

Roof Systems

Roof systems protect the house structure and interior from water penetration, wind and weather. In extreme weather situations, the roofing material also protects against wind-borne projectiles. Most roofing systems perform these tasks equally well, but each differs in life span, cost, and level of thermal protection.

Radiant Barriers

A radiant barrier can enhance the roof's thermal performance, regardless of the roof finish. Radiant barriers are installed in the attic space to reduce heat gain and loss, and can yield a savings of up to 15% on cooling bills. Radiant barriers comprise of a reflective metallic foil that can be attached to the underside of rafters or placed on top of the ceiling joists. Radiant barriers are also available as in a pre-installed layer on the underside of exterior sheathing material such as OSB or plywood.

Shingles

Shingles are manufactured using many different materials, including asphalt, metal, wood, and rubber. Regardless of material advantages, all shingle types are easy to handle. Installed in small units that overlap to form a water barrier, shingles tend to fail locally rather than as a system, which makes them easy to repair. Shingles are susceptible to failure in high winds. Most asphalt shingles are warranted for 15 years, but hurricane resistant types are available. Most asphalt shingles absorb a great deal of heat, increasing the heat of the house and the bills to cool it.

Tiles

Tiles are commonly made from clay or concrete. Advantages of using clay/concrete tile instead of asphalt shingles include longer life, greater resistance to projectiles, decreased thermal gain, and greater fire resistance. However, if not properly attached, tiles are prone to dislodging in high winds and can become damaging projectiles. Traditionally tiles are attached with mortar, which



(FIG.A) Radiant Barriers are available for the underside of roof sheathing. Adding this inexpensive layer can reduce Mississippi cooling bills by 15%.



(FIG.B) Shingles, Sheet Metal, & Tile come in a variety of styles. Pictured here are asphalt shingles, metal, and clay tiles.



(FIG.C) Green Roofs are an unusual option in residential construction. The larger the area, the greater the insulative impact.

roofs	construction process	speed	delivery method	required equipment	specialized labor	wind resistance	water resistance	fire resistance	thermal performance	life span	environmental impact	product versatility	market exposure	code approval	affordability	coastal considerations
radiation barrier	+	+	+	+	+				+		+	+	+	+	+	+
shingles		+	+	+	+	-		-		-	-		+			-
tiles	-				-	-	+	+	+	+	+				-	
sheet metal		+		+	-				+	+			+			+
green roof	-	-			-	-	+	+	+	+	+	+	-	-		
rubber	-				-		-		-	-	-					-

often fails in hurricane zones. Instead, tiles can be secured with screws and/or a chemical bonding agent for greater performance. Tiles can be expensive, and their increased weight requires stronger structural support.

Sheet Metal

Sheet metal roofs is available in a variety of colors and profiles, although a galvanized finish with low ribs is the most common. Sheet metal is generally approved for roofs as low as 2:12, with special underlayment. More expensive standing-seam varieties can handle roof pitches of 1:12. Most sheet metal roofs are warranted for 30 years or more, but can last much longer. Though historically as much as twice the price of asphalt shingles, the price can become comparable depending on larger market factors, such as the price of oil. A metal roof reflects more light than asphalt, saving on cooling bills. Sheets are very lightweight, and resist high winds better than shingles.

Green Roof

Green roofs comprise of a water barrier attached to the roof decking, over which planting medium such as soil and appropriate vegetation are placed. Green roofs collect rainwater and moderate interior temperatures. They must be detailed well to prevent water penetration. Green roofs are generally unused in hurricane zones or areas with heavy downpours, so further consultation and study is necessary.

Rubber

Rubber roofs, or EPDM membranes, consist of a wide rubber membrane glued to a substrate. Rubber roofs are common in commercial construction, but can be appropriate for flat or low-pitched residential roofs as well. If detailed properly, they will not leak, but precise installation is imperative. Rubber roofs can last more than 20 years. They are relatively inexpensive, but as they are usually black and absorb a significant amount of heat, increase cooling costs.

FURTHER INFORMATION

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OTHER TYPES OF ROOF SYSTEMS

Roof Systems small assembly systems

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ROOFING SYSTEMS

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Radiant Barriers

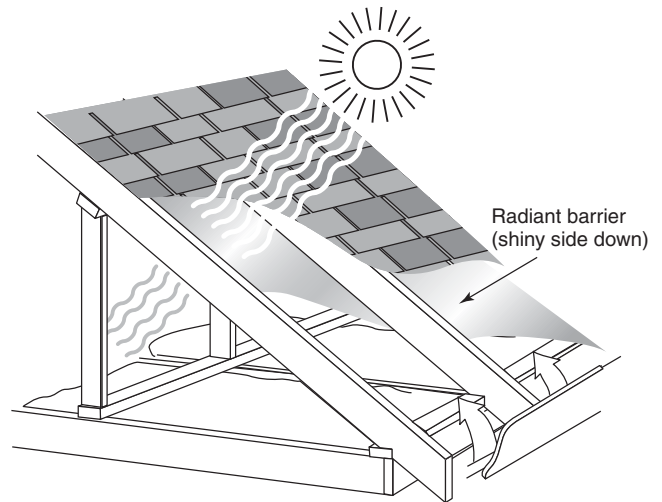
Overview: Most materials, particularly dark, matte ones, absorb much of the energy of radiant heat from the sun. In turn, they radiate this heat back into the immediate environment, including the house below, in the case of a roof material. Reflective and light-colored materials absorb and radiate less of this energy. Such reflective materials can be applied in attic spaces just below the roof, to act as radiant barriers.

Regardless of the roof finish, a radiant barrier can enhance the roof's thermal performance. Radiant barriers placed in the attic space drastically reduce heat gain, reducing cooling costs by up to 17%.¹ Radiant barrier products consist of a reflective metallic layer on a fabric or mesh back for stiffening, and can be attached to the underside of rafters or to the top of ceiling insulation or joists. There are also sprays which can be used to coat the underside of the roof sheathing. Some sheathing materials come with a factory-installed radiant barrier on the underside, which reduces installation time.

INSTALLATION

Construction process: Radiant barriers can be installed in several places in a home. If the goal is to reduce heat gain into the home, the most effective place to install radiant barriers is in the attic. The barrier can be placed above the ceiling insulation, where it will reflect the heat from the roof back into the attic space. Or it can be fastened to the underside of the roof or rafters, where it will reduce the amount of radiant heat entering into the attic space. Spray barriers can be applied to the underside of roof decking.

Speed: Installing a radiant barrier is a quick and easy process that does not require skilled labor. Using a product like TechShield, which is a foil backed roof sheathing,



(Fig. 1) Radiant barriers reduce solar heat gain. It is best to install the barrier where it keeps the heat from entering the attic and the conditioned space.



(Fig. 2) Foil backed sheathing can add radiant protection with no additional construction time. Note the shiny side faces the interior.



(Fig. 3) Rolled-out foil covers the attic floor insulation. Little fastening is needed to keep the product in place. Note the reflective side faces the interior.

adds no construction time. A spray barrier can be applied in 1-2 days.

Delivery Method: Radiant barrier products can be purchased at most construction stores or lumber yards and can be delivered to the site in a pick-up or flat-bed truck depending on the size of the order.

Required Equipment: No special equipment is required to install a radiant barrier beyond tools needed for basic carpentry or insulation installation. If a spray application is used, then special mixing and spraying equipment will be used by the installer.

Specialized Labor: No specialized labor is needed. Spray applications may require installation by a trained contractor.

PERFORMANCE

Wind Load: This product does not impact wind resistance.

Water Resistance: The product acts as a vapor barrier, which can be problematic when installed in locations where moisture may become trapped.

Energy / Thermal: Radiant barrier products are usually rated by their reflectivity and emissivity. Reflectivity is the amount of radiant heat reflected by a barrier, and emissivity is the measure of how much the material conducts heat. Most radiant barrier products have an emissivity rating of 0.05 or less and a reflectivity rating of 0.95 or greater.² A radiant barrier has no R-value, which means it cannot be used to replace insulation. Instead, radiant barriers should be used to improve the thermal barrier of a building envelope.

Life Span: There is insufficient information available on how long a radiant barrier will last. Barriers are fragile and can be easily damaged. Foil barriers will not last as long as sheathing or sprayed barriers.

Common Failure: There are two common failures for a radiant barrier. The first is a tearing of the very thin layers. Once there is a break in the barrier, it begins to trap heat.

The other common failure for a radiant barrier is due to dirt or dust.³ Once a layer of dust has built up on the barrier, that dust will heat up and transfer heat through conduction. This is a particular problem for barriers that are installed flat on top of ceiling insulation. The best way to avoid this failure is to install a radiant barrier fastened to the roof or rafters where dust is less likely to collect.

DESIGN

Environmental Impact: Reducing the heat transfer into a house can greatly reduce the amount of energy needed to cool that home. The Department of Energy writes that the use of radiant barriers could “result in a 2 to 10 percent reduction in the summer portion of a utility bill... perhaps as large as 17 percent.”⁴

Versatility / Flexibility: As noted, there are two locations where a radiant barrier can be installed in an attic, but there are many places a radiant barrier could be used to reduce the amount of heat transferred into a home. A radiant barrier will be effective as long as the reflective side of the material is facing out into an open space with an air space of at least 1” between it and the nearest surface.

Market Exposure: There are many different radiant barrier products available at home construction stores, both attached to sheathing and in rolls. The spray product is less common.

Code Approval: If installing a radiant barrier on top of the attic joists, ensure that the barrier does not cover any systems requiring inspection, such as mechanical or electrical equipment.

Affordability: The material cost of radiant barriers is between \$0.15 and \$0.75 per square foot. The cost is higher for products that combine insulation with reflective material.⁵ The additional cost of foil backed roof sheathing relative to conventional sheathing is only a couple of hundred dollars depending on the size of the roof.

Coastal Considerations: A roof exposed to the sun for a prolonged period will absorb a great deal of heat,



(Fig. 4) A spray-coated radiant barrier can be applied to the underside of the roof decking.

8.1 | Radiant Barriers

sometimes reaching temperatures in excess of 170°. Extreme heat and solar gains are common in the Gulf Coast climate. Because air-conditioning ductwork is located in the attic, it is subject to similar temperature extremes, increasing the energy required to cool a building. A radiant barrier reduces the temperature in an attic, the strain on the HVAC system, and the possibility of moisture and mold build-up in the ducts due to extreme temperature differences. The use of radiant barriers in roof construction is a sound building practice, particularly in a hot coastal climate.

GULF COAST AVAILABILITY / LOCAL MANUFACTURERS

Many construction supply stores will stock a variety of radiant barrier products to choose from. These selections should include radiant barrier backed plywood as well as various foils. Spray radiant barriers can also be ordered from suppliers and should be installed by experienced contractors.



(Fig.5) Radiant barriers come in a variety of forms. The main variable is the backing material.



(Fig.6) Radiant barriers are often installed between roof rafters. This is an example of a radiant barrier type that could be installed in an existing building.



(Fig. 7) Radiant barriers are commonly used in the attic, but can be installed in other locations. This image shows radiant barrier backed plywood being used inside a wall cavity.

Shingles

Overview: Shingles are small, easily handled units installed in overlapping layers to create a water barrier. Roofing shingles can be made of many materials: asphalt, wood, concrete, slate, rubber. Of these, asphalt is the most common, especially for residential construction.

Asphalt shingles are easy to install and repair, and are relatively inexpensive, although prices can vary with quality. They are also available in a variety of colors, styles, and textures, from a basic flat “three-tab” style to a more variegated “architectural” shingle.⁷ Asphalt shingles often come with 15-year warranties, but can fail sooner. Higher quality shingles with longer life spans are available and preferable.

There are drawbacks to asphalt shingles. Inexpensive, low-quality shingles can blow off in high winds, and dark asphalt absorbs a great deal of heat, increasing energy costs.

If using asphalt shingles in the Gulf Coast region, homeowners should use a hurricane-resistant asphalt shingle with a longer lifespan, and install a radiant barrier to counteract the high heat absorption.

INSTALLATION

Construction Process: Asphalt shingles, like all shingles, are only appropriate for roof slopes of 3:12 or steeper. They require very little preparation for installation. To prepare a roof, the roof sheathing is nailed into place and then covered with an underlayment such as 30 pound roofing felt. Around the edges of the roof and at valleys, an ice and water shield is laid in lieu of felt for greater moisture resistance, as well as to strengthen the roof surface at its edges. Eave and gable flashing should be installed before laying out shingles.

Strips of asphalt shingles are laid in rows, beginning at the

lowest roof edge and working up. Rows are chalked or marked on the roofing felt to facilitate parallel alignment and proper overlap.

Asphalt valley liners should be installed prior to shingling, and asphalt ridge caps should be nailed to any ridges after all shingles are in place. Nails are applied at the top of each shingle, which is covered by the next row, reducing leaks.

Speed of Construction: Even relatively inexperienced roofers can install asphalt shingles quickly. A 1,000 square foot house should take no more than a few days with a small crew of workers.

Delivery Method: Boxes of shingles and rolls of roofing felt are purchased and delivered from any building supply company. Higher quality or unusual styles may be special ordered.

Required Equipment: A nail gun increases the speed of installation but is not required. Galvanized Roofing nails should be used to attach the shingles to the roof.

Specialized Labor: Care should be taken with flashing details and proper valley detailing, but no particular specialized labor is required.

PERFORMANCE

Wind Load: Shingles may blow off in high winds or be damaged by wind-borne debris. Special high-wind-resistant asphalt shingles are available and recommended in coastal hurricane zones.

Water Resistance: When properly overlapped and installed, shingles should not leak, although their life span is relatively short and failure in valleys is more common. Mildew and mold may grow on shingles on north-facing or shaded faces of the roof.



(Fig. 8) A roofing installer nails down strips of asphalt shingles.

8.2 | Shingles

Energy/Thermal: Asphalt shingles absorb a great deal of heat from the sun, even when the applied aggregate is a light color. This makes them a particularly poor thermal choice for the Gulf Coast region, where cooling costs are already high. A radiant barrier below the roof sheathing is strongly recommended to reduce thermal impact.

Life Span: Most manufacturers warranty shingles for 15 years but many shingle roofs fail in less time. There are higher quality shingles on the market with 30 or 45 year warranties, which often last 25 years or more. Warranties are often voided due to imprecise installation.

Common Failure: Shingles are susceptible to mold and mildew on shaded parts of the roof. They can blow off in high winds and are easily damaged by debris. 15-year warranty shingles may not last a full 15 years, and are prone to leaking, especially in poorly detailed valleys or lower slopes.

DESIGN

Environmental Impact: Asphalt shingles are derived from petrochemicals the manufacturing process of which is toxic. Some shingles will include recycled content in their base or their aggregate. Lower-quality shingles have a short life span and must be replaced more frequently than other materials. They are not recyclable.⁸

An asphalt shingle roof absorbs much heat from the sun, especially if dark in color. Even light-colored asphalt shingles have a dark underlayment that absorbs heat. Cooling costs for the life of the building are much higher with asphalt roofs than with a more reflective metal roof. If using asphalt shingles, lighter colors, higher-quality shingles, and a radiant barrier layered below the sheathing are all highly recommended.

Versatility/Flexibility: Shingles can easily be adapted and installed around any roof vent or plumbing stack. They are very easily repaired because any damaged unit can be pulled out and replaced without disturbing surrounding units. They are easy to install on complicated roofs.

Market Exposure: Asphalt shingles are the most common choice for residential roofs, accounting for 80% of the market in the United States.⁹

Code Approval: Asphalt shingles are almost universally accepted and familiar to local building code officials.

Affordability: One of the main benefits of asphalt shingles are their relative affordability. Homeowners will need to resurface the roof much sooner than with more durable and wind resistant roofing materials, offsetting the initial cost savings.

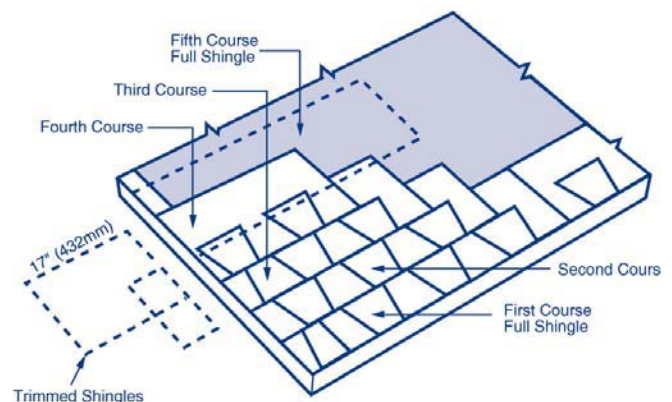
Coastal Considerations: Asphalt shingles are a common choice on the Gulf Coast, but high winds and heat absorption are strong arguments against their use.

GULF COAST AVAILABILITY / LOCAL MANUFACTURERS

Asphalt shingles are available throughout the Gulf Coast. There is a great deal of experience working with shingles in the local work force. Most shingle types can be ordered from construction supply stores. Specialty types should be ordered in advance. Most shingles are shipped throughout the United States, but if a regional manufacturer is preferred, Tamko from Missouri is one option.



(Fig.9) Architectural-style asphalt shingles are a more expensive, but more textured, alternative to a flat shingle.



(Fig.10) Diagram of shingle installation procedure.

Metal Roofs

Overview: Sheet metal roofs are lightweight, reflective, easily installed, and available in a variety of profiles, metals, and colors. Lead, zinc, and copper roofs are available, but are uncommon and expensive. Aluminum, galvanized steel, and especially galvanized aluminum (“galvalume”) are more common.

Metal roofs generally have a long life span, with some varieties lasting more than 50 years. They do not rip off easily in high winds, and sheet metal can be installed on slopes as low as 1:12. Metal roofs can easily be installed over existing asphalt roofs, making them a good choice for renovations. The metal is often made of recycled content, and is completely recyclable, making metal roofs a sound ecological choice. Although sheet metal comes in various gauges, builders should avoid metal thinner than 26 gauge.

Standing seam metal roofs have no visible fasteners, and are installed by crimping together the seams between sheets. This system is unusual in residential applications in the Gulf Coast region. Corrugated metal roofs, also known as architectural panel roofs, have a number of profile styles, and are attached to the roof with waterproof gaskets and roofing screws. Panels are overlapped to keep out water. This is a more common system in the Gulf Coast region¹⁰.

INSTALLATION

Construction Process: Roof decking is nailed according to building code and 30-pound roofing felt is applied on top. A layer of ice and water shield is then rolled along all roof edges, or over the entire roof, if the roof slope is less than 3:12.

Once the underlayment is in place, all low rakes are flashed. Standing seam roof panels are cut ahead of time to length, and butted up against each other with the seam side up. A crimper rolls down the doubled up edges of the panel and crimps the seam together tightly. A ridge cap is installed after the panels are in place.

If using a corrugated or architectural-panel roofing, 1x4 deck purlins are required to raise the panels above the surface of the roof to allow for air venting. Without this air space, condensation will build up below the surface of the metal and may cause leaks, mold, or other moisture damage. The purlins also provide more depth for the roofing screws. They are spaced at 2’ on center, parallel to the ridge, and nailed into the rafters.



(Fig.11) After the sheet metal is in place, contractors install the top rake cap.



(Fig.12) Sheet metal roofs can handle slopes from 1:12 to nearly vertical, and are a good choice in sunny climates.

8.3 | Metal Roofs

Because the screws are visible, the pattern of attachment should be considered. Rake caps and ridge caps are installed after the panels are in place.

To prevent corrosion, screws and other fasteners should be of the same metal as the roofing material. All exposed screws need some form of gasket or rubber ring to prevent leaks.

Speed of Construction: Panels on a small roof can be installed in a single day.

Delivery Method: Roofing supply companies will deliver packages with the panels, flashing, roll underlayment, and screws directly to the building site. Any purlins can be delivered from a lumber yard.

Required Equipment: If using standing seam panels, a specialized crimper should be used. No special equipment is needed for overlapping R-profile panels.

Specialized Labor: Standing seam roofs require professional installation. Architectural panels can be installed according to manufacturers' specifications without a professional, but extreme care should be taken and experienced installers are recommended.

PERFORMANCE

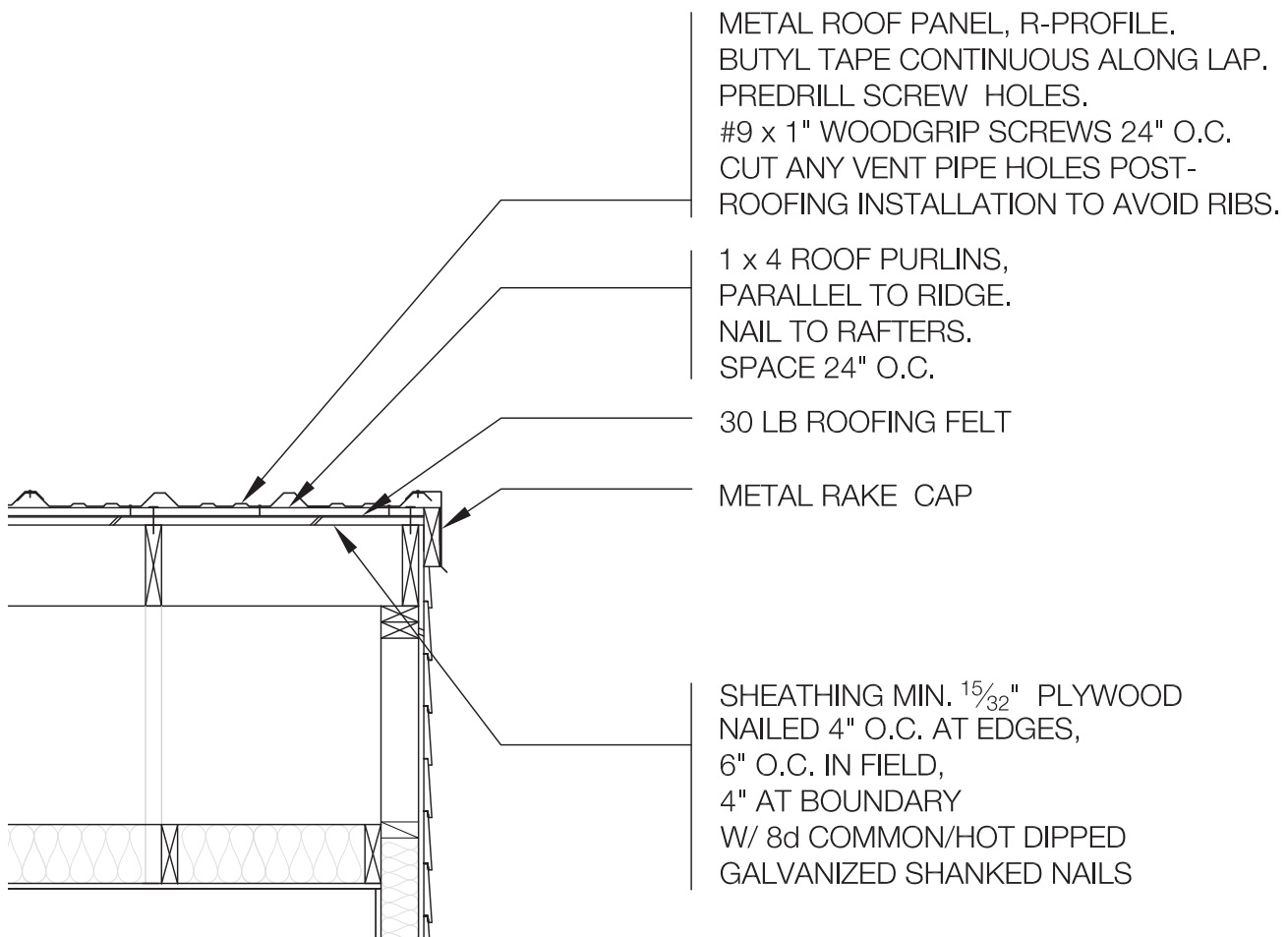
Wind Load: Sheet metal roofs are a smart choice in hurricane zones because their larger unit size and weight make them more resistive to uplift from heavy winds than smaller and lighter shingle systems.

Water Resistance: Metal roofs have fewer joints than shingles and are less prone to leaking when properly installed.

Energy/Thermal: Light colored and galvanized finish metal reflects light and heat, and thus is a smart choice for sunny coastal areas. Cooling costs are much lower with galvanized sheet metal roofs than with asphalt shingles.

Life Span: Most quality aluminum or galvalume coated metal panels will easily last 30 years, and some are marketed with a 50-year life span. Zinc or galvanized steel coatings can oxidize quickly in wet climates and therefore have a shorter life span.

Common Failure: Gaskets on roofing screws can become brittle over time, and may begin to leak. Low-quality metal will begin to rust over time¹¹.



(Fig.14) Metal roofs should be installed on 1x4 purlins and overlapped according to manufacturer's specifications.

DESIGN

Environmental Impact: Unlike asphalt shingles, metal roofs have a high recycled content. They are also completely recyclable.

In addition, lighter colored and galvanized roof finishes reflect sun and heat away from the house. Less energy is required for mechanical cooling systems, leading to lower energy bills for the homeowner.

Versatility/Flexibility: Metal panels are larger than shingles and should arrive on site pre-cut. Unusual or complicated roof profiles may be difficult to roof with metal panels. Metal roofs are appropriate for a wide range of slopes.

Market Exposure: Metal roofs are a traditional choice for the Gulf Coast region, and many historic or vernacular houses feature them.

Code Approval: Metal roofs are generally accepted by building code officials. In historic districts in the Gulf Coast region, they are encouraged over asphalt shingles.

Affordability: Metal roofs are becoming more affordable in the Gulf Coast region. A galvanized steel 26-gauge roof is generally no more than 150% the cost of a baseline asphalt shingle, and comparable in price to a higher quality or wind-resistant shingle. In addition, the material's longer life span will save the homeowner repeated installation costs over the life of the house, and its solar reflectivity will save the homeowner on monthly cooling bills.

Standing seam roofs are more expensive than corrugated panel roofs, and are more costly to install. However, they have an even longer life span.

Coastal Considerations: Metal roofs are a good choice for the Gulf Coast region. They reflect heat away from the house, lowering cooling bills. They withstand high winds well. They last much longer than asphalt shingles, and they are installed quickly.

GULF COAST AVAILABILITY / LOCAL MANUFACTURERS

Metal roofs are available throughout the Gulf Coast. The local workforce has a great deal of experience installing metal roofs. Most metal roofing types can be ordered from construction supply stores. Specialty types should be ordered in advance. Most metal roofs are shipped throughout the United States, but there are plenty of local manufacturers on the coast.



(Fig.14) A variety of profiles and colors is available for sheet metal roofs.



(Fig.15) Standing seam metal roofs are less common and more expensive, but have a longer life span.

Tile Roofs

Overview: Tiles are commonly made from clay or concrete. Advantages of using clay or concrete tile instead of standard asphalt shingles include longer life span, decreased thermal gain, and greater fire resistance. However, tiles are prone to dislodge in high winds and can become harmful projectiles. Traditionally tiles are attached with mortar, which often fails in hurricane zones. Instead, tiles should be secured with screws and/or a chemical bonding agent. Tiles can be expensive, and their weight requires stronger structural support.

INSTALLATION

Construction Process: Roof tile installation is similar to the installation of shingles or metal. Once the structure is in place, a layer of underlayment or felt paper is fastened to the sheathing to provide moisture protection. Tiles can be affixed to a roof in one of three ways: mechanically with a screw or fastener, chemically with epoxy, or with mortar.

Speed: Tile takes longer to install than other types of roofing such as shingles or metals. Aspects that can slow the installation of a clay roof include the weight of the product and the more complex fastening.

Delivery Method: Due to the heavy nature of the material, it is likely that material will be delivered to the site by truck in pallets.

Required Equipment: Some masonry tools may be needed to install tiles. Additionally, specialized clips, tracks, or fasteners may be needed.

Specialized Labor: An experienced contractor should install the tile roof.

PERFORMANCE

Wind Load: Tiles are very easily broken by wind-borne debris. Projectiles become a particular concern at wind speeds over 110mph. Where the expected wind speed is greater than 110mph, an additional clip is recommended to reduce the likelihood of failure due to uplift.¹²

Water Resistance: Higher quality tiles are kiln fired to high temperatures, creating a tile that is harder, less porous, and more water resistant. Less expensive tiles are often fired to a lower temperature and are less water resistant. When buying tile, look for an ASTM C1167 Grade 1 rating to insure a high level of water resistance.¹³

Energy / Thermal: Several tile products have received environmental ratings from various organizations, including a “cool roof” rating from the Cool Roof Rating Council (CRRC).¹⁴ The color, material, and quality of a tile can greatly affect the amount of heat or radiation it absorbs and transfers into the house.

Life Span: Tiles have a much longer life span than common asphalt shingles. They can last 50 to 100 years, if they are well installed and not exposed to severe storms. The minimum warranty for a quality product is 50 years.

Common Failure: Tiles can have detrimental chemical reactions when used with fire-resistant subdecking. Walking on a clay tile roof can quickly damage it, and should be avoided. Common failure points in high wind situations occur along the ridges.



(Fig.16) Tile will be delivered to the site on pallets. The weight of tile makes them difficult to move around on site.

DESIGN

Environmental Impact: Both clay and concrete tiles are produced with relatively environmentally responsible materials. Neither requires chemicals that can off-gas harmful toxins, so long as the coloration uses lead- and VOC-free colors. The longer life of the product and the increased thermal performance are also possible environmental benefits of using clay or concrete tiles.

Versatility / Flexibility: Tile roofs require a stronger roofing system due to the extra weight compared to other roofing materials. When plywood is used, the National Roofing Contractors Association (NRCA) recommends the use of a minimum 5/8" thick nominal exterior-grade plywood.

NRCA does not recommend installing tile roof systems on roof slopes less than 4:12.¹⁵

Market Exposure: Nationally there are many producers and a good deal of market exposure. Suppliers in Mississippi can deliver any tile product given proper lead time. There are a few tile roofers in the Gulf Coast area, but any company making a tile product will likely be able to help locate a quality contractor.

Code Approval: Tiles do not require additional fastening in roofs shallower than 5:12. One clip per row is needed when the roof slope is 5:12 to 12:12, and one clip per tile is required when the slope is greater than 12:12.¹⁶ These requirements do not include additional fasteners which may be required in high wind areas.

Affordability: Tile roofs can be more than twice as expensive as typical asphalt shingles.

Coastal Considerations: Due to the high wind loads along the coast, tile can be a dangerous material to use for roofing. However it performs well in rain.

GULF COAST AVAILABILITY / LOCAL MANUFACTURERS

Most home construction stores do not carry tile roof supplies. Some local contractors do advertise their experience with tile roofs, although it is best to inquire on a project by project basis.



(Fig.17) Tile roofs require a thicker roof deck to support the added weight of the tiles. These tiles are being installed using mortar to hold them in place.



(Fig.18) A preferred method for securing tiles in a high wind zone is to nail them to sleepers. This is a stronger connection that is less likely to fail over time and helps prevent uplift.



(Fig.19) Tiles ripped from a roof in a storm can become projectiles likely to damage other area of the roof. They can also cause damage to persons and structures.

Rubber Roofs

Overview: Low-slope (shallower than 3:12) or flat roofs require more detailing than steeper roofs. There are many options on the market for commercial or industrial products, but few are used for residential projects. Generally, low-slope residential roofs consist of an impervious sheet of material. Flat roofs have an increased vulnerability for water damage, and must be detailed and installed precisely in order to prevent leaks.¹⁷

Flat residential roofs fall roughly into three categories: built-up layers of bitumen or asphalt roofing felt applied with tar; a thin synthetic rubber called ethylene propylene diene monomer (EPDM), which is a large single-ply rubber membrane fully adhered to a subroof sheathing with a glue; or a fluid-applied membrane, which is usually used for unconventional geometric shapes or complex roofs.

An EPDM system, if installed properly, is more water resistant than a flat-roll built-up roof. EPDM roofs are a single piece of rubber, while built-up roofs comprise many overlapping pieces. Though EPDM roofs are relatively new, they have already proven to be more reliable and flexible than built-up roofs. They are also less messy to install and have a longer life span.¹⁸ This guide will focus on EPDM roofs.

In general, hire an experienced professional to design and install a flat roof or roof deck. A well-installed EPDM roof can last more than 20 years, and is relatively inexpensive. However, rubber roof membranes are almost always black, increasing heat absorption into the house and increasing cooling costs.¹⁹

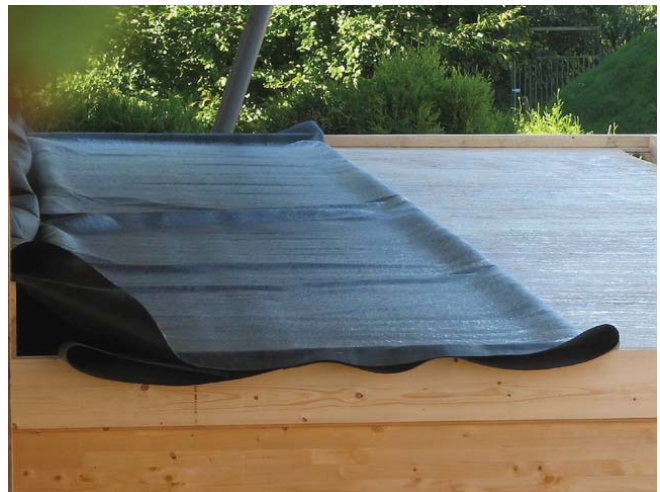
INSTALLATION

Construction Process: EPDM membranes are much easier and less messy to install than traditional built-up roof systems, but still require precise detailing and proper component pieces, adhesives, and fasteners. To prevent ponding, in which water collects and causes deflection in the structure, flat roofs must be sloped at least 1:48 (1/4" per 12"), although a steeper slope is recommended. Large surfaces should also have some form of internal drainage, especially if there are parapets.

An additional layer of plywood is added to the existing roof sheathing. This acts as an underlayment for the EPDM. This layer must be completely smooth, clean and dry before the EPDM can be laid.²⁰

The EPDM membrane is rolled out and dry fitted in position, with an extra 3" hanging over roof edges and turned up walls and vertical projections at least 12". After the membrane is trimmed to size, it is folded back upon itself for the adhesive application. A specialized bonding adhesive is applied with a paint roller in a smooth thin layer across both the plywood and the underside of the membrane. When the adhesive is tacky, the rubber is smoothed into place. Care should be taken to avoid wrinkles or air pockets, as adhesives bond quickly. A push broom is used for final smoothing.²¹

In high-wind zones, mechanical fasteners should be applied in addition to the adhesives. Such fasteners can be component pieces that screw on over underlaying knobs, some form of fastening bar, or simply a gasket and screw covered with a strip of membrane and sealed at edges. There are many variations depending on the manufacturer. These will act as a backup, in case the adhesive fails in hurricane-force winds.



(Fig.20) An EPDM membrane is first laid out and trimmed for application.

Speed of Construction: Most small flat roofs can be applied in less than a day.

Delivery Method: EPDM membrane is sold in sheets of up to 50' x 100', available through roofing supply companies. Various thicknesses are available, although a minimum of 0.060" is recommended. Depending on the supplier, the material can be picked up by the installer or dropped off on-site by the supplier.

Required Equipment: No required equipment is needed beyond the component pieces and adhesives.

Specialized Labor: Installers should have experience with EPDM and the specific product used, and follow all manufacturers' installation instructions.

PERFORMANCE

Wind Load: Homebuilders in coastal regions should not simply rely on adhesives or even ballasts, but use mechanical fasteners to keep the membrane in place.

Water Resistance: With the minimum roof slope, and no tears in the rubber, EPDM roofs are very watertight.

Energy/Thermal: EPDM products, like built-up roofs, are almost always dark or black materials that soak up a great deal of heat in the sun, raising cooling bills. There are some white EPDM products on the market. These generally have poor life spans and poor performance.

Life Span: Most manufacturers guarantee their products for 20 years. There is not enough evidence to show whether these roof systems last that long.

Common Failure: If not properly sealed, or if mechanical fasteners are not installed correctly, EPDM membranes may bubble, leak, or pond, especially over time as they become brittle.



(Fig.21) Installing an EPDM roofing membrane is a relatively straightforward task, but requires care and the appropriate adhesives.

DESIGN

Environmental Impact: Many rubber and synthetic membrane systems are produced using toxic chemicals and are laid with toxic adhesives. Most EPDM membranes are not recycled, and also not recyclable.

In addition, the high solar gain from a black flat roof will raise homeowners' heating bills substantially.

Versatility/Flexibility: Rubber roofs are a very flexible option for flat roofs or roof decks. The large sheets of rubber are pliable and easy to smooth into place and cut on site, making the material a good choice for complicated roof shapes.

Market Exposure: EPDM membranes are not as well known as built-up roofs, and builders may have to search to find knowledgeable suppliers and installers.

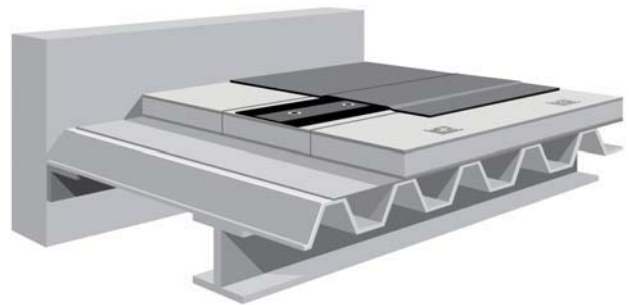
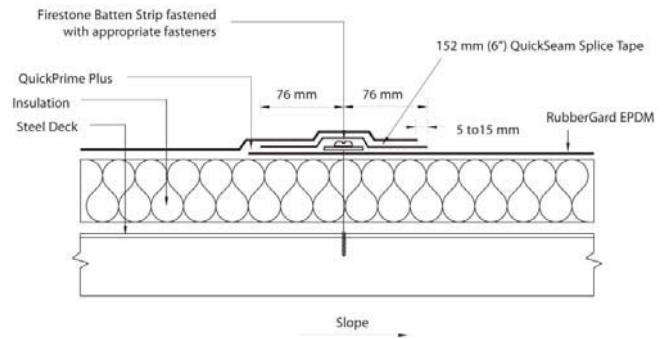
Code Approval: EPDM membranes are fairly new for residential use. Builders and homeowners should check with their local building code officials before committing to this system.

Affordability: One of the main benefits of rubber roofing is its affordability. Generally membranes cost no more than \$1/ft for the rubber, plus materials for adhesives and fasteners. Rubber roofs have inconsistent life spans, so homeowners may have ongoing maintenance costs. The high thermal gain will raise homeowners' cooling bills.

Coastal Considerations: Generally, flat roofs and rubber roofs are not the best choice for coastal areas. High winds, torrential rains, and high solar heat gain are all problematic for rubber roofs. However, if a project calls for a flat roof or a roof deck, EPDM membranes are a better choice than built-up roofs.

GULF COAST AVAILABILITY / LOCAL MANUFACTURERS

Many construction supply stores will stock a variety of rubber roof products. Because this construction method is often used in commercial buildings, commercial contractors will be more familiar with the process.



(Fig.22 - Fig.23) A mechanically fastened EPDM system uses gasketed screws to hold a sheet of EPDM in place. Some systems employ a second sheet overlapped at the joint or a separate strip of membrane to cover the fasteners. This ensures no water penetrates the hole created by the fastener.