BUILDING TRUST

TECHNICAL BULLETIN

Tenting and Cool Weather Application of Acrylic and Cementitious Materials

INTRODUCTION

When air temperatures begin to fall in the autumn and winter, special considerations must be given to application of cementitious and acrylic materials. Application of these materials are typically restricted to temperatures of 40 °F and rising. This minimum is critical to the proper curing and overall performance of the products. Acrylic coatings will not develop physical strengths properly or coalesce to form a film correctly in temperatures below their design standard. (Specialty or stone finishes such as SikaWall Granite and Stone and are restricted to application at temperatures of 50 °F and rising.) Application of materials in cool, cold and freezing conditions commonly cause materials to crack, flake, soften or delaminate. Tenting and heating is one of the most common practices to control working conditions during cold weather application. Factors which should be controlled during tenting are numerous and depend upon the severity and nature of the weather. Understanding the factors involved is extremely important and can help reduce heating cost and result in a more successful project.

DRYING PROCESS

Relative humidity (RH) is the amount of moisture contained in air, relative to the amount of moisture the air can hold at saturation. At saturation or 100% RH, air gets foggy. Cold air cannot hold as much moisture as hot air, thus as the temperature drops in a given area, such as under a tent, the RH will tend to increase until saturation or 100% RH is reached.

As material is applied to walls in a cooled area, the amount of moisture in the air increases. Moisture leaves the material by evaporating into the air. At a constant temperature, the amount of moisture will build up fairly rapidly to saturation or 100% RH. At this point the material on the wall will stop drying because the moisture cannot evaporate into saturated air. Walls and panels have been known to stay wet for weeks under these conditions.

You may also experience problems when the air temperature and the RH are moderate. Often, this problem occurs if the wall is cooler than the air. Thus, the RH at the wall is higher than other areas under the tent or in the panel shop. When the wall and the air immediately in front of the wall are cooler, the moisture in the warm air will condense on the wall, similar to water on a sweating glass of water. The moisture content of material on the wall or panel will actually increase. This can happen when the area under the tent is heated and the backside of the wall is extremely cold or below the dew point of the air. Moisture collecting on the inside wall of the tent indicates this condition is in effect. If the tent wall is sweating and there is no reason to expect that the application wall is warmer, you can be sure that the wall is also sweating. Instead of drying, it is increasing in water content.

Another typical condition you might encounter is a partially dried wall under a well-heated tent. If you turn off the heat in anticipation that the wall will dry before the temperature drops below 40 °F, the RH will build to saturation after only a slight drop in temperature. As a result, condensation can occur on the wall. The wall will re-wet, and, if the temperature continues to drop below 40 °F or the minimum application temperature, you can get cracking and crazing just as if the material had been applied below the required temperature. A wall may become re-wetted anytime before it has dried and before the acrylic particles have had time to coalesce.

Note: A good test to determine whether a wall has fully dried consists of applying maximum pressure with your thumb while rotating your thumb 90 degrees. If the film is dislodged or moves under the rotation and pressure, it has not dried enough for the acrylic particles to coalesce, and water can re-wet the wall.

With knowledge of the outside temperature and RH, the amount of heating and venting can be regulated, resulting in considerable cost savings. The level and duration that heat must be applied is just as much a function of RH as it is temperature. The lower the RH, the faster the finish will dry. It is not always true that the higher the temperature, the faster the finish will dry. At 100% RH, the wall will never dry regardless of how much heat is applied. The combination that results in the most rapid drying is high temperature and low humidity.

VENTING

Venting is the ideal method to lower humidity. However, it must be realized that when moisture is allowed to escape through vents, outside air can enter through the same vents. If incoming air is wet, as on a rainy or foggy day, the dry rate will be extremely slow. Additional heat will help only if there is a very large increase in temperature coupled with venting and a lowering of humidity. Temperatures above 40 °F are necessary for proper film formation for all products except specialty finishes such as the stone finishes SikaWall Granite & Stone, which require 50 °F. Increased temperature will also help dry the air, provided there is no additional moisture added. Low humidity is important to rapid drying at any temperature. Heating without venting is wastefully costly, because moisture build-up from the drying process will slow the drying.

Remember that temperature affects humidity. Humidity has a strong effect on drying rates. Other factors such as wind and circulation of the air, film thickness, and the amount of water contained in the formulation also affect the drying rates.

TEMP	RELATIVE HUMIDITY	DRY RATE
40 °F	90%	Very Slow
90 °F	90%	Slow
40 °F	20%	Slow-Average
60 °F	50%	Average
80 °F	60%	Average-Fast
90 °F	20%	Fast

Sometimes there is a reluctance to vent because of the idea that venting lets the expensive warm air out and cold air (that must be heated) in. Actually, it lets warm, saturated air out. The out-going air has done its job, which, if retained within the tent, will work against you. On a cold, dry day, it takes only a small amount of cold air, heated to slightly above 40 °F, to lower the RH considerably.

If the air under the tent is not saturated or near saturation, there is no need to vent. You can monitor the temperature and RH with a simple hygrometer. Since both temperature and RH will vary during the course of the day, your monitoring of these conditions is critical to ensure a proper cure is achieved.

When cementitious materials such as stucco base are applied, there is no need to vent. The added moisture will not harm these products as long as the temperature is maintained above 40 °F. With these bases, most of the water is consumed in the cement curing reaction.

TENTING TIPS

Following are ten recommended procedures that should be followed when tenting the jobsite. When practiced, they will help reduce costs and potential problems.

- Measure the RH and temperature on the inside and outside of the tented area. Adjust the heat to above 40 °F and vent to maintain the RH as low as possible.
- Adjust the roof of the tent so that water does not drain inside the tent. Wet ground can be a source of moisture under the tent and is a source of moisture that will tend to compete for evaporation with the moisture in the applied coating.
- Vent only as the humidity under the tent begins to build. Humidity will build as more material is applied and dries under the tent.
- Ensure that the wall is dry before turning off the heat and closing the vents. Use the “thumb test” in several key locations.
- Do not attempt to blow hot air directly on the finish. Localized hot spots will cause problems such as color variations and cracking.
- Watch for “sweating” on the tent. Increase heat and/or venting as needed to address this situation.
- There is no need to vent to cure cementitious bases, but the temperature must be maintained above 40 °F.
- The variables that affect drying rates are temperature, humidity, thickness of the applied product, wind/air circulation, and sunlight. Without air movement, the RH is always 100% immediately adjacent to the wall.
- Construct your tent with vent flaps that can be raised and lowered. A poorly constructed tent, which lets in too much air at the wrong time, can be costly.
- Observe manufacturer’s safety rules when using supplemental heaters. Heaters using fossil fuels produce carbon monoxide and must be ventilated. Electric heaters must be grounded and kept away from any locations where water can pool.

HELPFUL HINTS FOR COOL WEATHER

Keep these facts in mind when you are applying cementitious and acrylic materials in cool conditions:

- Materials with controlled set times will set up more slowly in cooler temperatures; at high relative humidity and cool temperature, they might not set up at all.
- Evaporation is generally slowed at cooler temperatures. Protect the work area for as long as it takes for completion of the curing.
- Strength development of the initial and ultimate physical and chemical strengths of materials will be reduced.
- Thermal fluctuations will cause movements in the substrates. Any crack in the substrate, including joints between substrate components, is subject to movement. Thermal cycling, and therefore maximum movement, is

at its highest frequency during the fall months. Cracks that appear narrow in the warmth of the afternoon (when substrates are expanded) may widen significantly during the night as the temperatures fall. This type of thermal movement can cause surface cracking. In patching/repair situations, the cracking could be even more pronounced because the patching material that fills between or around seasoned material has not yet developed its full strength.

- Monitor the extended weather forecast during the application and curing period so that you are prepared for any temperature drops. Also, pay attention to the dew point temperature. This will tell you the evaporation rate of the excess water that affects the cure and the open times of the applied material.
- Keep materials, both powder and liquids, in heated (40 °F or warmer) storage until ready for use.
- If patching/repairing, keep patch areas warm after initial set of the material. This will assist in curing and reduce the thermal stresses.
- Coating materials, whether cementitious or acrylic can also be compromised in many ways when applied in cool to cold temperatures.

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