mm) per foot be obtained to facilitate proper drainage and maximize long-term performance of the roof system. Firestone recommends following the NRCA guidelines.
   4. 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.
   5. Slope may be achieved by tapering the structure or through the use of tapered ISO 95+™ or RESISTA™ polyiso insulation; a sufficient number of roof drains should also be specified and properly located to allow for positive drainage.

6. Tapered insulation formed into edges, saddles or crickets is recommended to alleviate incidental areas of ponding water.
7. 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.

I. Vapor Barriers and Air Barriers

1. The need for a vapor barrier or air barrier is the decision of a design professional.
2. 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.
3. **Firestone V-Force™ Vapor Barrier Membrane** should be used whenever a vapor barrier is specified in a Firestone roofing system.

J. Construction Generated Moisture (CGM)

1. CGM typically occurs to increased moisture created during construction by a number of 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 a number of 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 to 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 necessity and location 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 location within the roof assembly to where condensation will not be allowed to form.
   d. Specifying a fully adhered roof assembly.

1.01.2 Warranty

The following Firestone warranties include the Firestone brand materials and the workmanship of the Firestone Red Shield Applicator, when the system is installed in compliance with all technical specifications per the Firestone Technical Database http://technicaldatabase.fsbp.com/.

A. The Firestone Red Shield™ Warranty

1. 5, 10, 15, or 20 years.
2. Covers repair of any leak warrantable in nature.
3. No Dollar Limit (NDL), Non-prorated, no limit to man hours necessary to perform repairs.
4. Includes all Firestone roofing products used in the roofing system.

B. The Firestone Red Shield Medallion™ Warranty

1. 25 years.
2. All details must be installed according to 30-year standards.
3. Covers repair of any leak warrantable in nature.
4. No Dollar Limit (NDL), Non-prorated, no limit to man hours necessary to perform repairs.
5. Includes all Firestone roofing products used in the roofing system.

C. Extended Warranty Coverage

1. The warranties listed above are eligible for the following extended coverage, within specific design limitations. Contact your Firestone Roof Systems Advisor regarding design limitations.
   a. Increased Wind Speed (72-120 mph, depending on system criteria).
   b. Hail up to 2" in diameter.
   c. Incidental Cuts & Puncture (reinforced single ply membranes only).

D. The Firestone Platinum™ Warranty

1. 30 years.
2. Covers repair of any leak warrantable in nature.
3. No Dollar Limit (NDL), Non-prorated, no limit to man hours necessary to perform repairs.
4. Includes all Firestone roofing products used in the roofing system.

E. Firestone Membrane Warranties

1. The Firestone Membrane Limited Warranty
   a. 5, 10, 15, or 20 years.
   b. Covers leaks caused by manufacturing defect or premature aging.
   c. Prorated and limited to cost of replacement membrane.

F. Other Firestone Warranties

1. AcryliTop PC-100 Adhesion Warranty.
2. AcryliTop PC-100 Reflectance Warranty.
3. ISO 95+ Thermal Resistance Warranty.

1.01.3 Quality Assurance

A. Materials

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.

B. Technical Deviations

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

C. Inspection

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

1.02 APP MODIFIED BITUMEN PRODUCTS

A. Phased Construction / Temporary Roofing:

1. Phased Construction
   a. Phased Construction is defined by the NRCA as "The installation of a roof system in two or more separate time intervals. Final surfacing is not considered a phase, and can be delayed in its application." Final surfacing, as defined by Firestone, is a flood coat and gravel or an approved roof surfacing, such as Firestone AcryliTop. In this definition, the granule cap sheet in a roof system is not considered the final surfacing and should not be phase constructed.
   b. Firestone does not recommend phased construction. Phased construction results in unprotected roof sections, which can allow moisture into the base 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
   c. A better option than phased construction is a temporary roof, which 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.

2. Temporary Roofing
    a. If installation of the roof system is required during unsuitable weather, or before completion of wood blocking, curbs, penetrations, or the erection of walls, a temporary roof may need to be installed.
    b. The base plies for the Firestone roof system are not to be considered a temporary roof as the base plies are an integral component of the roof system.
    c. If a temporary roof is needed to meet construction requirements, Firestone recommends installing a modified asphalt base sheet or two fiberglass roofing plies in an appropriate adhesive over an approved substrate, to be used as the temporary roof. 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.
    d. 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.
    e. When a temporary roof is specified as a vapor retarder, precaution shall be exercised in protecting the temporary roof from other construction tradesmen. 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.
    f. For additional information regarding temporary roofs, refer to the NRCA's Roofing and Waterproofing Manual.
    g. The determination of the necessity and location for a vapor retarder or an air barrier are project specific requirements, which is the responsibility of the building owner or his 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. Vapor Retarders
    1. 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. The inclusion of an air barrier or vapor retarder may affect the Underwriter Laboratory or Factory Mutual rating including the attachment of the Firestone roof system.
    2. A vapor retarder may be necessary when high interior humidity is of concern. High interior relative humidity is present in swimming pools, 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.
    3. 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.
    4. Vapor retarders are installed to prevent several types of roof assembly failures:
        a. Wet insulation becomes a conductor of heat rather than an insulator and reduces insulation R-value.
        b. Moisture promotes the deterioration of the roof membrane, insulation, structural decks, and associated building components.
        c. Moisture promotes delamination of roof components by freeze/thaw cycling, eventually causing blisters and delamination when vapor pressure results from solar heating.

5. The following is a partial list of situations which can influence the need for a vapor retarder:
    a. Building usage as related to vapor drive.
    b. External temperature in relation to internal temperature.
    c. The humidity of the interior and/or exterior air.
    d. Building code requirements.
    e. Construction generated moisture, particularly during winter construction.
6. A vapor retarder's effectiveness generally depends upon the following factors:
    a. The vapor retarder's perm (permeance) rating which should be as close to zero as possible.
    b. Location of the vapor retarder within the system.
    c. The integrity of the vapor retarder's seals at perimeters and penetrations.
    d. The integrity of the vapor retarder's membrane after other tradesmen finish their projects.
7. 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.
8. Contact one of the four generally accepted agencies for help in determining the need for a vapor retarder. They are:
    a. National Roofing Contractors Association (NRCA) guidelines
    b. U. S. Army Corp of Engineering Cold Regions Research and Engineering Laboratory (CRREL) guidelines
    c. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
    d. Oak Ridge National Laboratory (ORNL)
9. Vapor Retarder properties:
    a. A vapor retarder is defined as 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:
        i. Water vapor pressure difference across the roof assembly.
        ii. Resistance of materials along the migration path. Some materials have more resistance than others. Placing a high-resistance material in a roof assembly may help control moisture migration
    b. Vapor retarders are intended to limit moisture diffusion. Therefore, the main property requirement of a vapor retarder is low water vapor permeance. Water vapor permeance is defined as:

        "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".
10. Design Responsibility
    a. 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 more 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 a vapor retarder. The inclusion of an air barrier or vapor retarder may affect the Underwriter Laboratory or Factory Mutual rating including the attachment of the Firestone roof system.
    b. The list below, are examples of common vapor retarder applications.
        i. 2 plies of Mopped Firestone Type IV (4) M or VI (6) M Ply Sheet over a nailed Firestone MB Base Sheet.
        ii. Mechanically attached fiberglass or polyester venting base sheet with 18” (457 mm) side and end laps covering the fasteners, mopped with Firestone approved hot asphalt.
        iii. Existing dry and sound uninsulated built-up roof system (all splits and blisters repaired).

iv. Mopped Firestone Type IV (4) M or VI (6) Ply Sheet over an existing dry and sound uninsulated built-up roof system. If gravel surfaced, then gravel shall be removed by power brooming, vacuuming and spudding.
v. 2 plies of Mopped Firestone Type IV (4) M or VI (6) Ply Sheet set in Firestone approved hot asphalt over an acceptable mechanically attached barrier board.
vi. 2 plies of Mopped Firestone Type IV (4) M or VI (6) Ply Sheet set in Firestone approved hot asphalt directly on a properly prepared structural concrete deck.
vii. Fully adhered Firestone APP Base Sheet set in cold adhesive, or APP Torch Base heat fused, over an acceptable mechanically attached barrier board.
viii. Fully adhered Firestone APP Cool Base Sheet set in cold adhesive, or APP Torch Base heat fused, directly on a properly prepared structural concrete deck.
ix. The inclusion of an air barrier or vapor retarder may affect the Underwriter Laboratory or Factory Mutual rating including the attachment of the Firestone roof system.

c. It is the roof system designer's responsibility to:
i. Assure that the methods of attachment of the roof system to the vapor retarder selected are approved by Firestone and compatible with the roof system.
ii. Assure 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.
iii. Take the appropriate steps necessary to deal with the effect of construction moisture on a new roofing system, particularly during winter, when temporary propane heat is required.

C. Air Barriers

1. 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.
2. Air barriers are a component of building envelope systems that control the movement of air into and out of buildings.
3. 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.
4. Air barrier systems are generally comprised of building components and materials that have an air permeability not exceeding 0.004 cfm/ft^2 under a pressure differential of .3 in. water.
5. 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 are interfaced with each other. Firestone recommends that the individual manufacturers of these products provide written certification that their products, when used together, meet this requirement.
6. If the air barrier is to perform its intended role, it must meet a number of requirements:
   a. Continuity: the assembly must be linked together to ensure that there is no break in the air tightness of the envelope.
   b. 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.
   c. Air Impermeability: A major requirement of an air barrier is that it offers a high resistance to airflow.

d. 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)

1.03 SUBSTRATE AND SUBSTRATE REQUIREMENTS

A. General:

1. The Firestone roof system depends on a suitable substrate to perform its intended function of weatherproofing the building.
2. It is the roofing contractor's responsibility to ensure that the substrate is acceptable for the Firestone roof system
3. The substrate to which the Firestone roof system is installed must:
   a. Be structurally sound.
   b. Be dry, smooth, flat and clean.
   c. Be free of sharp fins, or foreign materials that could damage the membrane.
   d. Meet the minimum requirements for the system.
4. Concrete decks must cure for a minimum of 28 days so that the surface will be dry prior to the application of a roof membrane.
   a. NRCA recommends that concrete decks be tested for adequate dryness by two methods:
      i. Condensation Dryness Test: Place an 18" x 18" piece of window glass in contact with the deck and secure it with gun-grade silicon sealant. If moisture droplets appear after exposure to the midday sun for two hours, additional cure time is required.
      ii. Hot Bitumen Test: Pour a small amount of hot Type III or Type IV asphalt that has been heated to 400 °F onto the surface of the deck, and allow it to cool. If the deck is adequately dray, the asphalt cannot be peeled up in one piece and will have to be chipped off. If the deck surface iw too wet, the asphalt cal be peeled up in one piece.
5. When using Firestone approved hot asphalt to adhere approved insulation or ply sheets 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 1-1/2 to 2 gallons per 100 square feet (0.61 to 0.82 L/sq. m) and allowed to fully cure prior to application of insulation or roof membrane.
6. Concrete additives can have a negative impact on the adhesion of asphaltic membranes and insulation products. As a result, Firestone does not accept for warranty, freshly poured concrete decks that contain concrete additives used to modify curing.
7. Firestone does not accept for warranty any concrete substrates that have been sealed with chemical sealers or silicon surface treatments.
8. When applying BASEGARD™ SA to ISOGARD™HD, RESISTA, ISO95+ GL, SECUROCK or DensDeck, a Firestone APP torch cap must be heat welded in place over the BASEGARD SA sheet to adhere it properly to the insulation.
9. To avoid blister formation Roof substrates must be clean, dry and free of debris.

B. Fastener Pullout Requirements:

1. Substrates for membrane and or the insulation attachment are required to provide sufficient pullout resistance for the fasteners and the roof system.

Table 1.03-1
The Minimum Fastener Pullout Resistances For Specific Systems

System	Minimum Fastener Pullout
Insulation Mechanically Attached to Deck	300 lb (136.1 kg)
Base Sheet Mechanically Attached to Deck	300 lb (136.1 kg)
Base Sheet Nailed to Deck	40 lb (18.1 kg)
Contact your Roof Systems Advisor at 800-428-4511 when the structural deck does not meet the minimum fastener pullout requirements.	

2. See the Firestone Attachment section of this Guide for the minimum adhesive pull test requirements for insulation adhesives.
3. Pullout Tests: 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, the fastener manufacturer's representative or the roofing contractor, to determine actual pullout values. The following deck types are those which may not provide sufficient pullout resistance:
   a. Steel decks thinner than 22 gauge (0.76 mm).
   b. Concrete less than 3000 psi (20,684 kPa).
   c. Plywood or oriented strand board less than 7/16" (11.1 mm) thickness.
   d. Wood plank less than 3/4" (19 mm) thickness.
   e. All poured or pre-cast gypsum, cementitious wood fiber and lightweight insulating concrete decks.
   f. Existing masonry or brick.
   g. Any other substrate that does not have a published pullout capacity greater than the minimum required for the applicable roof system.
      i. The sections of the substrate where integrity is most in question should be used for testing. Test areas should include corners and drain areas and perimeters. The recommended minimum number of pullout tests are as follows:

Table 1.03 –2
Recommended Number of Pullout Tests

Roof Size		Number of Pullout Tests
Less Than 10,000 ft^2	Less Than 1,000 m^2	6
10,000 ft^2 - 50,000 ft^2	1,000 m^2 – 5,000 m^2	10
50,000 ft^2 - 100,000 ft^2	5,000 m^2 – 10,000 m^2	20
Over 100,000 ft^2	10,000 m^2	1 per 5,000 ft^2/ 500 m^2

      ii. 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 bid for potential increased fastening requirement).

C. Moisture Considerations:
   1. 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.
   2. A moisture survey should be conducted to determine the moisture content of any existing roof system component. All damaged and/or wet components of the existing system that would be detrimental to the new Firestone system must be removed prior to its installation.

3. Failure to remove any existing system components that could cause damage to the new Firestone roofing system may void the warranty.
4. The best diagnostic technique is by taking and evaluating a series of roof cores.
5. Three techniques are currently available to evaluate the roof by non-invasive means. Results of these studies must still be correlated with roof cores. These techniques provide measurements of factors that can be associated with the presence of moisture.
6. Building codes may require a specific minimum slope for drainage. It is the building owner or his design professional's responsibility to consult with the controlling code agency official(s) to determine the specific requirements of each project and each system.
7. When interior drains are necessary, they must be installed at the low points of a sloped roof deck and maintained in a working condition.

D. Drainage and Slope:
   1. Firestone requires a minimum of 1/4 inch (6.4 mm) per 12 inches (304.8 mm) slope, unless specified otherwise as a condition for warranty approval, to facilitate proper drainage and maximize long-term performance of the roof system.
   2. 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.
   3. Adequacy of drainage provisions, placement, sizing and/or number of drains required is the responsibility of the building owner or his design professional. Drainage conditions should meet the requirements of applicable codes as well as standard industry recommendations.
   4. In re-roofing or re-cover situations, analysis of the existing drainage conditions is the responsibility of the building owner and/or his design professional. Existing deck deflection or ponding water may necessitate the upgrading of drainage provisions, including relocation of existing drains, possible addition of new drains, increased bar joist support, etc. Firestone does not design roof drainage systems or assume any liability for the adequacy (or lack thereof) of roof drainage systems or facilities.
   5. 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, size, and located to provide satisfactory and rapid drainage of the entire roof surface (within 24 to 48 hours of precipitation). Although, a minimum roof slope of 1/4" (6.4 mm) per foot is recommended by NRCA, other slopes may be acceptable to receive a Firestone warranty.
   6. Tapered ISO 95+ 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+ is available in slopes from 1/16" to 1/2" per foot. Firestone provides a variety of technical support services for the installation of tapered insulation through the ***Firestone Tapered Engineering Design Department***.
   7. The following are some of the reasons why proper roof drainage is important:
      a. Standing water can result in deck deflection and possible structural damage.
      b. Water on the roof can promote vegetation, fungi and bacterial growth.
      c. 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.
      d. It is required by many, if not all, building codes.
      e. Proper drainage of the roof system prevents premature deterioration of the roof membrane and roof components.

E. Cant Strips:
   1. 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.

2. Cant Strips are required at all angle changes, greater than 45o, between the vertical and horizontal plane.
3. Acceptable Cant Strip materials:
   a. Wood or preservative-treated wood
   b. Wood fiber
   c. Perlite
   d. Primed concrete
4. Depending on the cant strip material, cant strips may be set in Firestone approved hot asphalt, Firestone Multi-Purpose MB Flashing Cement, or mechanically attached with acceptable fasteners and plates.

   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. Cant material maybe treated with Firestone Flame Out to help reduce the possibility of ignition.
5. If cants are concrete, they must be primed with ASTM D 41 primer prior to installing the roofing membrane and related flashings.

F. Wood Nailers:
1. For new construction projects, wood nailers must be kiln-dried (Southern Pine, Douglas Fir) structural grade #2 or better.
2. Wood nailers by others; make these specifications and details available when others will install nailers. Work that compromises the integrity of the system may jeopardize the warranty.
3. 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, #2 or better lumber. 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.
4. Due to EPA regulations regarding treated wood, new 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 the more corrosive materials.
5. Chemical treating for fire resistance or other purposes (other than pressure treating for rot resistance, i.e. CCA, ACZA, CBA, ACQ or other copper treatments) may affect the performance of the Firestone membrane and accessories. Contact your Roof Systems Advisor at 800-428-4511 when using chemically treated lumber that will come in contact with the membrane.
6. Firestone requires wood nailers at the following locations:
   a. All roof edges.
   b. Metal penetration pockets.
   c. Wood nailers must totally support all sheet metal flanges.
   d. Refer to Firestone Details for other location requirements.
7. The wood nailer may be omitted when metal flanges are more than 12 inches on a side and when metal flanges are placed and secured directly to the deck.
8. Firestone All-Purpose (AP) Fasteners may be used for attachment to wood decks for all Firestone Red Shield, Medallion and Platinum warranted roofing systems. Testing with the Firestone AP Fastener in wood decks has yielded outstanding pullout values, and applies to all types of wood decks: OSB, Tongue-and-Groove, Wood Plank, etc.
9. The building owner or his design professional must specify a wood nailer attachment system that will resist a minimum force of 200 lb per foot (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.

G. Expansion Joints:

1. The determination of the necessity and location for expansion joints is a project specific requirement, which is the responsibility of building owner or his design professional. Typical consideration for selection criteria may be one or more of the following:
    a. Where expansion or contraction joints are provided in the building structural system.
    b. Roof expansion joints must be located to accommodate movements caused by thermal expansion and building structural movement.
    c. Where structural framing elements such as joists, rafters, purlin, or steel decking change direction.
    d. Deck material changes (e.g. from steel to concrete deck). Where different types of roof decks such as concrete and steel abut each other.
    e. Where additions are connected to existing buildings.
    f. At junctions where interior heating conditions change such as a heated space abutting an unheated space.
    g. Where movement between vertical walls and the roof deck is anticipated.
    h. Roof areas greater than 200 feet (61 m) on any direction.
    i. Coordination and sequencing of expansion joint closure systems and their continuity, compatibility and function of seal is the responsibility of the design team.

    Note: The conditions above may not be inclusive. Other conditions may exist in which expansion joints should be considered.
2. Expansion joints must not restrict the flow of water.

H. Area Dividers, Control Joints:
1. 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.
2. 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 his design professional.
3. The areas of the roof should be rectangular in shape and uniformly spaced where possible.
4. Roof area dividers are recommended for the following conditions:
    a. Roof areas greater than 200 feet (61 m) on any direction.
    b. 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.
    c. Where expansion joints are not provided in the building structure, area dividers may be used to help control thermal stresses within the roof assembly.
5. Area dividers and control joints must not restrict the flow of water or cross roof areas considered for expansion joints.

I. Sloped Roofs:
1. The building owner or the 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.
2. When the slope of the roof exceeds ½ ": 12” (4.2%), and hot asphalt attachment is specified, Firestone requires that only Firestone approved SBES Mopping Asphalt or ASTM D 312 Type IV (4) or CSA A123.4 Type III (3) asphalt be used.
3. Contact your Roof Systems Advisor at 800-428-4511 for additional requirements regarding roof slopes over 3": 12" (25%).
4. For roof slopes up to and including ½ ": 12" (4.2%), the side laps can be installed parallel or perpendicular to the slope.
5. For roofs slopes greater than ½ ": 12" (4.2%), the membrane must run parallel to the slope.

Table 1.03-3
Back-Nailing Requirements for Sloped Roofs

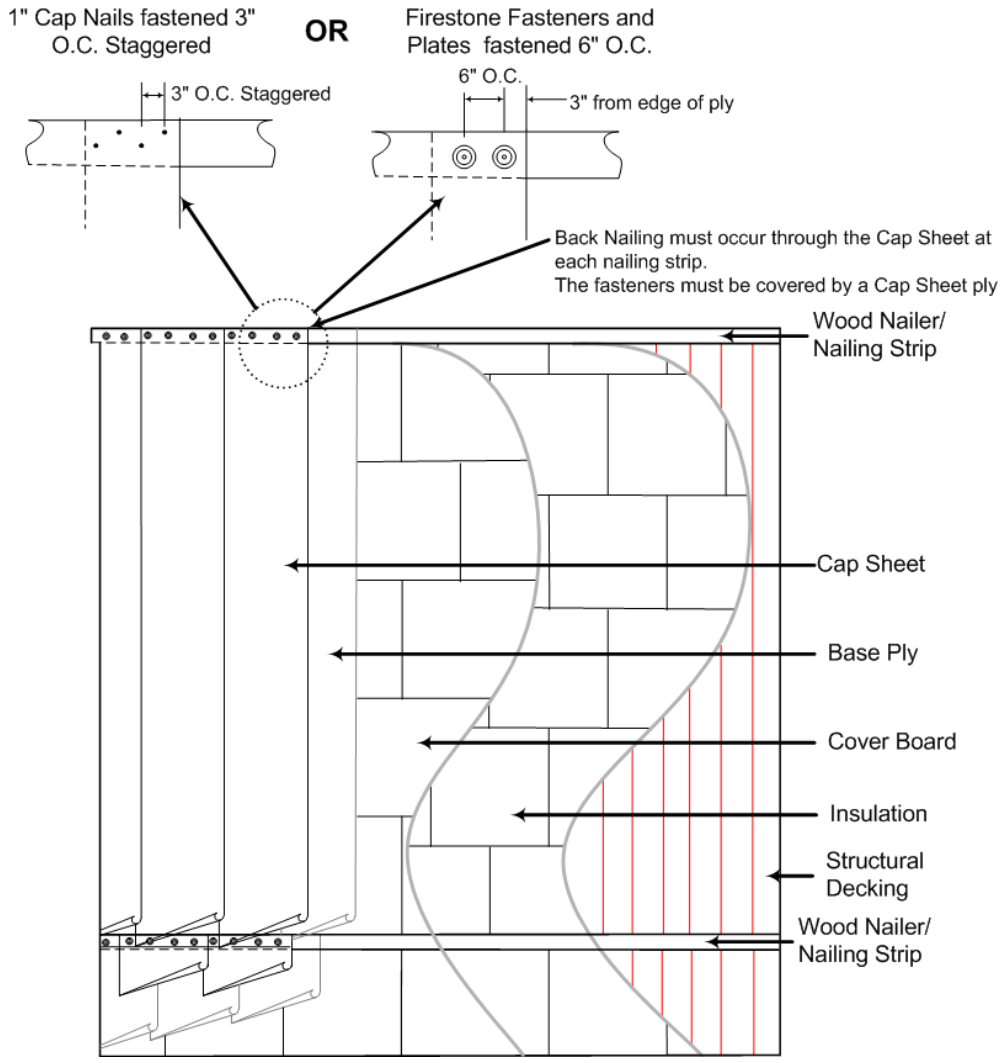
Cap Sheet	Attachment	Base Sheet	Attachment	≤1/2" (4.2%)	≥1/2" ≤1" (4.2% 8.3%)	≥1" (8.3%)	≥1"to ≥3" (8.3% 25%)
Any Applicable APP Cool Granule surfaced Cap Sheet	Firestone Multi-Purpose MB Cold Adhesive	Any Sand Surfaced Firestone APP Base Sheet	Heat Fused, Mechanically Attached, or Firestone Multi Purpose MB Cold Adhesive	NFR	NFR	Nailers 32' o.c. Full Length Sheet	Nailers 32' o.c. ½ Length Sheet
Any Applicable APP Cool Granule Surfaced Cap Sheet	Firestone Multi-Purpose MB Cold Adhesive	Any two Sand Surfaced Firestone APP Base or Ply Sheet	Heat Fused, Mechanically Attached, or Firestone Multi Purpose MB Cold Adhesive	NFR	NFR	Nailers 32' o.c. Full Length Sheet	Nailers 32' o.c. ½ Length Sheet
Any Applicable APP Granule Surfaced Cap Sheet	Heat Fused	Any Applicable Firestone Base Sheet	Self Adhered, Heat Fused, Mechanically Attached, or Firestone Multi Purpose MB Cold Adhesive	NFR	NFR	Nailers 32' o.c. Full Length Sheet	Nailers 32' o.c. ½ Length Sheet
Refer to Firestone MB-LS-9 for detailed back-nailing requirements.							
NFR – No Fastener Required at This Slope							

J. Insulation Stops and Back-nailing Nailing Strips:
   1. Back-nailing nailing strips are required on all roofs with slopes greater than 16.6% (2":12")
   2. Insulation stops and are recommended on all roofs with slopes greater than 16.6% (2:12)
   3. Back-nailing nailing strips and Insulation stops shall be a minimum of 3 1/2" (88.9 mm) 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 per lineal foot (2.9 kN/m) minimum.
   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 recommended.
   6. Contact your Roof Systems Advisor at 800-428-4511 for information regarding back-nailing requirements utilizing approved insulation less than 1 inch.

K. Back-nailing APP Modified Bitumen Base and Cap Sheets:
   1. Non-Nailable Decks and nailable Decks with Insulation:
      a. Cut the cap sheet to conform to nailer spacing. Using capped nails or Firestone screws and plates, nail the end lap across the width of the sheet, with the first nail spaced 3/4" (19 mm) from the leading edge of the sheet. The remaining nails are to be spaced approximately 3" (76.2 mm) 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 per end lap are required.
   2. Nailable decks with no insulation:
      a. Cut the cap sheet to conform to nailer spacing. Using capped nails or Firestone fasteners and plates, nail the end lap across the width of the sheet, with the first nail spaced 3/4" (19 mm) from the leading edge of the sheet. The remaining nails are to be spaced approximately 3" (76.2 mm) on center. The nails should be staggered

across the width of the nailer. Firestone fasteners and plates may be used in lieu of cap nails. Four per end lap are required.

3. Cap nails must have 1" (25.4 mm) 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.
4. End laps must extend a minimum of 6 inches beyond the edge of the fastener. For example, when fasteners and 3" plates are used (as shown below) each end lap must be a minimum of 9 inches.



1.04 FASTENERS

A. General:

Refer to the Technical Information Sheet (T. I. S.) 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.

1. Roof systems rely on the attachment of the components to the deck substrate to perform its basic functions. Wind creates uplift forces on the roof; therefore, the overall holding power of the fasteners is 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:
   a. How the fastener(s) might affect the deck.

b. The capability of the deck to hold the fasteners and roof system in place in a wind related event.

2. The structural integrity of the deck may have been 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.
3. For retrofit roof systems, Firestone HD Fasteners must be used for 15-year or greater warranty, when mechanically fastening insulation using fasteners and plates.
4. For new and replacement roofing, Firestone HD Fasteners must be used for a 20-year Red Shield Warranty, when mechanically fastening insulation using fasteners and plates

B. Cap Nails:

1. Cap nails must be FM Approved, and have 1" (25.4 mm) 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 with the exception of light weight 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.
4. Firestone Polymer Fasteners cannot be used with heat welded systems.

Table 1.04-1
Allowable Fastener and Substrate Configurations

Firestone Fastener	Acceptable for 20-year Warranty	Steel Decks	Structural Concrete Decks	Plywood or OSB Decks	Cementitious Wood Fiber Decks	Gypsum Decks	Lightweight Insulating Concrete Decks	
							(See Section 1.06 H for additional requirements)	
Fastener							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. Insulation may not be attached with LWC Base Ply Fastener.							
#12 Belted Fastener		✔		✔				
#15 Belted Fastener	✔	✔		✔				
Nail Driver				✔				
	For the attachment of base sheets. 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.							

✔ = Acceptable for use

Table 1.04-2
Acceptable Fasteners

Firestone Fastener		For the attachment of the following materials:			
		Roofing Insulation (In combination with Firestone Insulation Plate)	**Base Sheets** (In combination with Firestone Insulation Plate)	**Termination Bars**	**Other Accessories**
T.I.S. Sheet #	Fastener	See the specific fastener TIS for specific application data			
1001	All-Purpose Fastener	✔	✔	✔	✔
1002	Heavy-Duty Fastener	✔	✔	✔	✔
1005	Concrete Drive Fastener	✔	✔	✔	✔
		Do not use with polymer batten strips.			
1006	Polymer Fastener	✔	✔		
		Special battens and plates required.			
1007	Firestone AccuTrac Kit	✔	✔		
		Insulation to steel and wood roof decks with Buildex AccuTrac installation equipment. A kit consists of both fasteners and insulation plates for the AccuTrac tool.			
1012	LWC Base Ply Fastener		✔		
		For the attachment of base sheets. Insulation may not be attached with LWC Base Ply Fastener			
1013	#12 Belted Fastener	✔	✔		
		Insulation to steel (18-24 gage) and wood. Belted fasteners must be installed with the IF160 automatic installation tool available from SFS INTEC. When used for insulation attachment, the Firestone IFC/PH 2.75” x 2/75” (70 mm x 70 mm) plate is used.			
1014	#15 Belted Fastener	✔	✔		
		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. When used for membrane attachment, the Firestone 2 3/8” (60.3 mm) diameter plate is used. When used for insulation, the Firestone 2.75”x 2.75” (70 mm x 70 mm) plate is used.			
1015	Nail Driver		✔		
		Cap nails are to be used to attach a base sheet to a wood deck and cannot be used to attach insulation. Cap nails cannot be used to attach a base sheet through an existing built-up roof when the roof thickness is over 1/2” (12.7 mm).			
	HailGard Fastener	✔			
		For use with Firestone HailGard Insulation and OSB to approved decks. No insulation plate required.			
✔ = Acceptable for use					

1.05 DECKS

A. General:

1. 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.
2. Deteriorated decks should be repaired or replaced.
   a. All holes, deformations, depressions, etc. must be reinforced and /or smoothed prior to the roof application.
   b. Acceptance of a deck for re-roofing is the responsibility of the building owner or his design professional.
   c. The deck should provide a minimum of ¼"/foot slope to drain.
   d. Phenolic insulation must be removed prior to reroofing.
   e. Sprayed-In-Place polyurethane foam (PUF) roof systems require a COMPLETE TEAROFF of the foam system prior to reroofing.

B. Classification:

1. 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. Firestone has fasteners that are approved for use with these decks.
2. Structural decks can be classified as combustible or non-combustible for purposes of fire ratings and code requirements.

TABLE 1.05-1
Structural Deck Classification

Deck	**Nailable and Non-nailable**	**Combustible or Non-combustible**
Steel	Non-nailable	Non-combustible
Concrete	Both	Non-combustible
Wood	Nailable	Combustible
Cementitious Wood Fiber Decks	Both	Non-combustible
Gypsum	Nailable	Non-combustible
Lightweight Insulated Concrete	Nailable	Non-combustible

C. Steel Decks:

1. Firestone recommends that the steel deck be a minimum 22 Gauge (0.76 mm).
2. Factory Mutual Research-Approved steel decks are currently available in 22 gage (.0295 in., 0.794 mm), 20 gage. (.0358 in., 0.909 mm) and 18 gage (0.0474 in., 1.204 mm) thick sheets with 1.5 inch (38 mm) deep corrugations. The corrugations (ribs) are cold rolled in the sheets. The deck has a 6 inch (152 mm) module, that is, the ribs are 6 inches (152 mm) 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 inch (76 mm) deep deck, which usually has an 8 inch (203 mm) module.
3. When mechanically attaching insulation, steel decks are required to have a minimum fastener pullout strength of 300 lb per fastener.
4. The Firestone base sheet or cap sheet may not be adhered directly to a steel deck. Cap sheets and Base Sheets must be adhered to an acceptable insulation or coverboard.

5. On steel decks, the edges of insulation boards running parallel with the deck are required to be supported by the top flange of the metal deck. The board should have a minimum 1-1/2” (38.1 mm) bearing on the steel deck flange. Cantilevering insulation boards over deck flutes can fracture insulation boards, reducing the support for the membrane, making it susceptible to puncture.
6. It is a Firestone requirement for warranty that all phenolic insulation be removed prior to reroofing. Once removed, a visual inspection of the deck condition and other components is required. It is the building owner or his design professional’s responsibility to determine the condition of the deck. All deteriorated components must be replaced as necessary.

Table 1.05-2
Insulation Attachment for Steel Decks

Acceptable Insulation Fasteners		Acceptable Insulation Adhesives
Firestone Heavy Duty Firestone All Purpose Belted Fasteners	3/4" (19mm) through deck.	Firestone I.S.O. SPRAY Firestone I.S.O. FIX Firestone I.S.O. Twin Pack Firestone I.S.O. Stick

D. Structural Concrete Roof Decks:
1. Firestone recommends that the concrete deck be a minimum 3000 Psi (20,684 KPa).
2. When mechanically attaching insulation, structural concrete roof decks require a minimum fastener pullout of 300 lb (1.8 kN) per fastener.
3. Verify with the building owner or his design professional about the suitability of mechanical fastening into pre-stressed and post-tensioned structural concrete.
4. The Firestone base sheet or cap sheet may be adhered directly to a primed poured-in-place structural concrete, using Firestone approved hot 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, free of sharp fins or foreign materials that could damage the material.
5. Concrete may contain latent amounts of moisture that may affect the insulation and the roof system. To help protect the components, a Firestone Venting Base Sheet or other vapor retarder 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.
6. The application of a Firestone base sheet or cap sheet 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 drippage 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.

Table 1.05-3
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
Firestone Heavy Duty	1" (25.4mm) into the structural concrete deck.	Firestone I.S.O. SPRAY Firestone I.S.O. FIX Firestone I.S.O. Twin Pack Firestone I.S.O. Stick Hot Asphalt can not be used with ISGARD™ HD or RESISTA.	Firestone Multi Purpose MB Cold Adhesive for APP Cool Base sheets
Firestone Concrete Drives	1-1/4" (31.7mm) into the structural concrete deck.		

E. Wood Decks –Plywood, OSB, and Wood Plank:

1. Firestone requires that wood planks be a minimum 3/4” (19.1 mm) thick.
2. Firestone requires that plywood have a minimum thickness of ½ inch and that OSB decks have a minimum thickness of 7/16" (10.5mm).
3. Firestone base sheet and cap sheets may not be adhered directly to a wood substrate. Cap and/or base sheets must be adhered to an acceptable insulation, coverboard or mechanically attached base sheet. If the membranes are to be attached to a nailed base sheet with cold adhesive a ply of sheathing paper is required under the nailed Base.
4. When mechanically attaching insulation or base sheets, wood decks are required to have a fastener pullout of 300 lb (1.8 kN) per fastener.
5. When nailing a base sheet, wood decks are required to have a fastener pullout of 40 lb (0.24 kN) for cap nails per fastener.

Table 1.05-4
Base Sheet and Insulation Attachment for Plywood, OSB, And Wood Plank Roof Decks

Acceptable Fasteners for Insulation and Base Sheet Attachment		Acceptable Insulation Adhesives
Firestone Heavy Duty Firestone All Purpose Belted Fasteners	1" (25.4 mm) into or through deck.	Firestone I.S.O. SPRAY Firestone I.S.O. FIX Firestone I.S.O. Twin Pack Firestone I.S.O. Stick LiquiGard

F. Cementitious Wood Fiber Decks:

1. When mechanically attaching insulation, cementitious wood fiber decks are required to have a fastener pullout of 300 lb (1.8 kN) for each fastener.
2. Firestone recommends that cementitious wood fibers deck have a minimum 2" (51 mm) thickness.
3. The Firestone base sheet or cap sheet may not be adhered directly to a cementitious wood fiber deck. The cap sheet and/or the Base Sheet must be adhered to an acceptable insulation, cover board or a mechanically attached base sheet.

Table 1.05-5
Base Sheet and Insulation Attachment for Cementitious Wood Fiber Decks

Fasteners for Insulation and Base Sheet Attachment		Insulation Adhesives
Firestone Polymer Fastener	1-1/2" (38.1 mm) into deck	Firestone I.S.O. SPRAY Firestone I.S.O. FIX Firestone I.S.O. Twin Pack. Firestone I.S.O. Stick

G. Gypsum Roof Decks:

1. Firestone recommends that the gypsum roof deck have a minimum 2" (51 mm) thickness.
2. When attaching insulation to a gypsum roof deck, a fastener pullout of 300 lb (1.8 kN) per Firestone Polymer Fastener is required.
3. When mechanically attaching a base sheet to a gypsum roof deck, a fastener pullout of 40 lb (.24 kN) is required per 1.2 inch (30.5 mm) LWC Base Ply Fastener.
4. The Firestone base sheet or cap sheet may not be adhered directly to a gypsum deck. The cap sheet or the Base Sheet must be adhered to an acceptable insulation, cover board or a mechanically attached base sheet.

Table 1.05-6
Base Sheet and Insulation Attachment for Gypsum Roof Decks

Insulation Fasteners	Base Sheet Fasteners	Insulation Adhesives
Firestone Polymer Fastener 1-1/2" (38.1mm) into deck.	1.2” LWC Base Ply Fastener	Firestone I.S.O. SPRAY Firestone I.S.O. FIX Firestone I.S.O. Twin Pack Firestone I.S.O. Stick LiquiGard

H. Lightweight Insulating Concrete Roof Decks:

1. Firestone requires that the lightweight insulating concrete have a minimum 2" (51 mm) thickness.
2. A vapor retarder is required under new systems with insulation.
3. When mechanically attaching insulation through lightweight insulating concrete, into a structural deck, a fastener pullout of 300 lb (1.8 kN) per fastener is required.
4. When mechanically attaching a base sheet to lightweight insulating concrete using 1.7” LWC Base Ply Fasteners, a fastener pullout of 40 lb (0.24 kN) per fastener is required.
5. Firestone base and cap sheets may not be adhered directly to a lightweight insulating concrete roof deck. The cap sheet and/or the Base Sheet must be adhered to an acceptable insulation, cover board or mechanically attached base sheet.

Table 1.05-7
Base Sheet and Insulation Attachment for Lightweight Insulating Concrete roof Decks

Acceptable Fasteners for Insulation and Base Sheet Attachment		**Acceptable Insulation Adhesives**
Acceptable Fasteners into Steel Pan		**Not Allowed**
Firestone Heavy Duty (HD's)	3/4" (19mm) Minimum penetration of fastener through steel pan	
Acceptable Fasteners Into Structural Concrete Substrate		
Firestone Heavy Duty (HD's)	1” (25.4 mm) into concrete deck	
Firestone Concrete Drives	1-1/4 ” (31.8 mm) into concrete deck	
Acceptable Fasteners for Attaching Base Sheet to Lightweight Insulating Concrete		
1.7” LWC Base Ply Fastener		

I. Partial Tear Off and Re-cover Applications:

1. **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.
2. **Recover** is the installation of a new roof system over an existing roof system.
3. 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.
4. Limitations in flashing heights may be encountered. Existing building features (i.e., 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 Roof Systems Advisor at 800-428-4511 for assistance.**

5. Confirm the structural integrity of the existing deck and specify repair or replacement as required.
6. Existing roof components are not included in the Firestone warranty.
7. It is the responsibility of the building owner and/or his agents, to verify that the existing roof system is sound and intact.
8. All re-cover or retrofit systems using adhesives for insulation attachment require a pull test to verify adhesion.
9. Refer to the *Firestone Attachment Guide* for adhesion pull test requirements for I.S.O. Fix, I.S.O. Spray S, I.S.O. Stick and I.S.O. Twin Pack
10. When using fasteners, verify that the substrate has sufficient fastener pullout resistance to meet system requirements
11. New insulation or cover board is required.
12. 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. The existing insulation must be re-secured as necessary to meet Firestone, local code, or other specified wind uplift requirements.
    c. The existing insulation must be an acceptable substrate for the new insulation and the new membrane.
13. If existing insulation is to remain, all damaged or wet components must be replaced prior to installing the new roof system.
14. Existing roof components are not included in the Firestone warranty.

Table 1.05-8
Special Attachment Considerations for Partial Tear Off and Re-cover Applications

Deck	Special Considerations
Steel and Nailable Decks (Wood Plank, Plywood, OSB, Gypsum, Cement Wood Fiber, Poured-in-place Concrete decks)	If the existing system is not sound and intact mechanical attachment of the system may be necessary.
Non-Nailable Decks (Poured-in-place Concrete decks, Pre-cast Concrete decks, Post-Tension Concrete decks)	If the existing roof system is not sound and intact, additional securement may be necessary.

J. Recover Applications:
1. Existing Built-Up and Modified Bitumen Roofs
    a. Gravel surfacing must be completely removed from existing BUR roofs.
    b. 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.
    c. All damaged or wet components must be removed and replaced prior to installing the new roof system.
    d. Existing roof components are not included in the Firestone warranty.
2. Coal Tar Pitch Built-Up Roofs
    a. New, mechanically attached insulation or a cover board is required to divorce the new roof from the existing coal tar bitumen.
    b. If existing insulation is to remain, all damaged or wet insulation must be removed and replaced prior to installing the new roof system.
    c. Loose gravel 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 remaining gravel smooth to provide a level surface.

d. Existing roof components are not included in the Firestone warranty.
e. Flow of existing coal tar into the building may occur when new fasteners penetrate an existing coal tar pitch membrane

3. Gravel Surfaced Asphalt Built-Up and Modified Asphalt Roofs
   a. New properly attached insulation or cover board is required.
   b. If existing insulation is to remain, all damaged or wet insulation must be removed and replaced prior to installing the new roof system.
   c. Existing roof components are not included in the Firestone warranty.
   d. All loose gravel or granules must be removed by vacuuming and/or, power brooming. After all loose gravel has been removed; spud the remaining gravel smooth to provide a level surface.
   e. 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.
   f. All loose gravel or granules must be removed by vacuuming and/or, power brooming. After all loose surfacing has been removed; spud the remaining gravel smooth to provide a level surface.
   g. Prime the surface using an ASTM D 41 asphalt primer.
   h. Re-secure the existing assembly as necessary to meet local code, insurance wind uplift and Firestone slope/attachment requirements.
   i. Sprayed-in-place polyurethane foam (PUF) roof systems require a COMPLETE TEAR-OFF of the Sprayed In-Place polyurethane foam system.
   j. Existing roofs over phenolic insulation requires a COMPLETE TEAR OFF of the entire roof system to the structural deck.
   k. 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

4. 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.
   c. If existing insulation is to remain, all damaged or wet insulation must be removed and replaced prior to installing the new roof system.
   d. Existing roof components are not included in the Firestone warranty.

1.06 BASE SHEET AND BASE PLIES

A. General:
   1. Depending on the substrate, base sheets may be attached with fasteners, Multi Purpose MB Cold Adhesive, Firestone LiquiGard™ Membrane Adhesive, or heat fusing as required by Firestone specifications.
   2. Firestone modified bitumen systems must be installed so that all laps shed water.
   3. BUR base sheets, base plies, or ply sheets must not be glaze coated when used as a substrate for any APP base or cap sheet.

Table 1.06-1
Allowable Base Sheet Attachments

Substrate To Which the Base Sheet Will Be Attached	Attachment Method			
	Mechanically Attached	**Heat Weld**	**Multi Purpose MB Cold Adhesive**	**LiquiGard Adhesive**
Decks				
Structural Concrete	✔	✔	✔	✔
Plywood or Oriented Strand Board	✔			
Wood Planking	✔			
Poured Or Pre-Cast Gypsum	✔			✔
Cementitious Wood Fiber	✔			
Lightweight Insulating Concrete Decks (See Section 1.06 H for additional requirements)	✔			
Recover				
Smooth Surface BUR, Uncoated		✔	✔	✔
Mineral Surface BUR Mineral Surface Modified Bitumen Gravel Surfaced BUR Coal Tar Pitch BUR Existing Single-Ply Systems	New insulation or cover board is required			
New Insulation				
ISO 95+			✔	
RESISTA			✔	✔
HailGard	✔			
FiberTop				
DensDeck* (primed)	✔		✔	
DensDeck Prime*	✔	✔	✔	✔
DensDeck DuraGuard	✔	✔		✔
SECUROCK® Gypsum Fiber	✔	✔	✔	✔
SECUROCK® Glass Mat	✔			
ISOGARD™HD			✔	✔
Perlite Insulation				
Asphalt Base Sheet		✔	✔	✔

✔ **= Acceptable for use**

*** DensDeck and SECUROCK to be applied in hot asphalt must be dry. The max Type III asphalt temperature must not exceed 450°F**

Table 1.06-2
Base Sheet Seam / Lap Width Requirements

Sheet	Interply Adhesive	Seam / Lap Width Requirements	End Lap Width Requirements
Any APP Base Sheet	Heat Fused Mechanically Attached Adhered with Multi Purpose MB Cold Adhesive Adhered with LiquiGard	3” (76.2 mm)	6” (152.4 mm)
Self-Adhered Base	Self-Adhered with Heat Fused Cap Sheet	3” (76.2 mm)	6” (152.4 mm)
MB Base Sheet	Adhered with Hot Asphalt Adhered with Multi Purpose MB Cold Adhesive Adhered with LiquiGard	2” (50.8 mm)	6” (152.4 mm)
MB Base Sheet	Mechanically Attached	3” (76.2 mm)	6” (152.4 mm)
Any non -granulated APP Cool	Adhered with Multi Purpose MB Cold Adhesive	3” (76.2 mm)	6” (152.4 mm)

Any non-granulated APP product	Heat Fused	3” (76.2 mm)	6” (152.4 mm)

B. Hot Asphalt Attachment

1. Base sheets, base plies, or ply sheets must **not** be glaze coated when used as a substrate for APP base or cap sheets.
2. **When attaching 4’ x 4’ DensDeck or SECUROCK boards in hot asphalt both products must be completely dry. The maximum asphalt temperature must not exceed 450 oF and ASTM D 312 Type III asphalt must be used. Do not encapsulate DensDeck with hot asphalt.**
3. The following are overlays over polyiso that are generally acceptable when attaching any ply sheet with Firestone approved hot asphalt:
   a. DensDeck Prime, SECUROCK Gypsum-Fiber and Firestone Fiber Top. ASTM D 312 asphalt must be used, and the asphalt temperature must not exceed 450 °F

Table 1.06-3
Approved Substrates for use with Fully Mopped BUR Base Sheets

Approved base sheets that have been attached in accordance with Firestone requirements.		
Compatible Cover Boards	Approved DensDeck Products and SECUROCK Gypsum-Fiber. Only ASTM D 312 Type III asphalt can be used	✔
Poured-in-Place or pre-cast structural concrete decks that has been primed with ASTM 41 primer.		✔
Existing properly prepared asphalt uncoated smooth BUR membrane roof.		✔
✔ = Acceptable for use		

C. Mechanical attachment of Base Sheets:

1. 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.
2. Fastening rates and patterns may vary for code compliance. Contact the local code or insurance officials before contacting your Roof Systems Advisor at 800-428-4511.
3. Base sheets can be mechanically attached through insulation to deck where appropriate Adhere to Firestone Base Sheet Seam and Lap Width Requirements

Table 1.06-4
Mechanically Attaching / Nailing Base Sheet And Deck Chart Listing Acceptable Substrates

For Retrofit and/or Re-cover Mechanically Attach Base Sheets through Insulation Into Deck and/or Through Approved Roof Systems Into Deck There Is No Insulation Deck When					Notes
Deck	**Attachment**	**Base Sheet Fastening Pattern**			
Steel Deck	Firestone Fasteners and Plates	Diagram 1.06-1		✔	Insulation or cover board required on steel decks.
Concrete Deck	Firestone Fasteners and Plates	Diagram 1.06-1	✔	✔	
	Firestone Concrete Drive Fastener and Plates	Diagram 1.06-1	✔	✔	
Plywood, OSB, Wood Planking	Firestone Fasteners and Plates	Diagram 1.06-1	✔	✔	It is recommended that rosin sheeting paper or other slip-sheet be used between the base sheet and the Plywood, Oriented Strand Board, or Wood Planking.
	Firestone Cap Nails	Diagram 1.06-2	✔		Cap nails cannot be used to attach insulation or to attach a base sheet through an existing roof.
Gypsum Decks	Firestone Polymer Fasteners and Plates	Diagram 1.06-1		✔	
	1.2” (32.1 mm) Firestone LWC Base Ply Fasteners	Diagram 1.06-2	✔		Firestone LWC Base Ply Fasteners cannot be used to: Attach insulation. Attach a base sheet through an existing insulated roof. Attach a base sheet over a gravel surfaced built-up roof. Attach through a smooth surfaced un-insulated built-up roof over 1/2" (12.7 mm) thick.
Lightweight Insulating Concrete Decks	1.7” (44.7 mm) Firestone LWC Base Ply Fasteners	Diagram 1.06-2	✔		Firestone LWC Base Ply Fasteners cannot be used to: Attach insulation. Attach a base sheet through an existing insulated roof. Attach a base sheet through coverboard, over a gravel surfaced built-up roof. Attach through a smooth surfaced un-insulated built-up roof over 1/2" (12.7 mm) thick.
	HD Fasteners and Plates	Diagram 1.06-1	✔	✔	HD fasteners can be used in concrete decks or steel decks.
	Concrete Drive Fastener and Plates		✔	✔	Concrete Drive Fasteners can be used in concrete decks.
Cementitious Wood Fiber Decks	Firestone Polymer Fasteners and Plates	Diagram 1.06-1	✔	✔	

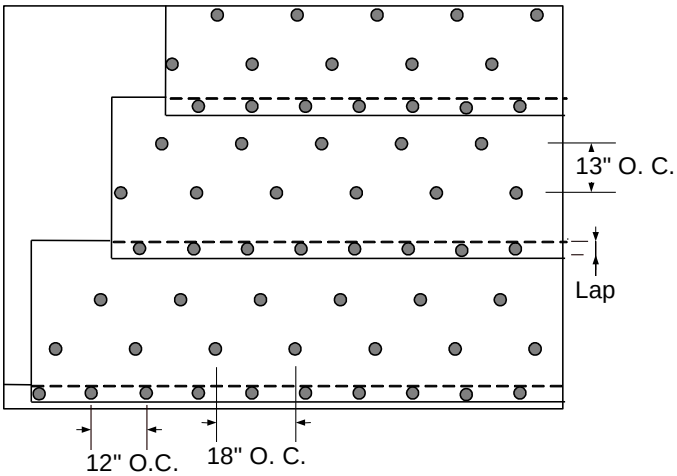
✔ = Acceptable for use Substrates must meet all requirements listed in Section 1.04.

Table 1.06-5
Base Sheet Mechanical Attachment Options

Pattern Diagram	Pattern	Notes
Diagram 1.06-1	Using Firestone insulation plates and fasteners, install two rows staggered at 18" (457.2 mm) o.c., each approximately 13" (330.2 mm) in from edge of sheet and in side laps at 12" (304.8 mm) o.c.	Contact your Technical Roof Systems Advisor at 800-428-4511 when the deck system will not provide a minimum of 300 lbf (1.3 kN) of pullout resistance per fastener.
Diagram 1.06-2	Two rows staggered at 18" (457.2 mm) o.c., each approximately 12" (304.8 mm) in from edge of sheet and in side laps at 9" (457.2 mm) o.c. Attachment pattern, plate/head size, and frequency may be different to meet code requirements.	Contact your Technical Roof Systems Advisor at 800-428-4511 when the deck system will not provide a minimum of 40 lbf (177.9 N) of pullout resistance per fastener.

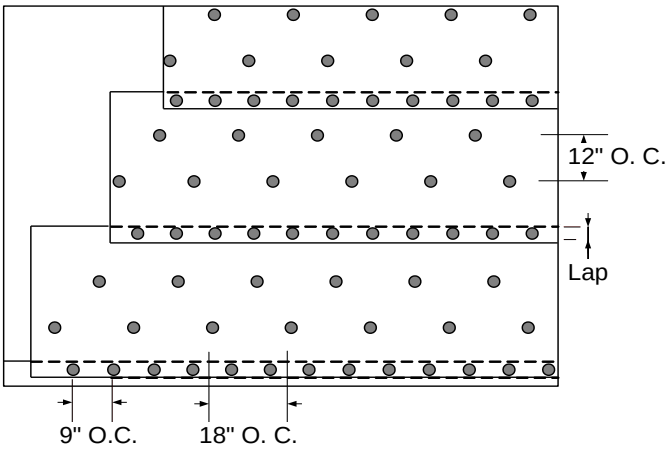
Base Sheet Fastening
Pattern Diagram1.06-1

Firestone Screws and Plates



Base Sheet Fastening
Pattern Diagram 1.06-2

Using Firestone Cap Nails
or
Firestone LWC Base Ply Fasteners



D. APP Sand Surfaced Base Sheets Installed in MB Multi-Purpose Cold Adhesive:
   1. Attachment of APP sand surfaced base sheets with Firestone Multi Purpose MB Cold Adhesive to expanded or extruded polystyrene insulation is not acceptable.
   2. Wood Fiber insulation is not an acceptable substrate for use with Multi-Purpose MB Cold Adhesive.

Table 1.06-6
Approved Substrates for APP Sand Surfaced Base Sheet Applied in Firestone Multi Purpose MB Cold Adhesive

Approved base sheets that have been attached in accordance with Firestone requirements		
Compatible insulations	ISO 95+ ISOGARD™HD RESISTA	✔
Compatible Cover Boards	Approved DensDeck Products (Dens Deck must be primed) ISOGARD™HD and SECUROCK	✔
Poured-in-place or pre-cast structural concrete decks that have been primed with ASTM 41 primer		✔
Existing properly prepared uncoated smooth asphalt BUR		✔
✔ = Acceptable for use		

E. Heat-Fused Base, Base Sheet:
   1. Attachment of base sheets by heat fusing to expanded or extruded polystyrene insulation is not acceptable.
   2. Roofing plies, base sheets or cap sheets cannot be heat fused to polyiso insulation. An overlay must be used to separate the polyiso insulation from the fully adhered heat fused ply.
   3. The following are acceptable overlays for use when attaching ply felts to polyiso:
      a. A base sheet mechanically attached through the polyiso insulation into the deck.
      b. Firestone BASEGARD SA (a cap sheet must be heat fused to BASEGARD SA.)

Table 1.06-7
Approved Substrates for Heat-Fused Base Sheet

Approved base sheets that have been attached in accordance with Firestone requirements.		✔
Compatible Cover Boards	DensDeck, DensDeck Prime and SECUROCK Gypsum-Fiber – must be dry! (Dens Deck must be primed with approved primer)	✔
Poured-in-place or pre-cast structural concrete decks that have been primed with ASTM 41 primer.		✔
Existing properly prepared uncoated smooth asphalt BUR.		✔
✔ = Acceptable for use		

F. Self Adhered Base Sheet
   1. In a two ply Modified Bitumen system that uses BASEGARD SA, a cap sheet must be heat welded to the BASEGARD SA to activate the adhesive.

Table 1.06-8
Approved Substrates for Self Adhered Base Sheet

Approved base sheets that have been attached in accordance with Firestone requirements		
Compatible insulations	ISO 95+ ISOGARD™ HD RESISTA	✔
Compatible Cover Boards	DensDeck Prime and SECUROCK Gypsum-Fiber ISOGARD™ HD	✔
Poured-in-place or pre-cast structural concrete decks that have been primed with ASTM 41 primer or SA Primer.		✔
Existing properly prepared and primed, uncoated smooth asphalt BUR.		✔

G. Base Sheets Adhered in LiquiGard membrane adhesive:

Table 1.06-9
Approved Substrates for LiquiGard Adhered Base Sheets

Approved base sheets that have been attached in accordance with Firestone requirements		
Compatible insulations	ISO 95+ ISOGARD™ HD RESISTA	✔
Compatible Cover Boards	Approved DensDeck Prime and SECUROCK ISOGARD™ HD	✔
Poured-in-place or pre-cast structural concrete decks that have been primed with ASTM 41 primer.		✔
Existing properly prepared uncoated smooth asphalt BUR.		✔
✔ = Acceptable for use		

1.07 INSULATION

A. General:

1. Only Firestone brand insulation can be included in a Firestone warranty
2. Insulation must provide a suitable substrate for the proposed roof system in addition to its function as insulation for the building.
3. Insulation thickness requirements may vary for code compliance. Contact local code and/or insurance officials before contacting your Roof Systems Advisor at Firestone Building Products.
4. Refer to the Firestone Attachment Guide for adhesion pull test requirements for I.S.O. Fix, I.S.O. Spray S, I.S.O. Stick and I.S.O. Twin Pack.
5. When using Firestone Wood Fiber/Composite flat and tapered insulation, install the ISO 95+ side down to the deck.
6. **Firestone ISOGARD™ HD should not come in contact with hot asphalt.**
7. Attachment of base sheets with Firestone Multi Purpose MB Cold Adhesive or Flashing Cement, to expanded or extruded polystyrene insulation is not acceptable.
8. 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.

Table 1.07-1
Acceptable Insulations for Use Under Asphalt Membrane Systems

System	Firestone ISO 95+ (Flat or tapered)	ISOGARD HD Composite	Firestone RESISTA (Flat or tapered)	Firestone ISOGARD™ HD	RESISTA™	Dens Deck Products - **must be dry!**
The minimum thickness of Firestone insulation acceptable for use as an immediate substrate for Firestone roof systems using a fully adhered base sheet.	1.0" (25.4 mm)	1.5" (38.1 mm)	1.0" (25.4 mm)	1/2" (12.2 mm)	1.0" (25.4 mm)	1/4" (6.3 mm)
APP Heat Fused Base Sheets	N/A	N/A	N/A	N/A	N/A	✔
APP Cool Base Sheets	✔	✔	✔	✔	✔	✔

Table 1.07-2
Insulation /Cover Board Attachment Options by Deck

Substrate To Which ISO 95+GL Insulation Will Be Attached	**Attachment Method**						
	Mechanically Attached	I.S.O. Fix	I.S.O. Spray S	I.S.O. Twin Pack	LiquiGard	Multi Purpose MB Cold Adhesive	Hot Asphalt
		Adhesive attachment may require an adhesive pull test. See the *Firestone Attachment Guide*					
Decks							
Steel	✔	✔	✔	✔	N/A	N/A	N/A
Structural Concrete	✔	✔	✔	✔	✔	N/A	✔
Plywood Or Oriented Strand Board	✔	✔	✔	✔	N/A	N/A	N/A
Wood Planking	✔	✔	✔	✔	N/A	N/A	N/A
Poured Or Pre-Cast Gypsum	✔	✔	✔	✔	✔	N/A	N/A
Cementitious Wood Fiber	✔	✔	✔	✔	✔	N/A	N/A
Lightweight Insulating Concrete Decks **(See Section 1.05 H for additional requirements)**	✔	N/A	N/A	N/A	N/A	N/A	N/A
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.						
Refer to the *Firestone Attachment Guide* for adhesion pull test requirements for I.S.O. Fix, I.S.O. Spray, and I.S.O. Twin Pack							
✔ = Acceptable for use N/A = Not Applicable							

Table 1.07-3
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	I.S.O. Spray	I.S.O. Twin Pack	Multi Purpose MB Cold Adhesive	LiquiGard
		Adhesive attachment may require an adhesive pull test. See the *Firestone Attachment Guide*				
Re-cover/Retrofit						
Existing Un-coated Smooth Surface Built-Up Roof or Modified Bitumen Roof	✔	✔	✔	✔	N/A	✔
Coal Tar Built-Up Roofs	N/A	N/A	N/A	N/A	N/A	N/A
Asphalt Gravel Surfaced Built-Up Roof	N/A	N/A	N/A	N/A	N/A	N/A
Granule Modified Bitumen Roof	✔	✔	✔	✔	N/A	N/A
Firestone recommends mechanically attaching a Cover Board over existing insulation. The responsibility of identifying and removal of damaged or wet insulation is that of the contractor.						
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 the deck condition and other components is required, all deteriorated components must be replaced as necessary					
Refer to the *Firestone Attachment Guide* for adhesion pull test requirements for I.S.O. Fix, I.S.O. Spray, and I.S.O. Twin Pack						
✔ = Acceptable for use N/A = Not Acceptable						

Table 1.07-4
Insulation / Cover Board Attachment to Insulation Options by Insulation Type

Base Layer of Insulation to which Insulation/Cover Board will be Adhered	Insulation / Cover Board to Insulation Attachment Method					
	I.S.O. Fix	I.S.O. Spray	I.S.O. Twin Pack	LiquiGard	Multi Purpose MB Cold Adhesive	Hot Asphalt
	Adhesive attachment may require an adhesive pull test. See the *Firestone Attachment Guide*					
Insulation						
ISO 95+	✔	✔	✔	✔	N/A	✔
ISOGARD™ HD	✔	✔	✔	✔	N/A	N/A
RESISTA	✔	✔	✔	✔	N/A	N/A
Dens Deck-must be primed	✔	✔	✔	✔	N/A	✔
Dens Deck Prime – must be dry!	✔	✔	✔	✔	N/A	✔
Asphalt Base Sheet	✔	✔	✔	✔	N/A	✔
Firestone recommends mechanically attaching a Cover Board over existing insulation. The responsibility of identifying and removal of damaged or wet insulation is that of the contractor.						
Refer to the *Firestone Attachment Guide* for adhesion pull test requirements for I.S.O. Fix, I.S.O. Spray, and I.S.O. Twin Pack						
✔ = Acceptable for use N/A = Not Acceptable						

B. Attachment:
   1. 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.
   2. Refer to specific Firestone Technical Information Sheets (T. I. S.) for installation and fastening requirements.
   3. Tapered insulation less than the 1.0" (25.4 mm) minimum thickness must be fastened at a rate of one (1) fastener and plate per two (2) square foot (0.22 sq. m) = 16 fasteners and plates per 4'X8' board. If possible, install the tapered insulation first, covered by the flat stock.

C. Multiple Layers of Insulation:
   1. Where overall insulation thickness is 2 inches (50 mm) or greater, Firestone recommends installing the insulation in two (2) or more layers with staggered joints.
   2. Insulation may be installed in one 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 inches (150 mm) in each direction.
   3. When a composite of two insulation layers is installed, the fastening pattern required is dependant on the top board type and thickness. A common fastener may be used to simultaneously fasten all layers to the structural deck.

D. Mechanical Attachment of Insulation and Cover Board to Approved Substrates:
   1. Insulation must be fastened with appropriate Firestone fasteners and insulation plates.
   2. Firestone All Purpose (AP's) fasteners are not acceptable for any 20-year systems or 15-year re-cover or partial tear off applications.
   3. Insulation must be installed in accordance with the fastening rate and pattern for the applicable system, as shown on the *Technical Information Sheet*.
   4. Fastening rates and patterns may vary for code compliance. Contact your Roof Systems Advisor at 800-428-4511 for specific FM Global code compliance requirements.
   5. When a composite of two insulation layers is installed, the fastening pattern required is dependant on the top board type and thickness. A common fastener may be used to simultaneously fasten all layers to the structural deck.
   6. In areas where tapered insulation thickness is below the 1.0" (25.4 mm) minimum thickness, the insulation must be fastened at a rate of one (1) fastener and plate per two (2) square foot (0.22 sq. m) = 16 fasteners and plates per 4'X8' board.

E. ISO 95+ GL Insulation Attachment with Hot Asphalt
   1. Firestone SBES Mopping Asphalt, ASTM D-312 Type III (3) or IV (4) or CSA A123.4 Type II (2) or Type III (3) must be used when hot mopping ISO 95+ GL. Choice of asphalt type must be appropriate to the roof slope.
   2. ISO 95+ GL Insulation boards, when applied using hot asphalt, require approximately 30 pounds (14 kg) of asphalt per 100 square feet (9.29 square meters) nominal application rate. A guideline for asphalt application temperature to install insulation board is the asphalt EVT less 25 to 30 degrees F (14 to 17 degrees C).
   3. Porous and irregular substrates generally require additional quantities of asphalt to assure positive adhesion of the insulation boards.
   4. ISOGARD™ HD and RESISTA™ can NOT be adhered with hot asphalt.

Table 1.07-5
Insulation Attachment Options
(Mechanical Attachment)

Structural Deck To Which Insulation/ Cover Board Will Be Attached	Attachment Method						
	Firestone All Purpose (AP) and Plates	Firestone Heavy Duty (HD) and Plates	Firestone Polymer Fasteners and Plates	Firestone Concrete Drives and Plates	Firestone Belted Fastener and Plates	Minimum penetration of fastener into/ through deck	
Steel	✔	✔			✔	3/4" (19mm) through deck	
Structural Concrete		✔		✔		Heavy Duty (HD)	1" (25.4mm) into deck
						Concrete Drives	1-1/4" (31.7mm) into deck
Plywood or OSB	✔	✔			✔	1" (25.4mm) into or through deck	
Wood Plank	✔	✔			✔	1" (25.4mm) into or through deck	
Gypsum			✔			1-1/2" (38.1mm) into deck.	
Cementitious Wood Fiber			✔			1-1/2" (38.1mm) into deck.	
Lightweight insulating concrete over steel deck		✔				Heavy Duty (HD) 3/4" (19mm) through steel pan	
Lightweight insulating concrete over concrete deck		✔		✔		Heavy Duty (HD) 1" (25.4mm) into the structural concrete deck.	
						Concrete Drives 1-1/4" (31.7mm)) into the structural concrete deck.	
✔ = Acceptable for use							

Table 1.07-6
Fastener Pullout Requirements

System	Minimum Fastener Pullout
Insulation Mechanically Attached to Deck	300 lb (136.1 kg)
Base Sheet Mechanically Attached to Deck	300 lb (136.1 kg)
Base Sheet Nailed to Deck	40 lb (18.1 kg)

F. Minimum number of fasteners and plates per insulation board:

See *Firestone T.I.S. Sheet 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 the following flat or tapered insulations. The most common fastener density and pattern requirements are shown. For non-standard fastener densities, contact your Roof Systems Advisor at 800-428-4511.

Table 1.07-7
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
Firestone ISO 95+	0.5"-1.4"	8	16
	1.5"-1.9"	6	12
	2" or Greater	4	8
Firestone ISOGARD™ HD	0.5"-1.0"	*6*	*12**
Dens Deck	0.25" or Greater	6	12
Firestone Composites	1.5" or Greater	8	16
Dens Deck Prime	0.25" or Greater	4	8

FOR MORE INFORMATION SEE *FIRESTONE T.I.S. SHEET 950 INSULATION ATTACHMENT PATTERNS*

G. Attachment of Insulation/Cover Board to Substrate with Firestone Approved Hot Asphalt:
   1. The proposed insulation or cover board must be compatible with the roof substrate, the proposed bitumen and the requirements of the Firestone roof system.
   2. Firestone Approved Asphalt ASTM D-312 Type III (3) or Type IV (4) or CSA A123.4 Type II (2) or Type III (3) must be utilized.
   3. **DensDeck products cannot be encapsulated in hot asphalt**.
   4. When using Firestone approved hot asphalt for insulation attachment:
      a. The insulation must be no larger than 4' X 4' (1.2 m X 1.2 m).
      b. All insulation joints must be staggered from adjoining and adjacent boards and adjacent layers.
      c. Follow all health and safety measures when installing Firestone approved hot asphalt to protect the installers and occupants of the building.
      d. See Section 1.03.I for slope restrictions.
   5. Expanded or extruded polystyrene insulation must not be attached with hot asphalt.
   6. ISOGARD™HD must not be attached with hot asphalt.

Table 1.07-8
Approved Substrates for Hot Asphalt Attachment Of Insulation

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		✔
Compatible insulations	ISO 95+	✔
Compatible Cover Boards	Approved DensDeck Products. Dens Deck must not be encapsulated with hot asphalt. SECUROCK Gypsum-Fiber Fiber Top (fiberboard)	✔
Poured-in-place or pre-cast structural concrete decks that has been primed with ASTM 41 primer		✔
Existing properly prepared asphalt membrane roof systems	Uncoated smooth BUR	✔
	Granule surfaced APP modified asphalt roof systems	✔
	Gravel surface built-up roof systems	✔
✔ = Acceptable for use		

Table 1.07-9
Allowable Adhesive Attachment Of Insulation /Cover Board To Structural Decks

Structural Deck To Which Insulation or Cover Board Will Be Adhered	ISO FIX			ISO Spray			ISO Twin Pack			LiquiGard			Notes
	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	
Steel	✔			✔			✔					✔	New steel decks may require cleaning to remove processing oils
New Structural Concrete	✔			✔			✔			✔			New poured decks must have a minimum 28-day drying time
Existing Structural Concrete		✔		✔				✔			✔		Existing concrete containing residual asphalt must be cleaned and scraped smooth as possible
Plywood, OSB, Wood Planking	✔			✔			✔			✔			
Cementitious Wood Fiber	✔			✔			✔			✔			
Poured Or Pre-Cast Gypsum		✔		✔				✔			✔		
Lightweight Insulating Concrete Decks **(See Section 1.06 H for additional requirements)**			✔			✔			✔			✔	

New Base Layer Of Insulation Or Asphalt Base Sheet To Which Insulation Or Cover Board Will Be Adhered	ISO FIX			ISO Spray			ISO Twin Pack			LiquiGard			Notes
	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not- Acceptable	
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			✔			✔			✔			✔	
Approved Firestone APP Sheets with surface pre-treatment			✔			✔	✔					✔	Millennium Surface Treatment

Table 1.07-10
Allowable Adhesive Attachment Of Insulation /Cover Board To Retrofit / Recover

Re-cover / Retrofit to which Insulation or Cover Board will be adhered	ISO FIX			ISO Spray			ISO Twin Pack			LiquiGard			Notes
	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	Acceptable	Pull Test Required	Not-Acceptable	
Smooth Surface BUR		✔		✔				✔			✔		
BUR with Gravel Removed Uncoated Smooth Surface BUR Mineral Surface SBS Modified Bitumen Mineral Surface APP Modified Bitumen		✔		✔				✔			✔		All interruptions in the existing roof membrane must be re-sealed to prevent air infiltration.
Uncoated APP Modified Bitumen			✔			✔		✔				✔	With surface pre-treatment
Coal Tar Pitch BUR			✔	✔				✔				✔	With surface pre-treatment
Existing Single-Ply Systems		.	✔			✔			✔			✔	

H. Adhesive Attachment of Insulation/Cover Board to Substrate:
   1. Firestone I.S.O. SPRAY S, I.S.O. FIX, I.S.O Stick, I.S.O. Twin Pack and LiquiGard Adhesive:
      a. The insulation must be no larger than 4’ X 4’ (1.2 m X 1.2 m).
      b. Stagger all insulation joints from adjoining and adjacent boards and adjacent layers.
      c. Refer to the Firestone Attachment Guide for adhesion pull test requirements for ISO Fix, ISO Spray, and ISO Twin Pack.
   2. Firestone insulation adhesives must be applied in accordance with the installation instructions and Technical Information Sheets (TIS).
   3. Assure that all safety measures are followed when installing insulation adhesives to protect the installer as well as the occupants of the building.
   4. Existing decks containing residual asphalt must be cleaned and scraped smooth as possible.
   5. Existing decks shall be smooth, flat, clean, dry, free of sharp fins, or foreign materials

1.08 ROOF MEMBRANE / CAP SHEET

A. General:
   1. Never use hot asphalt to adhere APP products.
   2. Bur base sheets, base plies, or ply sheets must not be glaze coated when used as a substrate for any APP base or cap sheet.

Table 1.08-1
Cap Sheet Substrate Options

System	Membrane		Acceptable Substrates				
	Cap Sheet	Attachment to Base	Base	Primed Concrete Deck	Approved Firestone Base Sheet	Approved Firestone Insulation	Approved Firestone Cover Board
Self Adhered Base with Heat Fused Cap	APP Cap	Heat Fused	BASEGARD SA	✔	✔	✔	✔
APP	APP Cap	Heat Fused	Approved Base Sheet	✔	✔		✔
APP COOL	APP COOL Cap	Multi Purpose MB Cold Adhesive or LiquiGard Adhesive	Approved Base Sheet	✔	✔	✔	✔
Modified Cap / BUR (Hybrid)	APP Cap	Heat Fused Multi Purpose MB Cold Adhesive or LiquiGard Adhesive	2 or 3 plies of Type IV (4) M or Type VI (6) M in Hot Asphalt	✔	✔		✔
✔ = Acceptable for use							

B. Cap sheet splicing is accomplished by mating the side and end laps using one of the following methods:

Table 1.08-2
Cap Sheet Seam and End Lap Width Requirements

Sheet	Interply Adhesive	Side Lap Width Requirements	End Lap Requirements
Heat Fused APP Cap	Heat Fused	3” (76.2 mm)	6” (152.4mm)
APP COOL	Heat Fused or Adhered with Multi Purpose MB Cold Adhesive	3” (76.2 mm)	6” (152.4mm)

1. Multi Purpose MB Cold Adhesive-Base Sheet Cap Sheet System:
   a. APP COOL cap and approved base sheets may be installed with Firestone Multi Purpose MB Cold Adhesive or LiquiGard Membrane Adhesive.
   b. APP torch base and torch cap sheets, backed with polyethylene burn-off film, cannot be applied with Firestone Multi-Purpose MB Cold Adhesive.
   c. APP Modified Bitumen Membranes installed with Firestone Multi-Purpose MB Cold Adhesive must be exposed for a minimum of 30 days before Acrylic Base Coat for Asphalt and AcryliTop PC-100 can be applied. This requirement applies only to roof systems installed in Multi-Purpose MB Cold Adhesive. Roof Systems must be inspected by a Firestone representative prior to the application of an AcryliTop system.
   d. Three Ply APP Cool Modified Bitumen Membranes installed with Firestone Multi-Purpose MB Cold Adhesive must be exposed for a minimum of 7 days after the first

two plies are installed and before the third ply can be installed. This requirement applies only to roof systems installed in Multi-Purpose MB Cold Adhesive.

e. FiberTop is not an acceptable substrate for use with Multi-Purpose MB Cold Adhesive

Table 1.08.3
Approved Substrates for use with Base Sheet, Cap Sheets Installed in Multi Purpose MB Cold Adhesive

Approved base sheets that have been attached in accordance with Firestone requirements		✔
Approved base plies that have been adhered in accordance with Firestone requirements		✔
Compatible insulations	ISO 95+ ISOGARD™HD RESISTA	✔
Compatible Cover Boards	Approved Dens Deck Products must be dry! Dens Deck must be primed	✔
Poured-in-place or pre-cast structural concrete decks that has been primed with ASTM D 41 primer		✔
Existing properly prepared, uncoated asphalt membrane roof systems	Uncoated smooth BUR that has been primed with D-41 primer	✔
Existing properly prepared uncoated granule surfaced APP Modified Bitumen roofs	Uncoated granule surfaced APP	✔
✔ = Acceptable for use		

2. Heat Fused Application of Firestone APP cap Sheets:
   a. Firestone recommends that all roofing contractors contact their insurance agent or broker to discuss their particular requirements and the potential ramifications of these new guidelines.
   b. APP Torch grade products are installed by heat fusing using a roofing torch.
   c. APP cap sheets are installed using by heat fusing using an LPG roofing torch.
   d. Hot asphalt is not an acceptable adhesive material for use with APP products.
   e. Attachment of cap sheets by heat fusing to expanded or extruded polystyrene insulation is not acceptable.
   f. Roofing plies, base sheets, or cap sheets cannot be heat fused to polyiso insulation. An overlay must be used to separate the polyiso insulation from the fully adhered heat-fused applied ply. The following are overlays over polyiso that are generally acceptable for use over any heat-fused ply sheet:

Table 1.08-4
Approved Substrates for use with Heat Fused-Base, Base Sheet, Cap Sheet

Approved base sheets that have been attached in accordance with Firestone requirements		✔
Approved base plies that have been adhered in accordance with Firestone requirements		✔
Compatible Cover Boards	Approved Dens Deck Products (must be primed)	✔
Poured-in-place or pre-cast structural concrete decks that has been primed with ASTM D 41 primer		✔
Existing properly prepared asphalt membrane roof systems	Uncoated smooth BUR	✔
Properly Protected ISO95+GL	Base Sheet mechanically attached through ISO, DensDeck Prime or SECUROCK and MB Base SA	✔
✔ = Acceptable for use		

1.09 FLASHINGS

A. Design Considerations:

1. Refer to the system application and detail sections. Extended warranties may require special flashing applications.
2. UltraFlash Liquid Flashing is not approved for use on APP membranes.
3. Many factors affect the performance of the flashing system. Design drawings for several common applications are available from the Firestone Web Site.
4. 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:
    - Terminations
    - Junctions
    - Projections
    - Joints
5. In any flashing detail, there are up to three different flashing components:
    - Base flashing
    - Counter-flashing
    - Cap flashing

    a. Base flashing
    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 have to be temporarily stored 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.

    b. Counter-flashing
    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.

    c. Cap flashing
    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 corrected subsequently.

B. Wall/Curb Flashing Materials and Requirements:

1. Refer to the APP QuickSpecs and Detail Drawings at: www.firestonebpco.com
2. Extended warranties require special flashing applications.

C. Penetrations (Pipes, Conduits, Etc.):

1. Pipe Flashings:
    Whenever possible, all round rigid pipe penetrations from 1” (25.4 mm) outside diameter to 6 1/2” (165 mm) 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.

2. Penetration Pockets:
    a. The following types of penetrations require the installation of a penetration pocket:
        - Rigid pipes with an outside diameter less than 1” (25.4 mm).
        - Clusters of pipes.
        - Unusual shapes, e.g., structural beams, channels or angles.
    b. A minimum clearance of 1” (25.4 mm) 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.
3. Flexible penetration (electrical and braided cable, etc.) must be installed in a sheet metal gooseneck.

D. Curbs and Terminations:
1. Where possible, provide a minimum design height of at least 8” (203.2 mm) for all flashing terminations (except penetration pockets).
2. Minimum flashing height must be 3 inches above the highest water level that could be reached during a deluging rain. Wherever a vertical termination height is 5” (127 mm) or less, contact your Roof Systems Advisor at 800-428-4511.
3. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.
4. 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.
5. When using a surface-mounted termination, ensure a consistent seal at the wall interface. The surface above the termination must be waterproof.
6. 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.
7. 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” (15.8 mm) exterior grade or pressure treated plywood. Attach as required for structural integrity.
8. UltraFlash liquid flashing may be used with textured masonry, corrugated metal panes and most uneven surfaces.

E. Sheet Metal Work:
1. Coping, gravel stops, counter flashings etc., must be supplied by Firestone. 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.
2. Metal work, 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.
3. It is the owner’s responsibility to maintain non-Firestone sheet metal in a watertight condition.
4. Make these specifications available to the sheet metal fabricator/contractor.
5. Attachment:
    - Counter flashings, copings, and other perimeter or penetration metal work must be properly fastened and sealed by the roofing contractor or others.
6. All sheet metal work not supplied by Firestone should be fabricated and installed in accordance with the recommendations of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
7. All sheet metal work 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.
8. Some specific roofing details in Firestone’s Technical Specifications may exceed SMACNA recommendations. For such details, the Firestone requirements must be used.

9. Refer to ANSI/SPRI ES-1 for information on wind design and metal edge treatments
10. Extended wind speed warranties require enhanced edge details. Contact your Roof Systems Advisor at 800-428-4511 for specific information

F. Walkways

1. Locations:

   a. Walkways help protect the membrane from damage due to necessary rooftop service traffic.
   b. Walkway systems must be installed on roofs:
      - Subjected to traffic more frequently than once per month.
      - At all access points (ladders, hatches, doorways, etc.) to the roof.
      - Around all serviceable rooftop units.
   c. If protection of the insulation system is required, additional measures must be specified (i.e., concrete pavers, pre-fabricated walkways).
   d. The owner is responsible for maintaining walkways.

2. Walkway Material:

   a. Walkways may consist of an additional layer of Firestone modified bitumen cap sheet.
   b. Do not use Black Granule Surfaced products when installing walkways in cold adhesive. Do not heat seal the edges of walkways installed in cold adhesive.

Table 1.09-1
Acceptable Walkway Attachment of Modified Bitumen Walkway Material

System	Acceptable Modified Bitumen Walkway Attachment
Smooth Surfaced BUR	Granule Surfaced SBS Mopped in Firestone Approved Hot Asphalt Granule Surfaced SBS Heat Fused
Granule Surfaced SBS	Granule Surfaced SBS Mopped in Firestone Approved Hot Asphalt Granule Surfaced SBS Heat Fused
Contact your Roof Systems Advisor at 800-428-4511 regarding other materials designed to be used as a walking surface.	

G. Roof Coatings

1. General:
   a. Coatings are considered a maintenance item. Firestone recommends that coatings be adequately and regularly maintained.
   b. Periodic maintenance and recoating may be required to maintain the Underwriters Laboratories, Factory Mutual or other ratings.
   c. 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.
   d. Proper preparation of the roof surface is important to assure the best possible adhesion of the roof coating. Refer to section 1.09.1 for information regarding preparation of an SBS surface to receive a 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).

System	Smooth and Granule surfaced APP Modified Roof Systems	BUR Roof Systems
Firestone AcryliTop PC-100 Base Coat for Asphalt Systems and AcryliTop Coating	✔	✔
Aluminum Coating	N/A	N/A
Firestone Multi-Purpose MB Cold Adhesive and Gravel	✔	✔
Hot Asphalt and Gravel	N/A	N/A
Coatings are a maintenance item		
✔ = Acceptable for use N/A = Not Applicable		

2. Firestone AcryliTop PC-100 Base Coat for Asphalt Systems and AcryliTop Coating:
    a. 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.
    b. Modified Bitumen Membranes installed with Firestone Multi-Purpose MB Cold Adhesive must be exposed for a minimum of 60 days at a minimum of 60 oF 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. If an interim inspection has not been conducted, roof systems must be inspected by a Firestone representative prior to the application of an AcryliTop system.
    c. Refer to the *Technical Information Sheets* and Material Safety Data Sheets for AcryliTop PC-100, AcryliTop PC-100 Base Coat for additional information on application, storage and safety.
    d. Never apply Firestone AcryliTop PC 100 or Firestone Base Coat for Asphalt to Owens Corning “Perma Mop”
3. Gravel Surfacing:
    a. Firestone Multi-Purpose MB Cold Adhesive and Gravel
        i. For every 100 sq. ft of roof surface, apply in a 4-gallon/100 sq. ft flood coat of Firestone Multi-Purpose Cold MB Adhesive approximately:
            - 400 lb (19.5 kg/sq. m) of roofing gravel, or
            - 500 lb (24.4 kg/sq. m) of slag (both $\pm$ 25%)
        ii. No more Firestone Multi-Purpose MB Adhesive may be spread or poured at one time than can be covered immediately with gravel or slag, to insure proper embedment of the aggregate. Gravel, slag or other accepted surfacing material must comply with ASTM D 1863 and be 1/4" to 3/4" (6.4 mm to 19.1 mm) in diameter, substantially opaque, dry, and free from dust and other foreign materials.

1.10 WARRANTIES

A. General:
1. 15 and 20-Year Red Shield Warranties require the top 2 layers of waterproofing membrane be installed in a continuous layer of Multi-Purpose MB Cold Adhesive or fully heat fused as appropriate to the roof membrane. A heat-fused cap sheet over Firestone BASEGARD SA is applicable for a 20-Year Red Shield Warranty.
2. For new and replacement roofing, Firestone HD Fasteners must be used for a 20-year Red Shield Warranty, when mechanically fastening insulation using fasteners and plates.
3. For Retrofit roof systems, Firestone HD Fasteners must be used for a 15 or 20-year Red

Shield warranty, when mechanically fastening insulation using fasteners and plates.

4. Firestone does not warrant Firestone roof system tie-ins to other roofing systems.
5. 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.
6. 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. 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. Issuance of a warranty for projects outside the US and Canada must be submitted to Firestone Solutions Group for consideration prior to bidding. Individual residential construction does not qualify for a Firestone warranty. Only Firestone-supplied components are eligible to be covered as part of the Firestone Warranty.
7. It is the owner's responsibility to expose the membrane in the event that warranty service is required when access is impaired. Such impairment includes, but is not limited to:

    - 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.
    - Any equipment, ornamentation, building service units and other roof top surfacing materials that are not defined as part of the membrane assembly.
    - Intricately placed or multicolored ballast configurations.
    - Individual pavers utilized as ballast, which weigh more that 80 lb (36.3 kg) per unit, unless otherwise required by Firestone for wind uplift resistance.
    - Interlocking paver systems that utilize mechanical clips, strapping, adhesive, etc.
    - Rooftop equipment that does not provide Firestone with reasonable access to the membrane.
    - Ponded water, snow, ice, and other materials.

Table 1.10-1
APP Roof Systems Warranty Requirements

	Base	Cap	Coating	Flashings
10-year	**Mechanically Attached Base** (Not required on structural concrete deck or smooth BUR) MB Base M APP 80 Glass Base APP 160 APP 170 APP Premium Base	APP Premium FR APP 180 APP 180 FR	None Required on Granule Surfaced Cap Sheets	1 ply APP Granule Surfaced Cap Sheet
15-year	**Fully Adhered Base** APP 80 Glass Base APP 160 APP 170 APP Premium Base	APP Premium FR APP 180 APP 180 FR	None required on Granules Surfaced Cap Sheets	1 ply Fully Adhered Base Sheet and 1 ply Fully Adhered APP Granule surfaced Cap Sheet
20-year	**Fully Adhered Base** APP 160 APP 170 APP Premium Base	APP Premium FR APP 180 APP 180 FR	None Required on Granule Surfaced Sheets	1 ply Fully Adhered Base Sheet and 1 ply Fully Adhered Granule Surfaced APP Cap Sheet

Table 1.10-2
APP Cool Roof Systems Warranty Requirements

	Base	Cap	Coating	Flashings
10-year	**Mechanically Attached Base** (Not required on concrete deck or smooth uncoated BUR) MB Base M APP 80 Glass Base APP 160 APP 170 APP Premium Base	APP Premium FR APP 180 Cool APP 180 FR Cool	None Required on granule surfaced cap sheets	1 ply APP Granule Surfaced Cap Sheet
15-year	**Fully Adhered Base** APP 80 Glass Base Cool APP 170 Cool APP 160 Cool APP Premium Base	APP Premium FR APP 180 Cool APP 180 FR Cool	Coating not Required on Granule surfaced APP Cap Sheets	1 ply Fully Adhered Base Sheet and 1 ply Fully Adhered Granule Surfaced APP Cap Sheet
20-year	**Fully Adhered Base** APP 170 Cool APP 160 Cool APP Premium Base	APP Premium FR APP 180 Cool APP 180 FR Cool	None Required on Granule Sheets	1 ply Fully Adhered Base Sheet and 1 ply Fully Adhered Granule APP Cap

Table 1.10-3
BASEGARD SA Roof Systems Warranty Requirements

	Base	Heat Welded Cap	Coating	Flashings
10-year	BASEGARD SA or MB Base SA	APP 160 APP 170 APP 180 APP 180 FR SBS FR Torch APP Premium FR	None Required	1 ply Fully Adhered Granule Surfaced Cap Sheet
15-year	BASEGARD SA or MB Base SA	APP 180 APP 180 FR APP Premium FR	None Required	1 ply Fully Adhered Firestone MB Base M or 1 ply of MB Base SA and 1 ply Fully Adhered Granule Surfaced Cap
20-year	BASEGARD SA or MB Base SA	APP 180 APP 180 FR APP Premium FR	No Coating Required on Granule Surfaced Cap Sheets	1 ply Fully Adhered Base Sheet and 1 ply Fully Adhered Granule Cap

Table 1.10-4
MODIFIED BITUMEN CAP SHEET / BUR Roof Systems Warranty Requirements

	Ply Sheets	Cap	Coating	Flashings
10-year	1 Ply IV (4) M or 1 Ply VI (6) M or MB Base M	APP 160 APP 160 Cool APP 170 APP 170 Cool APP 180 APP 180 Cool APP 180 FR APP 180 FR Cool APP Premium FR	None Required	1 ply Fully Adhered Granule Surfaced Modified Bitumen Cap
15-year	2 Ply IV (4) M or 2 Ply VI (6) M	APP 180 APP 180 Cool APP 180 FR APP 180 FR Cool APP Premium FR	None Required	1 ply Fully Adhered Firestone MB Base M or any APP Base Sheet and 1 ply Fully Adhered Granule Surfaced Cap
20-year	3 Ply IV (4) M or 3 Ply VI (6) M	APP 180 APP 180 Cool APP 180 FR APP 180 FR Cool APP Premium FR	None Required	1 ply Fully Adhered Modified Bitumen Base Sheet and 1 ply Fully Adhered Granule Surfaced Cap Sheet

Table 1.10-5
Flashing Warranty Requirements

Asphalt Flashing System	Warranty Term		
	10-year	**15-year**	**20-year**
APP	APP Flashing consisting of one (1) ply of APP Cool Granule Surfaced Cap Sheet in Multi-Purpose MB Cold Adhesive or One ply of heat welded APP Granule Surfaced Cap Sheet over a mechanically attached Firestone Base Sheet	Two-ply flashing consisting of One (1) fully adhered ply of APP Granule Surfaced Cap Sheet over One (1) fully adhered ply of APP 80 Glass Base Cool or SBS Base or MB Base SA	Two-ply flashing consisting of: One (1) fully adhered ply of Granule Surfaced APP Cap Sheet **Over** One (1) fully adhered ply of APP 160 or APP 170 or MB Base SA

Table 1.10-6
FIRESTONE WARRANTY SUMMARY:

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+ to repair the affected roof area if the Firestone ISO 95+ warps, bows or destabilizes to the point of causing a roof leak as a result of any manufacturing defect in the ISO 95+.
10 Year ISO 95+ Thermal Insulation Warranty	Firestone Asphalt specifications	Red Shield	Provide replacement insulation should the Firestone ISO 95+ fail to retain 80% of its published R-value.

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