ABSTRACT
The intent of this article is to address some of the concerns regarding hot weather uses and application procedures for asphalt shingles. Although asphalt shingles are designed for a wide range of uses and conditions, care should always be exercised whenever approaching temperature extremes. The scope of this article deals with “hot weather” application and use.

HOT WEATHER SHINGLE CHARACTERISTICS
Asphalt shingles, due to their construction, will heat up an average of 50° to 60°F above ambient when exposed to the sun’s radiant energy for a period of time. The amount of radiant energy that reaches the roof depends upon its orientation to the sun, the time of year, and the degree of pollutants in the atmosphere. As much as 70% of the sun’s radiant energy may reach the roof in a non-polluted residential area. During winter months with cooler ambient temperatures and less direct energy from the sun, black shingles rarely get to 90°F, while during summer, they reach as much as 160°F peak with a sustained temperature of 140°F for more than five hours. White shingles are usually 20-25°F cooler than black and reach a peak of 140°F in summer with a

sustained temperature of 120°F for more than five hours. The heat that is absorbed by the roof is then transferred to the attic space – 90% by infrared radiation and 10% by conduction. This heats the ceiling of the occupied space, which then tends to radiate into the rooms below.

Higher temperatures can also prematurely “age” the shingle. Elevated rooftop and attic temperatures will keep the shingle hotter throughout the daily temperature cycle of day and night. Keeping the shingle hotter will cause accelerated weathering or hardening of the filled-coating asphalt, which is the waterproofing component of the shingle. Severe hardening of the filled-coating asphalt generally causes premature shingle failure.

Most asphalt roofing shingle manufacturers, as well as ARMA (the Asphalt Roofing Manufacturing Association), cite that caution should be used when installing asphalt shingles in ambient temperatures at or above 90°F. At these temperatures, the shingle’s filled-coating asphalt softens and may be scuffed and damaged as shingles are installed or walked upon. In addition, as the shingles get hotter, the seal strip tack increases, making it more difficult to separate the packaged shingles. Accordingly, bundles that are stacked too high may create staining of the shingles in the bottom bundles.

Store all shingle bundles in the shade whenever possible. Keep the bundle wrapper in place until applying the shingles, as it offers some degree of protection against elevated temperatures. Once installed, limit all foot traffic over the completed roof. Restrict access to the roof, especially during temperature extremes, both hot and cold. Make certain that only trained inspection and repair personnel perform any rooftop activity. This is especially important for other trades such as solar collectors and satellite dish installers.

Photo 1: “Net, free ventilation area” means just that. Screens (and painted openings), louvers, and any other impediment serve to obstruct air flow.
**VENTILATION AND MOISTURE ISSUES**

**Ventilation**

The roofing industry considers proper ventilation to be extremely important to the success of not only the roof but of the building itself. Lack of ventilation can lead to excessive heat, as well as moisture build-up, both of which can adversely affect the short-term and the long-term performance of the structure, as well as the shingled roof.

Minimum ventilation for steep roofing has been defined as the ratio of 1 sq. ft. of “net-free” ventilation for every 150 sq. ft. of attic space (1:150) as measured at the attic floor level, with continuous balanced ventilation below the shingled deck, from eaves (soffit) to ridge. Half of the total ventilation should be provided at the eaves and half at the ridge. As screening of the soffit and ridge vents reduces the airflow appreciably, it is important to use the proper net-free ventilation area (NFVA) ratings when calculating the ventilation requirement. Make certain that all soffit vents are not blocked and have unrestricted airflow.

When ventilating a compact (i.e., cathedral) pitched roof, it is important to have adequate airways in the space between the insulation and the nailing deck. Narrower airways and longer runs (soffit to ridge) increase the resistance to airflow, thus the greater need to increase the ventilating air-
way space. If fiberglass batts are used below the airway, a proper air barrier must be added to prevent the insulation from expanding and blocking, or significantly reducing, the airway. A properly installed air barrier such as polyethylene or spun bonded polyolefin will keep the insulation from filling the airway. It also increases the net insulating ability of the insulation by keeping airflow from it. The use of an effective air barrier increases ventilation and reduces the potential for moisture build-up and its related problems.

**Moisture effect**

Hot, humid air holds more moisture vapor than cooler, drier air. If the warm, moisture-laden air is not properly ventilated and is allowed to cool, it can condense into liquid, giving the appearance of a leak. Also, moisture gain in wood can cause nails to back out. (See section on Decking.) Excessive moisture can also weaken shingles, reducing physical properties such as tear strength. Moisture change will cause wood to expand or contract more than thermal change. This effect increases when excessive moisture is combined with heat. Moisture drive, when combined with elevated temperatures, will prematurely age shingles, causing a weakening of the bond of the shingle matrix to the fiberglass mat.

**APPLICATION IN SUMMER AND HOT CONDITIONS**

**Storage**

Store bundles inside whenever possible to protect the shingle and wrapper from the elements. In hot weather, store the bundles in small stacks in a shaded area. Avoid improper and prolonged job site storage. Stacking too high or cross bundle stacking could create pressure points that could cause bleed-through of the asphalt coating as well as distortion of the shingle. This could also cause staining of the bottom shingles.

**Substrate**

The substrate or decking needs to be flat and smooth. Underlayments (ice and water, 15 or 30# organic) are also extremely vulnerable to damage from foot traffic when exposed to elevated temperatures. The underlayment should also be flat and wrinkle free.

---

![Photo 3A: Underlayment felt should not be left exposed; wrinkles are sure to develop.](image)

![Photo 3B: Underlayment wrinkles will “telegraph” through shingles – especially lighter weight products.](image)
Shingles bond together quickly in hot weather, and if they aren’t installed flat, the heated shingles will take on the irregularities of either the substrate or underlayment. Once a wrinkled shingle is sealed, it will be permanently distorted. As noted previously, keep the shingle as cool as possible prior to installation. Keep the shingle in its wrapper to reduce the effect of the sun’s radiant energy and prevent it from elevating the shingle’s temperature.

**Decking**

Wood responds to changes in temperature and moisture. Wood expands more in volume from moisture increase than it does from thermal increase. Moisture affects sheathing (such as plywood and oriented strand boards (OSB), causing the edges to separate and rise. Deck sheathing needs to be spaced 1/8” from adjacent boards to prevent buckling in case moisture pickup causes swelling and expansion.

Moisture increase in wood decking can also cause nails to back out, reducing attachment of the sheathing to the joists. Elevated temperatures will also cause wood to expand and create many of the same conditions as moisture. Deck movement, either from expansion, contraction, or from other problems (such as limited structural deflection), is generally slow and difficult to observe as it is occurring. Deck movement or its effects must usually be observed over a longer period.

**Fastening**

When hand-nailing, take care not to over- or under-drive the nail. To avoid improper fastening with pneumatic application, the pressure setting must be set for flush application and will need to be adjusted as the temperature changes. As the sun passes directly overhead, its radiant energy will elevate the shingle’s temperature, making it easier to over-drive the fastener. This can be a greater concern with conventional roofing staples, as their narrow wire crown can be over-driven, and with fiberglass shingles can cut and weaken the reinforcing mat carrier.

**Installation**

During installation, never cut or trim directly on top of an installed shingle, as it is very easy to cut and damage the shingle beneath. At the very least, this could leave a score mark that will weather improperly. Care is especially important when cutting the overlying shingles in a closed-cut valley, as a cut shingle is very likely to create a leak. The best tool for this type of cutting is a hook-bladed knife.

After cutting shingles around flashing or trimming at the end of a row, never lay the cut shingle with the adhesive in contact with the installed shingles. During warm weather, the shingles will stick together in a matter of minutes. Even if it were possible to separate them, the seal strip residue will permanently mark the installed shingle.

**Water Dams**

In warmer climates, the water dam usually starts from leaves and debris that force water to back up under the shingles. The lower the slope, the greater the problem can be. Immediate leaking and the potential for more serious long-term structural damage are the likely result. Use care when removing any debris so as not to damage the underlying shingles. Self-adhering membranes should be used over the deck at eaves and valleys and any other critical areas where water damming may occur. Be
cautious when using impermeable underlayment; covering too much of the deck can lead to moisture condensation under certain conditions.  

Wind  
The force of wind as it flows across the roof can have an impact upon the performance of the system. Poorly attached or inadequately sealed shingles may be subject to blow-off. Consideration must be given to the swirling characteristics of wind as it impinges on roofs of different shapes, size, and slopes. Variables to be considered are: wind velocity (instantaneous and average), real speed and duration of the gusts, pattern of wind acceleration, air density, roof shape and slope, height of eaves and ridge, shape of the shingle and its sealing adhesive, the shingle position relative to the roof penetrations, air temperature, and building orientation (leeward vs. windward).  

In warmer or hot weather, shingles seal quicker and the seal bond is stronger, reducing or eliminating the blow-off concern for all but extreme high wind conditions. For high wind conditions, most manufacturers, as well as ARMA and NRCA, recommend the use of additional fasteners per shingle (six instead of four).

EXPECTED SHINGLE LIFE  
A properly designed and installed shingle on a stable roof deck with proper ventilation will easily provide the owner with satisfactory service life. How long this product performs is also a function of the local climatic conditions, major storms, the abuse to which it may be subjected, and the maintenance performed. At the very least, attention will be required over the lifespan of the roof for the various flashing details. Given the proper conditions, it is not unreasonable to expect an asphalt shingle to perform for 25 years or even longer.

Organic felt shingles, because of their stiffer feel and better resistance to wind uplift, are often used in colder climates. When applied in cooler months, they are better able to resist blow-off until they have time to seal when the weather warms up. However, because of their organic felt and the saturating asphalt necessary to weatherproof the felt, they generally do not perform in hotter climates as well as fiberglass shingles.

Correctly designed shingles, manufactured on lighter weight fiberglass mat, also have favorable performance history. In the middle to late 1960s, thirty different roof locations in the St. Petersburg, FL, area were installed with shingles manufactured with fiberglass mats weighing 1.8#/100 sq. ft. These earlier mats were considered to be lightweight at that time. The roofs were observed every 2-3 years for over a 25-year period and were found to have performed properly. Based upon the last inspection of 14 years ago, it’s likely that these roofs may still be performing as long as recent high wind events have not caused excessive damage.

SUMMARY  
When given the choice of whether to apply shingles during hot weather, the
installer should wait for cooler conditions, or if marginal, exercise as much care as possible during installation. If the installer is unable to wait for milder weather, work should be scheduled during the cooler hours of the day and never from noon to 2 p.m. The architect and designer should also require that precautions be followed concerning ventilation, moisture control, shingle handling, and storage.

Even the best products will not perform up to their expected life if the roof system is not adequately designed or if the application is improper. When uncertain as to proper use or application, follow the industry guidelines as set forth by the shingle manufacturer, the National Roofing Contractors Association (NRCA), and the Asphalt Roofing Manufacturers Association (ARMA).

REFERENCES

Residential Manual, ARMA.
Rooftop Quality Assurance Course Manual, RCI.
Steep Roofing Manual, NRCA.

Raymond L. Corbin

Raymond L. Corbin is the president of Corbin Roofing Systems. For 20 years, he was the director of BURSI, the Better Understanding of Roofing Systems Institute for Johns Manville. Ray holds four United States roofing shingle design and application patents. He is a former chairman of the Asphalt Roofing Manufacturers Association’s Code Committee. Ray has been an industry member of RCI since 1985 and was honored with the Richard Horowitz Award for excellence in technical writing for Interface in March 2003. In 2004, he was awarded honorary membership in the Roof Consultants Institute.