



Metal Roofing Systems Design Guide

UC-3, UC-4, UC-6 and UC-14

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1.01 GENERAL DESIGN CRITERIA

A. APPLICABILITY

1. Parameters of this manual outline the **minimum** requirements for a Firestone Red Shield Metal Roof Warranty. Local code and insurance requirements may require specific enhancements for a given performance level.
2. Statements in this Design Guide are provided in good faith with the expectation that a design professional be consulted prior to any job decisions being made.
3. The metal roof system shall consist of Firestone: UC-3, UC-4, UC-6 or UC-14 metal roof panels all with in-seam sealant, CLAD-GARD™ SA, CLAD-GARD SA-FR, CLAD-GARD R, or CLAD-GARD MA underlayment, mechanically attached to an acceptable substrate combined with other Firestone roof system accessories as indicated in the following text, tables and manual details.
4. Firestone Red Shield warranted metal roof systems may or may not be applicable, without special consideration, if subject to local, regional, or national building code requirements, testing agency restrictions, or insurance company requirements.
 - a) It is the building owner's or the design professional's responsibility to consult with the Authority having jurisdiction to determine the specific requirements of each project and each system.
 - b) Your Firestone Building System Advisor should be contacted at 1-800-428-4511 when local or controlling codes or insurance requirements are in conflict with Firestone recommendations.



Certain situations may arise where Firestone specifications and/or roofing requirements cannot be applied. It may not be possible for Firestone to issue the desired warranty for projects that deviate from current Firestone requirements and standards, unless a written deviation request for approval has been received, reviewed and approved by the Firestone Building System Advisor prior to application of the proposed system.

5. The following conditions require special consideration and may not be warrantable. Contact your Firestone Building System Advisor if any of the following conditions are present.
 - a) Roofs that do not meet the minimum slope and/or exceed the maximum height limits for the Firestone Metal Roof system assembly. See Table 1.01-1
 - b) Projects that require special wind coverage greater than 55 mph
 - c) Roofs located where localized wind phenomenon may occur, reference ASCE-7 wind maps
 - d) Roofs located down slope, foothills, mountain ranges, or escarpments
 - e) Geographical areas susceptible to hurricanes
 - f) Roofs subject to chemical or process by product discharge
 - g) Building with large openings in a wall (greater than 10% of the wall surface) that could be left open in a storm
 - h) Roofs subject to positive pressure situations such as: pressurized buildings, air infiltrating decks, canopies, overhangs, airplane hangars, distribution centers, laboratories, etc.
 - i) Buildings with high interior humidity such as swimming pools, paper mills or textile mills, for example.
 - j) Roof decks that do not provide adequate fastener pullout resistance
 - k) Roofs with domes, barrels or swales, or other curvatures or unusual shapes
 - l) Roofs located within 1500 feet of a saltwater environment
6. Cold Storage and freezer facilities constitute a special condition. A design professional familiar with cold storage construction and vapor migration should be consulted in the design of the roof system.



Unlimited slope in the below chart only refers to the potential maximum installation slope. When using installation equipment there may be practical limitations to the slope. Safety is the first order of consider when doing any job. Consult with the equipment manufacturer on the performance of the individual items.

TABLE 1.01-1
CHART OF ROOF SYSTEM ACCEPTABILITY

System	Slope	Barrel, Arch, etc.	Maximum Height	Maximum Warranty Term
UC-3	3:12 Min	Acceptable	250'	Platinum 30 Year
UC-4	3:12 Min	Not Acceptable	250'	Platinum 30 Year
UC-6	3:12 Min	Acceptable	250'	Platinum 30 Year
UC-14	3:12 Min	Not Acceptable	250'	Platinum 30 Year

TABLE 1.01-2
5 to 20 YEAR RED SHIELD WARRANTY ASSEMBLY REQUIREMENTS UC-3, 4, 6, & 14

Deck	Insulation + Fastener						Underlayment	
Steel 22 ga. min (Insulation and/or Cover Board required)	HailGard 1.5" (38.1 mm) min.	Plywood Coverboard ½" (12.7 mm) min.	OSB Coverboard 7/16" (11.1 mm) min.	ISO 95+ GL, 1" (25.4 mm) min.	RESISTA 1" (25.4 mm) min.	ISO GARD HD ½" (12.7 mm) min.	DensDeck ¼" (6.35mm) min.	CLAD-GARD SA, REQUIRED for 30-Year Platinum Warranty, with an extra course at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations. CLAD-GARD SA required for Red Shield 25 Year Warranties. CLAD-GARD SA-FR may be used for Red Shield Warranties. CLAD-GARD MA may be used over nailable decks only, in the field of the roof only, for up to a 20 Red Shield Warranty. CLAD- GARD SA or R must be used at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations.
	HD HailGard Fastener or Heavy Duty (20-25 yr) or All- Purpose Fastener (5-15yr) + Plates			Heavy Duty (20-25 yr) or All- Purpose Fastener (5-15yr) + Plates				
	Fastener ¾" (19.0 mm) through deck							
Wood <ul style="list-style-type: none"> OSB or Plywood with "H" clip or T&G, 7/16" (11.1 mm) min. T&G structural, 1" (25.4 mm) min Planks, 1" (25.4 mm) min (Insulation and/or Cover Board Required) 	HailGard 1.5" (38.1 mm) min.	Plywood Coverboard ½" (12.7 mm) min.	OSB Coverboard 7/16" (11.1 mm) min.	ISO 95+ GL, 1" (25.4 mm) min.	RESISTA 1" (25.4 mm) min.	ISO GARD HD ½" (12.7 mm) min.	DensDeck ¼" (6.35mm) min.	CLAD-GARD MA may be used over nailable decks only, in the field of the roof only, for up to a 20 Red Shield Warranty. CLAD- GARD SA or R must be used at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations.
	HD HailGard Fastener or Heavy Duty (20-25yr) or All-Purpose Fastener (5- 15yr) + Plates			Heavy Duty (20-25 yr) or All- Purpose Fastener (5-15yr) + Plates				
	Fastener 1" (25.4 mm) into or through deck							

NOTES:

- Contact your Firestone Building System Advisor for the proper fastener attachment pattern for other extended wind speed warranties, agency or code requirements.
- Insulation thickness requirements may vary for agency or code compliance. Consult the Authority having jurisdiction and your Firestone Building System Advisor.
- HailGard Insulation must be mechanically fastened with acceptable Firestone fasteners. Insulation adhesives are not acceptable.

B. CONSULTATION

1. Firestone recommends that a design professional be involved in the design process. For additional assistance your Firestone Building System Advisor is available for consultation with respect to any necessary deviations from current Firestone requirements and standards.
2. For recommendations on any specific project, the applicability or appropriateness of any material's suitability for use, or use of products in conjunction with any other specific material, follow these steps:
 - a) Consult Firestone Building Products Website: www.firestonebpco.com
 - b) Consult the Technical Database, the **Firestone Metal Design Guide** and the product-specific **Technical Information Sheets (TIS)**.
 - c) Consult with the building owner or their design professional.
 - d) Consult with your Firestone Building System Advisor.
3. Statements in this design guide are provided in good faith with the expectation that a design professional be consulted prior to any job decisions being made.

C. DESIGN

1. Firestone recommends that a design professional be consulted to ensure proper design, (ie. Roof system selection) installation and conformance to building codes, insurance requirements, etc.

The following are just a few of the conditions which may influence the need for a design professional:

- Structural conditions that might not be sufficient to support the anticipated load of the completed roof installation.
- Structural conditions to support the dynamic loading of the roof system
- The need to review the proposed system assembly for its applicability on specific projects
- The requirements of local building codes for the need of a thermal barrier
- The requirements of local building codes for the need of an underlayment or air barrier
- When considering the effect of loads on the structure/decking due to the loading/staging of materials as a part of system installation, the building owner or his design professional should specify the load limitations to be observed by the Firestone Red Shield licensed applicator.

D. WARRANTY

1. Where a Firestone Red Shield Warranty is required.
 - a) Submit a Pre-Installation Notice (PIN) along with an approved roof drawing, at least 2 weeks prior to project start. The PIN will be reviewed by your Firestone Building System Advisor.
 - b) Submit a full set of shop drawings to your Building System Advisor that show the roof plan and all details. Following your Building System Advisor's review, you will receive an acknowledgement either of *Acceptance* or of a request for *Additional Information* and changes necessary to meet Firestone warranty requirements.
 - c) The roof must be installed according to the current Firestone requirements appropriate to the project conditions and design requirements, as posted on the Firestone website: firestonebp.com
 - d) The Firestone roof system must be installed by a current Firestone Red Shield licensed applicator.
 - e) The Firestone roof system must be inspected by a Quality Building Services (QBS) Technical Representative.
 - f) Upon inspection and acceptance of the installed roof system by a QBS Technical Representative, the warranty will be issued and dated based on the completion date of the roof by the roofing contractor.

2. The Firestone/QBS inspection is to confirm the installation details of the roofing system for compliance with Firestone documents of record for warranty requirements. The inspection is not intended as an inspection for benefit of the building owner or the design professional with respect to contract, building codes or compliance with specifications other than those of Firestone's for a specified performance level as indicated on the PIN



Firestone metal roof systems cannot receive a Red Shield warranty if the application is for a single family residence.



Certain situations may arise where Firestone metal specifications and/or roofing requirements cannot be applied. It may not be possible for Firestone to issue the desired warranty for projects that deviate from current Firestone requirements and standards, unless a written request for approval has been received, reviewed and approved by your Firestone Building System Advisor prior to application of the proposed system or detail.

3. At a minimum, the metal roof system shall consist of an approved substrate: CLAD-GARD SA, CLAD-GARD SA-FR, CLAD GARD R, and CLAD-GARD MA underlayment; UC-3, UC-4, UC-6 or UC-14 metal panel system with in seam sealant, mechanically attached with Firestone fasteners and clips as needed to meet the predetermined and agreed upon performance level.
4. Consult warranty table 1.01-2 for information on the systems appropriate for warranty.

1.02 QUALITY ASSURANCE

A. JOB SITE CONSIDERATIONS

1. During the construction process, the roofing contractor is responsible for ensuring that all components of the Firestone metal roof system are protected from damage, including the finished areas of the Firestone metal roof system. This includes:
 - Damage that may result from the continued construction process
 - Discharges such as petroleum products, greases, oils (mineral and vegetable), animal fats and other chemicals or byproducts.
2. All safety regulations required by OSHA and other agencies having jurisdiction must be followed.
3. Cold weather application considerations:
 - a) When the outside temperature is below 40 °F (4.4 °C), installation of Firestone roof system may require additional application precautions.
 - b) For a minimum of 24 hours before installation, self adhering underlayment membranes, sealants, primers and tapes should remain in an environment between 60 °F and 80 °F (15.5 °C and 26.6 °C). Consult manufacturer's application instructions.
 - c) Materials should be used within four hours of removal from a heated storage area. If materials are not used within that time period or become too chilled to use, they should be returned to the heated storage area until the temperature of the material returns to the temperature of the heated storage area. Typically, this is 24 hours. Check product for quality prior to use as the cold may affect the integrity of materials.
 - d) Firestone zinc products should not be installed unless materials and ambient temperature are at 50 °F (10 °C) and rising.

B. TEMPORARY ROOFING

1. If installation of the metal roof system is required during unsuitable weather, or before completion of wood blocking, curbs or the erection of walls, a temporary roof may need to be installed.
2. If a temporary roof is needed due to construction requirements, Firestone recommends installing Firestone CLAD-GARD SA underlayment 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, or can be left as an underlayment prior to the installation of the finished Firestone roof system. The maximum allowable time CLAD-GARD SA underlayment can be exposed without application of metal roof system is 90 days.
3. 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 metal roof system.
4. When a temporary roof is specified as using an underlayment, precaution shall be exercised in protecting the temporary roof from other construction trades. Damage to the temporary roof may impair its effectiveness as an underlayment. If CLAD-GARD SA underlayment is installed as a temporary roof during construction, the underlayment shall be examined, and if necessary, repaired to ensure watertight integrity prior to installation of the remainder of the roof system.

1.03 UNDERLAYMENTS



THE DETERMINATION OF THE NECESSITY AND LOCATION OF A VAPOR RETARDER IN ADDITION TO AN UNDERLAYMENT 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 IN ADDITION TO THE NEED FOR AND THE PROPER DESIGN OF THE AIR BARRIER AND VAPOR RETARDER MAY BE CRITICAL TO THE LONG-TERM OPERATION OF THE ROOF SYSTEM.



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.



THE INCLUSION OF AN AIR BARRIER OR VAPOR BARRIER MAY AFFECT THE OVERRIDING CODE RATING OF THE ROOF SYSTEM. THE INCLUSION OF AN AIR BARRIER OR VAPOR BARRIER MAY AFFECT THE FIRESTONE SYSTEM REQUIREMENTS AND CONSEQUENTLY THE FIRESTONE WARRANTY. CONTACT YOUR FIRESTONE BUILDING SYSTEM ADVISOR PRIOR TO APPLICATION OF THE PROPOSED SYSTEM.

A. UNDERLAYMENT DESIGN:

1. The roof system designer is generally responsible for the design requirements of the roof deck, underlayment, vapor retarder, and rigid insulation. The need for a vapor retarder, as well as the type, placement and location of any vapor retarder should be determined by a professional architect or engineer.
2. A Firestone CLAD -GARD SA, CLAD-GARD SA-FR, CLAD-GARD R, or CLAD-GARD MA underlayment, appropriate to the deck type and requested warranty term, is required for a Firestone warranty.
3. The roof system designer must:
 - Ensure that the method of attachment of the selected underlayment to the roof system substrate is acceptable to the underlayment selected. Primers may be required for specific substrates and substrate conditions.
 - Ensure that the underlayment is compatible with the metal of the roof system selected and any other materials it may contact.
 - Ensure that the underlayment 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 and compatibility of the wall and roof air retarder systems is essential.
 - Consider the effect of construction moisture on a new roof system, particularly during winter, when temporary gas heat is required.



Firestone zinc metal roof systems are recommended to have either the ProRoofing backside coating or a ventilation underlayment layer of Enkamat 7010 directly under the metal and over the CLAD- GARD underlayment's. Special extended clips may be required.

TABLE 1.03-1

METAL ROOF SYSTEM UNDERLAYMENTS APPROVED FOR USE IN A RED SHIELD WARRANTED SYSTEM

APPROVED UNDERLAYMENTS			
5-20 YEAR RED SHIELD WARRANTY		25-YEAR RED SHIELD WARRANTY	30-YEAR PLATINUM WARRANTY
Min. 3:12" Slope	Up to 5:12" Slope	Min. 3:12" Slope	Min. 3:12" Slope
CLAD-GARD SA, CLAD-GARD SA-FR	CLAD-GARD MA in the field of the roof, CLAD-GARD SA or CLAD-GARD R at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations.	CLAD-GARD SA, CLAD-GARD SA-FR Required, with an additional course at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations.	CLAD-GARD SA, CLAD-GARD SA-FR Required, with an additional course at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations.

NOTE: Refer to the NRCA Roofing and Waterproofing Manual and design professional for specific underlayment requirements for a project's location.

B. MOISTURE CONTROL

1. The roofing contractor is responsible for ensuring that the substrate is suitable to receive a Firestone Metal roof system. All damaged and/or wet substrate must be dried, removed and replaced, in kind, prior to the application of the Firestone CLAD-GARD underlayment.
2. A moisture survey should be conducted to determine the moisture content of any roof system component prior to starting in anticipation of wet areas.
3. Three techniques are currently available to evaluate the roof by indirect/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.
 - Nuclear moisture detection
 - Infrared thermography
 - Electric capacitance

1.04 SUBSTRATE AND SUBSTRATE REQUIREMENTS

A. GENERAL

1. The Firestone Metal roof system depends on a suitable substrate to perform its intended function of weatherproofing the building.



It is the roofing contractor's responsibility for ensuring that the substrate is acceptable for the Firestone metal roof system.

2. The substrate to which the Firestone roof system is installed must:
 - Be continuous and monolithic within a defined area.
 - Be structurally sound
 - Be dry, smooth, flat and clean
 - Be free of sharp fins, or foreign materials that could damage the roof system
 - Meet the minimum requirements for the system performance being installed
 - Not be out of plane more than ¼" (6.35 mm) in 10' (3048 mm) in any direction

B. FASTENER/PULLOUT REQUIREMENTS

1. Substrates for insulation attachment are required to provide sufficient pullout resistance for the fasteners and roof system.
2. In the case where the structural deck does not meet the minimum fastener pullout requirements contact your Firestone Building System Advisor.

**TABLE 1.04-1
THE MINIMUM FASTENER PULLOUT RESISTANCES FOR INSULATION ATTACHMENT**

SYSTEM	MINIMUM FASTENER RESISTANCE
Metal Roof Systems with mechanically attached insulation or approved cover board	300 lb (136.1 KG) Minimum Pullout Contact the your Building System Advisor at Firestone Building Products when the structural deck does not meet the minimum fastener pullout requirements.

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 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:
 - Steel decks thinner than 22 gauge (0.76 mm)
 - Plywood or oriented strand board less than 7/16" (11.1 mm) thickness
 - Tongue and Groove Decks less than 1" (25.4 mm) thick.
 - Any other substrate that does not have a published pullout capacity greater than the minimum required for the applicable roof system
- a) The sections of the substrate where integrity is most in question should be used for testing. Test areas should include corners and perimeters. The minimum number of pullout tests recommended are as follows:

**TABLE 1.04 -2
RECOMMENDED NUMBER OF PULL OUT TESTS**

ROOF SIZE	NUMBER OF PULLOUT TESTS	
Less Than 10,000 sf	Less Than 1,000 m ²	6
10,000 sf – 50,000 sf	1,000 m ² - 5,000 m ²	1
50,000 sf – 100,000 sf	5,000 m ² - 10,000 m ²	2
Over 100,000 sf	10,000 m ²	1 per 5,000 sf/500 m ²

- b) 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. DRAINAGE AND SLOPE



Building codes may require a specific minimum slope for drainage on metal roof systems. 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.

1. The NRCA and prevailing building codes recommend, and some codes may require, that a minimum roof slope of 3" (76.2 mm) per ft (301.8 mm) be obtained to facilitate proper drainage and maximize long-term performance of the roof system. The minimum Firestone requirement is 3" (76.2 mm) per ft (304.8 mm)
2. The following are just some of the reasons why proper roof drainage is important:
 - Proper drainage of the roof system prevents premature deterioration of the roof system and roof components
 - It is required by many, if not all, building codes

D. WOOD NAILERS

1. Wood nailers are required at the perimeter of any area to provide a securement base for fascia detail metals and protect insulation that would otherwise be partially exposed to the elements.
2. For new construction projects, wood nailers must be kiln-dried (Southern Pine, Douglas Fir) structural grade #2 or better.
3. Wood nailers installed 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.



Treated lumber may be highly corrosive to fasteners and other metal components. Contact the fastener manufacturer for their recommendations on fasteners if attaching nailers that have been treated with the more corrosive materials.



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 UNA-CLAD metal and accessories. Contact your Building System Advisor at Firestone Building Products when using chemically treated lumber that will come in contact with the UNA-CLAD roof system.

4. The building owner or his design professional must specify a wood nailer attachment system that will resist a minimum force of 200 lb per ft (2.9 N/m) in any direction. Firestone fasteners are required for all roofing applications. For further clarification, please refer to FM Global Loss Prevention Data Sheet 1-49 and or contact specified manufactures for technical data.

E. EXPANSION JOINTS

1. The determination of the necessity and location for expansion joints is a project specific requirement, which is the responsibility of the building owner or his design professional. Typical consideration for selection criteria may be one or more of the following:
 - Where expansion, contraction or deflection joints are provided in the building structural system
 - Roof expansion joints must be located to accommodate movements caused by building structural movement with consideration to keep the location parallel to the fall line and out of valleys.
 - Where structural framing elements such as joists, rafters, purlin, or steel decking change direction
 - Deck material changes (e.g. from steel to wood deck). Where different types of roof decks such as wood and steel abut each other
 - Where additions abut existing buildings
 - At junctions where interior heating conditions change such as a heated space abutting an unheated space
 - Where movement between vertical walls and the roof deck is anticipated
 - Roof areas greater than 200 feet (61m) on any direction
 - 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 all inclusive. Other conditions may exist which expansion joints should be considered.

2. Expansion joints must extend through the perimeter of a roof area for freedom of movement of all components. They may not restrict the flow of water.

1.05 FASTENERS

A. GENERAL

Consult the **Technical Information Sheet (TIS)** that references the specific fastener being used, and for the deck penetration requirements of that fastener. All fasteners must be suitable and compatible for the existing deck, clips, and panel materials type.

- 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:
 - How the fastener(s) might affect the deck
 - The capability of the deck to hold the fasteners and roof system in place in a wind related event
- 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.
- Stainless steel fasteners are REQUIRED** for all projects receiving a **30-Year Platinum Warranty**.



When using fasteners, verify that the substrate has sufficient fastener pullout resistance to meet the system requirements.

TABLE 1.05-1 FIRESTONE FASTENER TYPE BY PANEL METAL TYPE		Steel Decks	Plywood, OSB, and T & G Deck
Roof system	Fastener		
Galvanized	UNA-CLAD Coated or Stainless Steel	✓	✓
Aluminum	UNA-CLAD Stainless Steel	✓	✓
Copper	UNA-CLAD Stainless Steel	✓	✓
Zinc	UNA-CLAD Stainless Steel	✓	✓

✓ = ACCEPTABLE FOR USE

TABLE 1.05-2 FIRESTONE INSULATION AND COVERBOARD FASTENERS BY SUBSTRATE		Steel Decks	Plywood, OSB, and T & G Deck
TIS	Fastener		
1017	All Purpose Fastener and Plate; 5-15yr Red Shield	✓	✓
1002	Heavy-Duty Fastener and Plate; 20-25yr Red Shield	✓	✓
1019	HD HailGard Fastener; 5-25yr Red Shield (with HailGard, OSB or Plywood Cover Boards)	✓	✓

✓ = ACCEPTABLE FOR USE

1.06 CLIPS

A. GENERAL

Refer to the **Technical Information Sheet (TIS)** that references the specific clip being used and for the proper conditions for use. All clips must be suitable and compatible for the panel, existing deck, movements, and panel material 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 clips is critical. Firestone recommends that the use of any clip be confirmed for meeting any special needs the job may require.
2. The structural integrity of the deck may have been weakened over time, thus the choice of clip and fastener should be considered in determining the best solution to the given deck and situation for the performance needed.

**TABLE 1.06-1
FIRESTONE CLIP STYLE AND MATERIAL BY PANEL MATERIAL TYPE**

Roof System:	Clips:	Clip Type:	Panel Type:	Special Considerations:
UC-3	UC-3 Expansion Clip	Stainless Steel	Steel, Aluminum, Copper, Zinc	• May require shimming when used with Enkamat 7010
	UC-3 Super Clip	Galvanized Stainless Steel	Steel, Aluminum, Copper, Zinc	• Required for specific code ratings • 1.8" Tab required with Enkamat 7010
	UC-3 Fixed Clip	Galvanized Stainless Steel	Steel, Aluminum, Copper, Zinc	• For use on limited panel lengths & at radius high point
UC-4	None – No Clip System	Fastener: Coated Steel Stainless Steel	Steel, Aluminum, Copper, Zinc	• Fasteners must incorporate a nylon washer for thermal movement
UC-6	UC-6 Low-Float Clip	Galvanized Stainless Steel	Steel, Aluminum, Copper, Zinc	• May require shimming when used with Enkamat 7010
	UC-6 Super Clip	Galvanized Stainless Steel	Steel, Aluminum, Copper, Zinc	• May require shimming when used with Enkamat 7010
UC-14	UC-14 Clip	Galvanized Stainless Steel	Steel, Aluminum, Copper, Zinc	• May require shimming when used with Enkamat 7010

1.07 DECKS

A. NEW OR RE-ROOF APPLICATIONS:

1. The Firestone Metal roof system cannot receive the Firestone Red Shield warranty if the existing substrate roof remains in place. A complete removal of the existing roof system, including the membrane, shingles, metal, insulation and flashings is required.



If present, it is required that phenolic insulation be removed. Once removed, a visual inspection of the deck condition and other components is required; all deteriorated components must be replaced as necessary. It is the building owner or his design professional's responsibility to determine the condition of the deck and supporting structures.

B. GENERAL

1. Structural roof decks should be properly designed and constructed to provide sufficient strength to support the anticipated dead and live loads along with the loads anticipated due to the construction traffic, without excessive deflection or movement.
2. Roof replacement usually involves more complexities than new construction roofing. Such contingencies as rusted or deteriorated decks, rotted wood components, rooftop equipment that cannot be moved or shut down, and numerous other conditions are often encountered. For roof slopes up to and including ½": 12" (4.2%), the side laps can be installed parallel or perpendicular to the slope.
 - a) All holes, deformations, depressions, etc., must be reinforced and /or smoothed prior to the roof application.
 - b) Determination and acceptance of a deck is the responsibility of the building owner or his design professional.
 - c) The deck should provide a minimum 3" (76.2 mm) per foot (304.8 mm) slope to the roof edge or gutter.

C. CLASSIFICATION

1. Structural decks can be classified as Nailable or non-nailable (sometimes both) for purposes of mechanically attaching or nailing insulation. Firestone Building Products has fasteners that are approved for these decks.

Structural decks can be classified as combustible or non-combustible for purposes of fire ratings and code requirements.

**TABLE 1.07-1
STRUCTURAL DECK CLASSIFICATION**

Deck	Nailable or Non-nailable	Combustible or Non-combustible
Steel	Non-nailable	Non-combustible
Wood	Nailable	Combustible

D. STEEL DECK

1. Firestone recommends that the steel deck be a minimum 22 ga (0.76 mm). For light gauge decks such as 24 or 26 ga, please contact your Firestone Building System Advisor. Cut the cap sheet to conform to nailer spacing. Using capped nails, nail the end lap across the width of the sheet with the first nail spaced ¾" (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.
2. FM Global-Approved steel decks are currently available in 22 ga (.0295", 0.794 mm), 20 ga. (.0358", 0.909 mm) and 18 ga. (0.0474", 1.204 mm) thick sheets with 1.5 in. (38 mm) deep corrugations. The corrugations (ribs) are cold rolled in the sheets. The deck has a 6" (152 mm) module, that is, the ribs are 6" (152 mm) on center. All fastening approvals and recommendations are based on this profile. (Approved and recommended spacing's are such that the fasteners will engage the top flange of the deck). Another common configuration is 3" (76 mm) deep deck, which usually has an 8" (203 mm) module.
3. When mechanically attaching insulation, steel decks are required to have a minimum fastener pullout of 300 lb (1.8 kN) per fastener.
4. 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" bearing on the steel deck flange. Cantilevering insulation boards over deck flutes can fracture insulation boards, reducing the support for the underlayment, making it susceptible to puncture.
5. All deteriorated components must be replaced in kind as necessary.

E. WOOD DECKS: TONGUE AND GROOVE DECK, PLYWOOD AND OSB

- a) Firestone recommends that wood tongue and grove deck have a minimum 1" (25.4 mm) min. nominal thickness.

Fire treated plywood may be used provided it has not been treated with ammonium phosphates.

- b) Plank decking without tongue and groove shall be overlaid with a minimum of 7/16" (10.5 mm) thick OSB or plywood properly attached to substrate with Firestone fasteners.
- c) Firestone recommends that plywood and OSB decks have a minimum 7/16" (10.5 mm) thickness.
- d) When mechanically attaching insulation, wood decks are required to have a fastener pullout of 300 lb (1.8 kN) per fastener.
- e) The Firestone metal roof system can be installed directly with appropriate vapor barrier to a plywood, OSB or T & G deck. The panels must attach utilizing acceptable fasteners.

1.08 INSULATION

A. GENERAL

1. Insulation must provide a suitable substrate for the proposed roof system as well as insulation for the building.
2. Insulation thickness requirements may vary for code compliance. Contact the local code or insurance official before contacting your Firestone Building System Advisor.

B. MULTIPLE LAYERS OF INSULATION

Insulation may be installed in one or multiple layer applications. If installed in multiple layers, the joints of each succeeding and adjoining layer should be staggered from the joints of previous layers by a minimum of 6" (150 mm) in each direction

C. MECHANICAL ATTACHMENT OF INSULATION AND COVER BOARD TO APPROVED SUBSTRATES

1. Insulation must be fastened with appropriate Firestone fasteners and insulation plates (as required) at a rate of not less than sixteen (16) per 4' x 8' (1219 mm x 2438 mm) board.
2. Extended wind speed conditions, above 55 mph, may require additional fasteners. Contact your Firestone Building System Advisor for the proper fastener and attachment pattern.
3. Refer to specific Firestone **Technical Information Sheet (TIS)** for installation and fastening pattern requirements. When a composite of two insulation layers is installed, the fastening pattern required for the top board thickness must be used. A common fastener may be used to install multiple layers of insulation. Certain specifications, codes, or insurance groups may call for enhancement of fasteners in the perimeter, hips & ridges, and corners of roofs.



All insulation and cover board must be fastened at a rate of no less than 16 appropriate Firestone fasteners or fasteners and insulation plates (as required) per 4' x 8' (1219 mm x 2438 mm) board. This method is for delayed installation of the roof panel system. All insulation and cover board must be covered with a suitable Firestone underlayment. When roofing insulation and/or cover board and roofing panels are installed immediately, 5 appropriate fasteners per 4' x 8' board is acceptable

1.09 METAL ROOFING PANEL

A. METAL PANEL

1. The roof covering shall consist of a UC-3, UC-4, UC-6 or UC-14 Metal Roof Panel mechanically attached to the approved substrate with Firestone approved fasteners.
2. Oil Canning is an aesthetic issue not covered in the Firestone Warranty. This issue can be reduced or minimized by using some of the following processing methods and or design considerations:

Design considerations to reduce oil canning:

- Coil stock shall be tension-leveled to improve flatness of material
- Use a heavier gauge and/or higher tensile strength metal that will provide additional rigidity.
- Use as narrow a panel as possible with a profile that offers a minimum of flat expanse.
- Consider profiles with stiffening ribs or striations.
- Adjust fastening method and/or frequency within system performance requirements.
- Texturing metal surface adds some stiffness and minimizes any one reflective area to conceal oil canning.
- Choose a paint finish that has a lower gloss factor.
- Choose a natural finish metal that ages with time and will develop a lower reflectance.

3. Installation considerations to reduce oil canning:

- Ensure that all substrates are within roofing manufactures required or approved designs and tolerances prior to commencement of work.
- Ensure that all supplied materials are as specified, approved and ordered for the job. c) Use proper care and handling of all materials at all times.
- Properly use and adjustment of all installation tools.
- Install all materials with proper clearance for anticipated thermal movements with manufacture's supplied accessories and details.
- Installation of an appropriate size backer rod on the center back of the panel for a slight crown.

4. Chart of thermal movement with metal roof panels with a 100 °F temperature change in the panel and 50 °F temperature change in the substrate, for 150 °F change add 50 percent more to movements.

**TABLE 1.09-1
CHART OF THERMAL MOVEMENT OF METAL ROOF PANELS(100 °F PANEL CHANGE)**

Panel Material	Coefficient of Expansion	Total movement Per 100 °F (37.8 °C) inches (mm)		
		10' (3048 mm)	50' (15,240 mm)	100' (30,480 mm)
Steel	6.7 x 10 ⁻⁶ in/in/°F 2.0 x 10 ⁻⁶ in/in/°F	3/32" (28.6 mm)	13/32"(123.8 mm)	25/32" (238.1 mm)
Aluminum (3000 Series Typ.)	12.7 x 10 ⁻⁶ in/in/°F 12.7 x 10 ⁻⁶ in/in/°F	1/16" (19.1 mm)	3/8" (114.3 mm)	5/8" (190.5 mm)
Copper	9.3 x 10 ⁻⁶ in/in/°F 9.3 x 10 ⁻⁶ in/in/°F	1/16" (19.1 mm)	3/8" (114.3 mm)	13/32" (123.8 mm)
Zinc	17.5 x 10 ⁻⁶ in/in/°F 17.5 x 10 ⁻⁶ in/in/°F	5/32" (47.6 mm)	11/16" (209.6 mm)	1 3/8" (419.1 mm)

**TABLE 1.09-2
CHART OF MINIMUM THICKNESS OF METAL ROOF PANELS, TRIMS, & FLASHINGS**

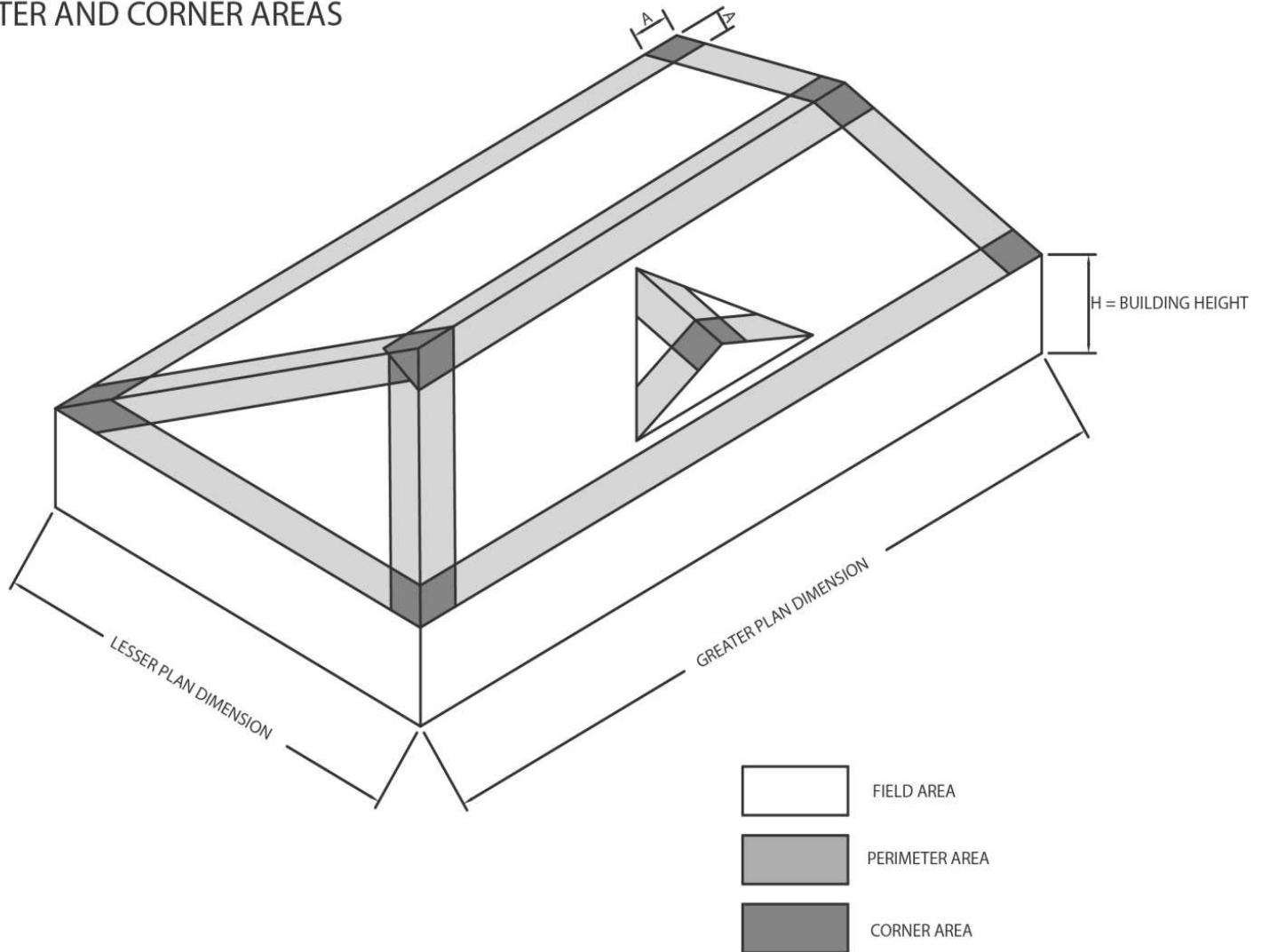
Base Metal:	Steel	Aluminum	Copper	Zinc
Minimum Thickness	24 ga (0.6 mm)	0.032" (0.8 mm)	16 oz (0.7 mm)	0.7 mm (0.027")

**TABLE 1.09-3
CHART OF FASTENER & CLIP SPACING**

System	Fasteners Per Clip/Slots	Clip Spacing		
		Roof Height	Field	Perimeter & Corners
UC-3 (5-20 yrs)	2	0-50' (0-15.2 m)	36" o.c. (914 mm)	12" o.c. (305 mm)
		51'-75' (15.5-22.8 m)	24" o.c. (610 mm)	12" o.c. (305 mm)
		76'-120' (23.1-36.6 m)	16" o.c. (406 mm)	12" o.c. (305 mm)
		121'-250' (36.9-76.2 m)	12" o.c. (305 mm)	6" o.c. (152 mm)
UC-4 (5-20 yrs)	1	0-75' (0-22.8 m)	24" o.c. (610 mm)	12" o.c. (305 mm)
	2 Consecutive Slots	76'-120' (23.1-36.6 m)	16" o.c. (406 mm)	12" o.c. (305 mm)
		121'-250' (36.9-76.2 m)	12" o.c. (305 mm)	6" o.c. (152 mm)
UC-4 (25 yrs)	1	0-120' (0-36.6 m)	12" o.c. (305 mm)	
	2 Consecutive Slots	121'-250' (36.9-76.2 m)	12" o.c. (305 mm)	6" o.c. (152 mm)
UC-6 (5-20 yrs)	2	0-50' (0-15.2 m)	48" o.c. (1219 mm)	24" o.c. (610 mm)
		51'-75' (15.5-22.8 m)	30" o.c. (762 mm)	12" o.c. (305 mm)
		76'-120' (23.1-36.6 m)	24" o.c. (610 mm)	12" o.c. (305 mm)
		121'-250' (36.9-76.2 m)	16" o.c. (406 mm)	12" o.c. (305 mm)
UC-14 (5-20 yrs)	2	0-50' (0-15.2 m)	48" o.c. (1219 mm)	24" o.c. (610 mm)
		51'-75' (15.5-22.8 m)	30" o.c. (762 mm)	12" o.c. (305 mm)
		76'-120' (23.1-36.6 m)	24" o.c. (610 mm)	12" o.c. (305 mm)
		121'-250' (36.9-76.2 m)	16" o.c. (406 mm)	12" o.c. (305 mm)

- a) Perimeter and corner widths are calculated as either 10% of the lesser plan dimension or 40% of the low eave height, whichever is smaller, but not less than 4 ft. (see "Perimeter & Corner Areas", next page)
- b) Panel attachment directly over ISO 95+ GL requires the placement of a bearing plate under each clip.
- c) Each fastener must pass through the clip, bearing plate (if required), all insulation layers, and achieve the required penetration into an approved deck.

PERIMETER AND CORNER AREAS



NOTE:

"A" = THE LESSER VALUE OF: (0.1 X "LESSER PLAN DIMENSION") OR (0.4 X "H")

"H" = BUILDING HEIGHT

AND

"A" IS NEVER LESS THAN (0.04 X "LESSER PLAN DIMENSION") OR (4' MIN.)

1.10 FLASHINGS

A. DESIGN CONSIDERATIONS

1. Many factors affect the performance of the flashing system for specific detail requirements; refer to the **Metal Design Guide**, **Metal detail drawings**, and **Table 1.09 CHART OF MINIMUM THICKNESS OF FLASHINGS**.
2. A flashing is a roofing element used to prevent water from penetrating the exterior surface of a roof or to intercept and lead water off of it. Flashings divert the water to the roofing panels. The panel then carries it to the gutters or roof edge. Typically, flashing intercepts water flowing down parapets, walls of higher adjacent construction, and roof penetrations. There are four typical locations where a flashing is needed:
 - Terminations
 - Junctions
 - Penetrations
 - Joints

In any flashing detail, there are up to three different flashing components:

a) Base flashing

Base flashing is an extension of the roofing metal 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 panel. The base flashing shall reach a higher level than that of the water.

b) Counter-flashing

Counter-flashing is used, in some situations, to carry water onto the base flashing and the panel. 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.

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.

d) 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 roof system. Contact your Firestone Building System Advisor for assistance.

**TABLE 1.10-1
CHART OF MINIMUM THICKNESS OF FLASHINGS**

Base Metal:	Steel	Aluminum	Copper	Zinc
Minimum Thickness	24 ga (0.6 mm)	0.032" (0.8 mm)	16 oz (0.7 mm)	0.7 mm (0.027")

NOTE: Flashing material should be no thinner than panel material

B. PENETRACTIONS (PIPES, CONDUITS, ETC.):

	Minimize the number of penetrations on all metal roofing projects.
	Under no circumstance can a pipe penetrate through or come within 4" or the panel seam. If this occurs, move pipe into the pan of the panel. Share these specifications with responsible parties that may penetrate the roof plane. Proper planning for panel size, layout and placement of mechanical equipment coordination is critical.

1. Pipe Flashings:

- a) Refer to the Metal Penetration Details**
- b) All round rigid pipe penetrations ranging in size from 1" (25.4 mm) outside diameter to 19" outside diameter must be flashed with pre-molded pipe boot.**
- c) *Special consideration may be required for panel width, start point, end splices or special curbing installations.***

C. CURBS AND TERMINATIONS

- 1. Refer to the Firestone Metal Penetration Details**
- 2. Crickets are required on the up-slope side of all curbs (i.e. Skylights, Ventilation Ducts, Air Conditioning Units) to promote shedding of water around penetrations.**
- 3. Provide a minimum design height of at least 8" (203.2 mm) for all flashing termination's. Flashing height must be at least as high as the potential water level that could be reached as a result of a deluging rain and resulting splash from flow. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.**

4. Termination must be made directly to a sound, watertight, rigid, vertical substrate. Existing loose flashing material must be removed, or overlaid with 5/8" (15.87 mm) minimum exterior grade plywood.
5. When using a surface-mounted termination, (i.e., surface-mounted counter flashing) ensure a consistent seal at the wall interface. The surface above the termination must be waterproof.
6. Stucco, cobblestone, textured masonry, corrugated metal panels or any uneven surface is not a suitable substrate to receive flashing. Such surfaces must be prepared to provide an acceptable substrate or attach a minimum 5/8" (15.8 mm) exterior grade or pressure treated plywood. Attach and counter flash as required for structural integrity and proper sealing with material from above.
7. Termination of metal panels to walls with any kind of abutment, side or lap joints require special consideration of flashings that may include saw cut reglets, through wall flashings or full seam caulking to the above flashing.

D. ACCESSORIES

1. Snow Retention Systems, lightening rods, and other roof mounted accessories shall be mechanically installed to metal roof systems seams with either non-penetrating clamps or similar devices.



Adhered, taped, or glued snow retention systems may void the finish warranty. Snow retention systems mechanically attached through the metal roof system may void the Red Shield Warranty due to thermal movement restrictions.

1.11 WARRANTY

A. WHERE A FIRESTONE RED SHIELD WARRANTY IS REQUIRED

1. The roof must be installed according to the current Firestone requirements appropriate to the project conditions and design requirements as submitted, reviewed (noted/revised) and accepted on the Firestone Pre-Installation Notice (PIN **two weeks** prior to job start).
 2. A roof plan showing the intended roofing system construction and shop drawings of all details must be sent to your Building System Advisor for review and approval, prior to acceptance of the project by Firestone.
 3. The Firestone roof system must be installed by a current Firestone Red Shield licensed applicator.
 4. The Firestone roof system must be inspected and accepted by a Quality Building Services (QBS) Technical Representative.
- B.** 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 contracts, building codes or compliance with specifications other than Firestone's specifications. 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.
- C.** Projects outside the US must be submitted to the appropriate **FSBP-International** for consideration prior to specifying or bidding. The issuance of a warranty is dependant on this process.
- D.** Only Firestone-supplied components are eligible to be covered as part of the Firestone Warranty.
- E.** It is the owner's responsibility to expose the roofing system in the event that warranty service is required when access is impaired. Such impairment includes:
1. Rooftop equipment that does not provide Firestone with reasonable access to the roof system.
 2. Severe snow, ice, overburdens and super strata, etc., and other unrelated roofing system materials.

F. LIMITS

1. Firestone Metal roof system tie-ins to existing or new building roof systems other than Firestone are not warranted by Firestone.
2. 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 that is beyond the limits of the Firestone Metal Roof System warranty.
3. The water tight integrity of gutters or downspouts is not covered in the terms and conditions of a Firestone Red Shield Warranty.

G. CONDITIONS

Roofing systems cannot receive a Firestone warranty if any of the following conditions exist:

- The existing roof system remains in place. A complete removal of the existing roof system is required.
- Roofs where structural conditions are insufficient to support the load of the completed roof installation and other anticipated loads as identified by the building owner or the design professional.
- Roofing applications for single-family residences.

**TABLE 1.11-1
FIRESTONE WARRANTY SUMMARY**

WARRANTY NAME	SYSTEM	ELIGIBLE CONTRACTOR	COVERAGE
Red Shield	Firestone UC-3, UC-4, UC-6 or UC-14 Metal Roofing System installed over an appropriate layer of CLAD- GARD SA, CLAD-GARD SA-FR, R, or MA underlayment over an approved substrate.	Red Shield	Warranty term: 5-20 Years Repair leaks in the roof system caused by Firestone- supplied materials or the workmanship used to install them. No dollar limit to Firestone expenditures to honor the warranty.
25 Year Red Shield	Firestone UC-3, UC-4, UC-6 or UC-14 Metal Roofing System installed over a complete layer of CLAD-GARD SA or CLAD-GARD SA-FR underlayment over an approved substrate, with an additional course at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations. Stainless Steel Fasteners and clips are required for all 25 Year Red Shield projects.	Red Shield	Warranty term: 25 Years Repair leaks in the roof system caused by Firestone- supplied materials or the workmanship used to install them. No dollar limit to Firestone expenditures to honor the warranty.
30 Year Platinum	Firestone UC-3, UC-4, UC-6 or UC-14 Metal Roofing System installed over an appropriate layer of CLAD- GARD SA or CLAD-GARD SA-FR underlayment on top of an approved substrate, with an additional course at all eaves, rake edges, ridges, hips, sidewalls, headwalls, valleys, and penetrations. Stainless Steel Fasteners are required for all 30 Year Platinum projects.	Red Shield, with four (4) warranted projects in the previous 12 months.	Warranty term: 30 Years Repair leaks in the roof system caused by Firestone- supplied materials or the workmanship used to install them. No dollar limit to Firestone expenditures to honor the warranty.

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