



## ENERGY SERIES: What about the Roof?

Your roof is an investment. It is also your first line of defense in protecting your home and its valuable contents against the elements.

### What is a roof system?

Roofing is more than shingles, tile, or metal. A roof system consists of several components, properly assembled to provide the appropriate shelter for a structure. These include structural elements, moisture barriers, and possibly insulation or ventilation.

The primary design of a roof system includes features that match the weather conditions in your area. For example, a moderate-slope, hip roof will work best for hurricane prone areas while a roofline with a higher pitch and gable ends may work better for homes where snow is a dominant climate feature.

Secondary design includes limiting complexity in the roof system. A simple roofline with few openings through the roof (penetrations) will perform better with less maintenance. In addition, repair or replacement costs are generally less for homes with a simple roof design. Things that can add complexity to roof systems are dormers, skylights, plumbing penetrations, or ventilation penetrations.

A home's structural roof elements, including trusses or rafters, bracing and sheathing, protect it from damage caused by wind or falling debris. Key to a roof system's effectiveness is complete protection. What may seem like a minor oversight or slight damage can have a negative effect on the performance and longevity of roof components. Proper design and material selection are crucial in creating and maintaining a roof system.

### How can my roof act as a moisture barrier?

Protection from the various sources of moisture requires consideration of many factors such as avoiding condensation, proper flashing (many roof leaks are really flashing leaks), and sound interaction with gutters (one blockage could cause water to seep into the interior of your house).

The roof system begins with sheathing, generally oriented strand board (OSB) or plywood, which is attached to the rafters or trusses. The sheathing serves as a basic water barrier, provides lateral support for trusses, supports distributed load (like snow or workers), and forms a surface for applying a more complete moisture barrier.

The exterior roofing material acts as a home's primary bulk water barrier, and many different types are available. For most structures, roofing materials must meet certain minimum standards. This information can be found in your local building code. The most common roofing materials used in hot, humid climates include shingles (fiber glass/asphalt and organic/asphalt), metal, tile (clay or concrete), and built-up (flat roof, tar or modified bitumen and gravel).

The roofing underlayment, usually roofing felt (or tar paper), is applied underneath the primary roofing material to shed water that seeps through the roofing. It is an essential part of the primary protection system. This material comes in rolls and is attached directly to the roof sheathing in overlapping layers. Sometimes another layer of defense is installed between the roof sheathing and the roofing felt for protection from high wind or snow build-up. This secondary water barrier can be 4-inch wide strips of self-adhering polymer bitumen tape applied directly to the sheathing or decking (where edges meet). It may also be an approved self-adhering polymer modified bitumen sheet covering the entire roof deck. Check your local

building code to determine what is required in your area.

The most likely places to encounter leaks in a roof are at joints or penetrations. These locations are generally sealed using metal flashing, asphalt shingles, neoprene, caulk, or tar. Over time, with exposure to extremes in temperature, these materials can expand, contract, shift, or crack, creating spaces for water intrusion. Annual inspection can help ensure that that your roofing system is in good condition.

## How do I choose roofing materials?

### INVESTMENT

There are a number of things to consider in choosing the best roofing materials for your needs. Cost is a factor for most people, but this involves more than simply looking at the up-front price. Choosing materials that cost more initially may yield immediate savings (lower utility bills, possible lower insurance rates), intermediate term savings (better protection of your valuables from storms), and long-term savings (many more years before your next roof replacement).

### CONDITIONS

The location of your home may influence your choice of roofing materials. Among the things you should consider are: need for fire resistance (Class A rating is highest), exposure to sun, amount of rainfall, risk of high wind, whether conditions are favorable for growth of moss and algae, proximity to trees (source of falling leaves or other debris), etc. In hurricane zones, it is wise to invest in wind rated roofing options and high performance underlayments (synthetic or membrane) installed according to manufacturer instructions for high wind zones. (For more information on high wind roofing systems, see FEMA publications listed in the References and Resources section of this document.

### ENERGY EFFICIENCY

In this publication, we are concentrating on roofs with energy efficiency in mind. The U.S. Environmental Protection Agency (EPA) estimates that Americans spend about \$40 billion each year to air condition buildings – one-sixth of all electricity generated in this country. With energy savings in mind, the first thing to consider is the solar reflectance of the roofing material – the higher the number (decimal between 0 and 1) the better. Solar reflectance will depend on composition of the roofing material as well as its color. In general, lighter colored materials will reflect more solar radiation than darker materials, and smooth materials will reflect more than coarse materials. However, new advances in materials and techniques are reaching the marketplace, so there are exceptions to these rules of thumb.. “Cool color” pigments can make a dark color perform like a light color.

A reflective roofing with a high emissivity rating (>0.8) will perform best. So, a cool color painted metal roof will reduce heat gain more effectively than an unpainted metal roof.

To help you get started, look for ENERGY STAR qualified roof products. These products can lower the roof surface temperature by up to 100 degrees F, thereby decreasing the amount of heat transferred into your home. The EPA states that ENERGY STAR-qualified roof products can reduce peak cooling demand by 10 to 15 percent. This might allow you to purchase a smaller, more efficient, and less expensive cooling system. To find out more about energy efficient reflective roof products visit [https://www.energystar.gov/products/building\\_products/roof\\_products](https://www.energystar.gov/products/building_products/roof_products)

Keep in mind that ENERGYSTAR-labeled roof products can help save money by reflecting more of the sun’s energy back to the atmosphere, thereby keeping your building cooler and reducing your air conditioning bills. Therefore, you’ll receive the most benefit from using these products in hot, sunny climates.

## How do I choose a roofing contractor?

All roofing contractors are not alike and time spent finding a well-qualified contractor will make a big difference in the quality of your roof and the experience of roofing or re-roofing your house. At a minimum, roofing work in many states requires a competency license. Generally, a roofing license is required. Under limited circumstances, roofing may be performed by a general, building, or residential contractor (specifically: installation, or repair made under warranty, of wood shingles, wood shakes, or asphalt or fiberglass shingle roofing materials on a new building of his or her own construction—this does not include re-roofing). The key is to make sure the contractor is qualified to do roofing and the specific type of roofing for your house. The National Roofing Contractors Association ([www.nrca.net](http://www.nrca.net)) has a consumer-focused website to assist you in making this determination, see: <http://www.everybodyneedsarroof.com/>

In addition to licensure, some states require compliance with workers' compensation insurance coverage, and this is especially important since roofing is dangerous work. If you select a contractor or company without proper workers' compensation insurance or good general liability insurance, you may be held responsible for any injury or damage. Contact your local building department to determine the requirements in your area.

Because you expect your roof to last for many years, it makes a lot of sense to research the quality of the roofing contractor or roofing company you select. Your new roof will come with a warranty, but this may not help much if the roofing company is out of business by the time you need a repair. You can and should verify the length of time your contractor has been licensed

and in business. This verification should be done for both the individual licensed contractor and for the business. You should also check your local court records for any liens or judgments filed by or against your contractor. This is your roof, your investment, and you should ask questions before signing a contract.

## Repair issue cautions:

- Re-roofing estimates and work can be heavily impacted by the quality of previous roofing work, including repairs.
- If roof damage is extensive, you may be required to bring your entire roof (not just the damaged portion) up to current building code standards, check with your local building department.
- Failure to hire a properly licensed and qualified contractor may invalidate your homeowner's insurance coverage for roofing damage or other damage related to the performance of your roof. It may also subject you to criminal penalties.
- Failure of your contractor to obtain a roofing permit (where required) and comply with workers' compensation and safety requirements may stop work and cost you more money to complete the work.
- If you need a building permit and your contractor suggests it will be best if you obtain the permit yourself, beware this is never a good idea. It is your responsibility to make sure that all material suppliers and subcontractors (if any) are paid. If you pay your contractor and he or she does not pay others, you may legally be required to pay twice.

## References and Resources

609

- Federal Alliance for Safe Homes, Inc. (FLASH). Click on "Roof". <http://www.flash.org>

- FEMA. 2005. *Asphalt Shingle Roofing for High-Wind Regions*.  
[https://www.fema.gov/media-library-data/20130726-1604-20490-4255/ra2\\_asphalt\\_shingle\\_roofing.pdf](https://www.fema.gov/media-library-data/20130726-1604-20490-4255/ra2_asphalt_shingle_roofing.pdf)
- FEMA. 2005. *Tile Roofing for High-Wind Areas*. [https://www.fema.gov/media-library-data/20130726-1537-20490-7022/fema499\\_7\\_4.pdf](https://www.fema.gov/media-library-data/20130726-1537-20490-7022/fema499_7_4.pdf)
- FEMA. 2009. *Metal Roof Systems in High-Wind Regions*. Available at [https://www.fema.gov/media-library-data/20130726-1644-20490-8474/757\\_apd\\_7\\_metalroof.pdf](https://www.fema.gov/media-library-data/20130726-1644-20490-8474/757_apd_7_metalroof.pdf)
- National Roofing Contractors Association. Consumer section (homeowner information). <http://www.everybodyneedsarroof.com/>.
- Parker, D.S., McIlvaine, J., Barkaszi, S.F., Beal, D.J. and Anello, M.T. (2000). *Laboratory Testing of the Reflectance Properties of Roofing Material*. FSEC-CR-670-00. Florida Solar Energy Center, Cocoa, FL.
- U.S. Environmental Protection Agency. Roof Products : ENERGY STAR [https://www.energystar.gov/products/building\\_products/roof\\_products](https://www.energystar.gov/products/building_products/roof_products)
- Van de Lindt, John W., Andrew J. Graettinger, Rakesh Gupta, Steven E. Pryor, and Thomas D. Skaggs. “Damage Assessment of Woodframe Residential Structures in the Wake of Hurricane Katrina.” *Report of the National Science Foundation*, 2005.

---

Developed as part of the NASULGC/DOE Building Science Community of Practice. The factsheet editors are: Robert "Bobby" Grisso, Ph. D., Extension Engineer, Biological Systems Engineering; Martha A. Walker, Ph.D, Community Viability Specialist, Central District; Philip Agee, Ph. D., Assistant Professor, Department of Building Construction, and John Ignosh, Extension Specialist, Biological Systems Engineering, Virginia Tech.

DISCLAIMER – This document is intended to give the reader only general factual information current at the time of publication. It is not a substitute for professional advice and should not be used for guidance or decisions related to a specific design or construction project. This document is not intended to reflect the opinion of any of the entities, agencies or organizations identified in the materials and, if any opinions appear, are those of the individual author and should not be relied upon in any event.