FEELS WARM®
TECHNOLOGY

Dangers of Floor Heaters on Countertops

With good reason, homeowners have universally adopted heated flooring in bathrooms, basements, and even kitchens as one of the thermal comforts of higher-end homes. Technology has now advanced to take on the long-standing issue of reliably eliminating the cold feel of stone countertops without introducing a risk of cracking the stone.

Causes of Cracking

Due to the thermal properties of stone, heating a stone countertop can present a challenge. The largest concern is introducing thermal shock to the stone which can crack the countertop if a floor heating is utilized. With stone surfaces often costing thousands of dollars, the financial risk to the contractor or installer is significant, not only in loss of profit, but in damage to his/her reputation as well as the impact to the specific customer's project.

Heat-induced cracking of countertops occurs due to the molecular properties of stone (natural or man-made varieties). All materials experience expansion/contraction when subjected to temperature variations. Scientists utilize a method of measuring this physical change called CTE – Coefficient of Thermal Expansion. Low thermal expansion indexes indicate materials that have low physical change across at thermal range. *See Chart on Right*

When stone is subjected to heat, for every degree F of temperature rise, the stone expands a minute level. Cracking occurs when the differential of expansion between hot and cold zones within the stone is too severe, introducing thermal stress within the stone either vertically (between layers within the stone's thickness) or horizontally (side-by-side hot/cold areas). When the thermal stress becomes too high, it overcomes the stone's ability to hold itself together and a crack develops. Additionally, cracks can be formed when the thermal stress of heat differential is repeated time and time again, weakening the stone's ability to overcome the stresses.

CTE of Common Materials

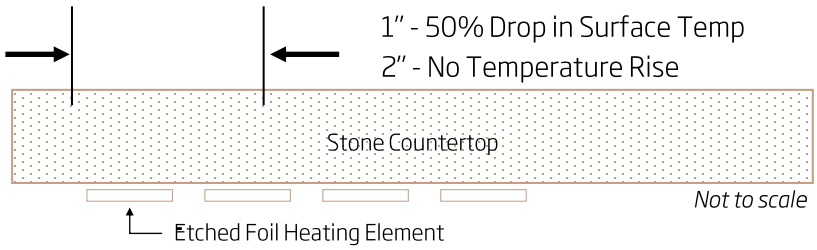
Product	(10^{-6} in/in °F)
Aluminum	12.3
Brass	10.4
Brick Masonry	3.1
Cast Iron Gray	6
Cement	6
Concrete	8
Copper	9.3
Glass, Plate	5
Gold	8.2
Granite	4.4
Iron, Cast	5.9
Lead	15.1
Marble	3.1 – 7.9
Silicon	1.7
Steel	7.3
Wood, Parallel to Grain	1.7
Wood, Across (Perpendicular) to Grain	17

Source: The Engineering Toolbox

To specifically address stone cracking risks, the following items should be incorporated into the heating scheme: Gradually heat the stone so uniformity exists throughout its thickness Avoid spot area heating Minimize the number of on/off cycles Incorporate heating element runs that are close together to produce uniform/even heat across the surface .

Methods of Heating

In the past, contractors/installers have used various methods to heat countertops on a sporadic project-by-project basis. Force air heating, fluid-based tube heating, and electric resistive floor heating mats have been used in the past with modest results. These technologies have been developed for general home heating and floor heating but they are not ideal for the specifics needs of countertop heating.



*Due to the thermal properties of stone, there is little lateral heat spread within the stone in its normal application.

One of the technical challenges in warming a countertop is that countertop stones do not radiate heat laterally within the stone. Within 1 inch of a heating element, the stone surface temperature can drop 50% and within 2 inches, the stone may not be heated at all. With countertops, it is essential that the countertop's edges are warmed just like in the body of the counter or customers will be disappointed. Because of the poor thermal conductivity of stone, the heating element therefore needs to extend as close to the edge of the stone as possible to avoid cold edges (within ½" if possible).

Risk-Free Solution

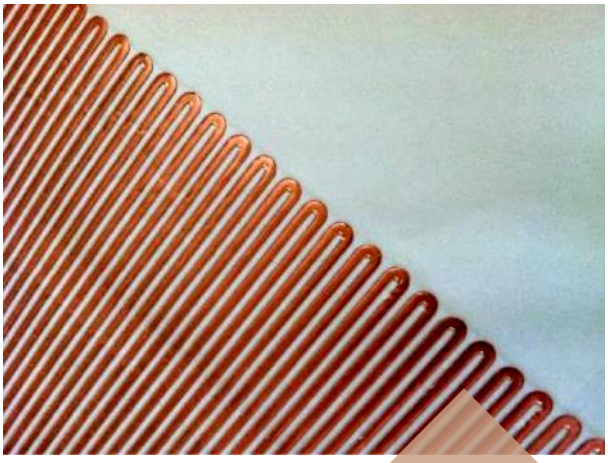
Within the past year, a technical advancement of electric radiant heaters has occurred that specifically addresses the obstacles with heating countertops. Electric heating mats utilizing ultra-thin elements have become available in large-format custom shapes and sizes. Ultra-thin flexible heaters operate on low voltage and utilize flat foil as the resistive conductor instead of thick round wire. These 'etched-foil' based heaters are laminated between thin high performance plastic films constructed of Polyimide or PET (Polyethylene Terephthalate) polymer materials to create a very rugged and dependable heating mat.

The resulting heater can be as thin as .010" thick. Etched-foil heaters are also patterned so that the conductive heating element will match the shape and size of the countertop, will come close to the edge, and will have narrow spacing between elements (around .025" gaps). These heaters can be adhered to the underside of stone countertops using pressure sensitive tape for quick installation. The flatness permits the heater to be sandwiched between the stone and the cabinet without introducing a reliability risk or without having to mill out areas to compensate for thickness.

Floor heating elements are often 2-3 inches apart which cause uneven heating. It is also difficult to apply the elements close to the counter edge, leaving the edge cold.

Photo by Polmaster Tile Center +3D Design Studio Inc.

In 2013, Heated Stone Products of Lakeville, MN was the first company to introduce etched-foil heaters for countertops under the brand name of FeelsWarm® heating technology. FeelsWarm heating pads are designed to provide very gradual heat rise by operating under low voltage (12-24 volts) and each heater is supplied with its own transformer. The company offers custom and standard heating pads.



Floor Heating Limitations

As a comparison, floor heating mats utilizing thick round wire elements are designed to heat large areas of flooring and therefore are powered by high voltages (household power of 120V or even 240V) in order to get the needed wattage output. Floor heating is controlled using a closed loop control scheme where a sensor provides feedback to the electronic control device on what the temperature of the floor is.

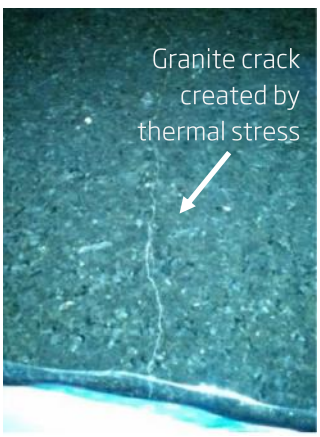
FeelsWarm patterns have spaces that are under ¼ inch. This allows for uniform heating and the ability to get close to the edge of the counter.

The combination of higher voltage and a temperature sensing system creates pulsing of the heating element that institutes a fast heat rise followed by a delayed power off stage. This repeats continually to arrive at an average surface temperature.

Real Example: Floor Heating Cracked Counter

The following photographs, provided by a custom homebuilder in California, show an application of cracking of a granite countertop due to integrating a NuHeat floor heating element system as a countertop heater. Within 24 hours of activating the heater, the stone cracked on the surface. Per Derek Dykstra, "The countertop would lie perfectly flat while cold, but once the heat was applied, the countertop would heave at its seam. Eventually, the crack grew across the width of the slab." He repeated the identical job using a FeelsWarm heater and has a happy customer.

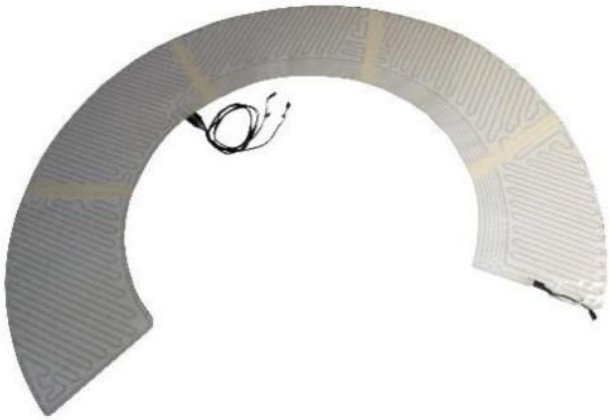
Photo by Derek Dykstra, A Place To Hang Your Hat,

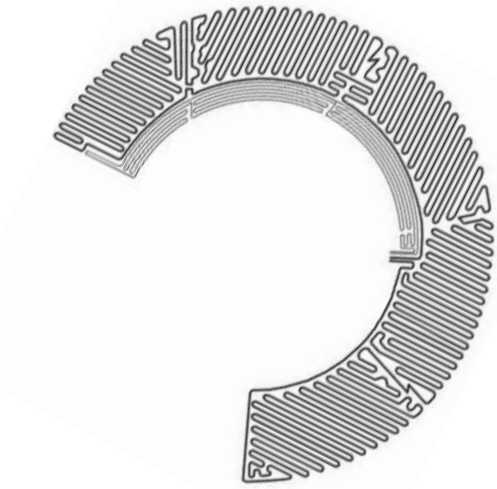


"FeelsWarm is superior to NuHeat in every way for a countertop application. It is vastly easier to install, and, more importantly, it provides a much better level of comfort and consistency of heat across the slab."

-Derek Dykstra

NuHeat Installation: It took the contractor 8 hours to install this floor heating mat to the countertop. It required the contractor to trowel a thin-set compound to encapsulate the heating element. Within a day, the floor heating mat caused the countertop to crack and the $5,800 stone slab had to be discarded.





FeelsWarm Installation: After the counter was cracked, the contractor ordered a custom FeelsWarm heater. He was able to heat all the way to the edge of the counter and install it four times faster. The FeelsWarm heater eliminated the thermal stress and the potential of another cracked counter.

Results

The overall appearance of stone countertops ensures that the elegant surface will remain a mainstay in luxury homes and businesses for decades. Addressing the cold feel of countertops only adds to this long-standing standard. Yet, utilizing floor heating techniques can produce sub-par quality in feel and performance. Furthermore, the added risk of cracking a premiere and expensive countertop surface is something contractors and installers should be concerned if not using a technology designed specifically for the countertops.