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Temperature, Humidity and Dew Point Guidelines

CONTENT

INTRODUCTION

The ambient temperature, substrate temperature, humidity and dew point will affect the handling properties, initial cure rate and ultimate mechanical properties of the cure product under the best conditions. Under adverse conducts the ambient temperature, substrate temperature, relative humidity and dew point will cause problems.

ENCLOSED FACILITIES WITH HVAC

The US Occupational Safety and Health Administration recommends that indoor air temperatures be maintained between 68°F to 76°F (20°C to 24.4°C), with the relative humidity between 20% to 60%. For enclosed facilities, with properly working HVAC systems, they can maintain the temperature and relative humidity. However, newly enclosed facilities or retrofit facilities without a working HVAC system are not acclimatized, which can cause problems.

OUTSIDE INSTALLATIONS OR NO HVAC

Outside applications or facilities without a working HVAC system are affected by the prevailing environmental conditions. Cold temperatures delay cure time and increase viscosity; inversely, warmer temperatures accelerate cure time and decrease viscosity. For those installations the temperature swings can be tremendous, often exceeding 50°F (28°C) from early in the morning to late evening. Extremely low relative humidity level can affect moisture cured polyurethanes, and high relative humidity can affect the evaporation rates of the moisture in waterborne and can interfere with chemical reaction of polyurethanes.

EFFECTS OF TEMPERATURE

Epoxies, polyaspartics, polyurethanes, etc. are polymer chemicals that cure into semi-rigid to hard surfaces when employed within their design limitations. These polymer coating and surfacing products cure to an inert lightweight, corrosive, abrasion and microbial resistance, and they possess other mechanical qualities that make them valuable material for use in construction and concrete surface repair. While epoxy remains durable under most everyday conditions, degradation of its polymer matrix can occur due to high temperatures and extremely low temperatures.

For best results with material intended for "ambient temperature installations" (not the materials designed to be applied at elevated temperatures), condition and install the material between 68°F to 76°F (20°C to 24.4°C), with the relative humidity between 20% to 60%. In addition, this technical bulletin does not address "in-use" elevated or lower temperatures.

Low Temperature Installations

1. Freezing
2. Crystallization
3. Increase in viscosity
4. Excessive material demand (due to increase in viscosity)
5. Protracted cure times
6. Amine blush
7. Arrested cure

High Temperature Installations

1. Shortened working time
2. Possibility of the top skinning over (entrapping solvent)
3. Lowing of viscosity
4. Resin starvation on slopes
5. Lap Lines (failure to hold a wet edge)
6. Flash set (poor bond)
7. Crater (no back flow)
8. Blister for outgassing
9. Stress cracking
10. Rough or uneven texture
11. Run especially on vertical surface

HUMIDITY

Polyurethanes and waterborne epoxies are sensitive to moisture. Polyurethane and waterborne epoxies are capable of being applied up to a maximum of 75% RH and as long as they are placed and cured at 5 degrees below the dew point. When there is excess moisture in the air, moisture can form on the surface of the coating film that will reduce the clarity of the finish, and may cause pin holing and foaming.

Early water contact with an uncured resin will contaminate the surface causing a variety of surface defects. As the relative humidity (moisture vapor) in the air increases, the potential for condensing as liquid increases as the dew point is approached.

For Polyurethane coatings, this can manifest itself as a milky haze or streaks.

EFFECTS OF HUMIDITY

Humidity is defined as the amount of water vapor (gaseous phase of water) in the air. It is an indicator of the presence of dew, frost, fog, and precipitation. The maximum water vapor which can be held in air is affected by temperature and atmospheric pressure variation. The higher the temperature, the greater the amount of water vapor it can hold before reaching a saturation point.

ABSOLUTE HUMIDITY

Absolute humidity is the measurement of the water content in the air typically in units of grams per cubic meter. It is calculated by dividing the total mass of water vapor by the volume of the air. Given the same amount of water vapor in air, the absolute humidity does not change with temperature at a fixed volume. If the volume is not fixed, as in the atmosphere, absolute humidity changes in response to the volume changes caused by the temperature and pressure variation.

RELATIVE HUMIDITY

Relative humidity compares the current ratio of absolute humidity to the maximum humidity for a given temperature and expresses this value as a percentage. The higher the percentage, the higher the humidity. It is affected by both temperature and atmospheric pressure. As an example, the same amount of water vapor will be a higher relative humidity in cool air than in warmer air.

Relative humidity is a commonly used metric in weather reports and forecasts and is a good indicator of precipitation, dew, frost, fog, and apparent temperature. Apparent temperature is the temperature perceived by humans. In summer, the higher the relative humidity, the higher the apparent temperature. This is a result of a higher humidity reducing the rate at which sweat evaporates, which increases perceived temperature.

A relative humidity of 100% indicates that the air is saturated, given the current conditions, water vapor in the air cannot increase further in normal conditions. 100% relative humidity is also the point at which dew can begin to form.

EFFECTS OF DEW POINT

Dew point is the temperature at which a given volume of air, at a certain atmospheric pressure, is saturated with water vapor, causing condensation, which results in the formation of dew.

Dew is the condensed water that is seen on the surface of objects. Dew point varies depending on the amount of water vapor present in the air, with more humid air resulting in a higher dew point than dry air. The higher the relative humidity, the closer the dew point to the current air temperature, with 100% relative humidity meaning that dew point is equivalent to the current temperature. (Dew point below freezing (0°C or 32°F), the water vapor turns directly into frost rather than dew.)

As long as the air temperature remains above the Dew Point, the air is unsaturated; i.e. it is capable of holding additional water vapor. Crown Polymers has adopted a “safe zone” of 5°F (2°C) above the Dew Point.

DEW POINT CHART

Dew Point – The temperature at which moisture will condense on a surface. No polymer coating should be installed unless the temperature is a minimum of 5°F (2°C) above this point.

Example: If the air temperature is 70°F and the relative humidity is 65%, the Dew Point is 57°F. No coating should be placed unless the surface temperature is 62°F or above.

Relative Humidity	Ambient Air Temperature – Fahrenheit								
	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F	120°F
	The Surface Temperature On Which Moisture Condensation Occurs								
90%	37°F	47°F	57°F	67°F	77°F	87°F	97°F	107°F	117°F
85%	36°F	45%	55°F	65°F	74°F	84°F	95°F	104°F	113°F
80%	34°F	44°F	54°F	63°F	72°F	82°F	93°F	102°F	110°F
75%	33°F	42°F	52°F	62°F	70°F	80°F	91°F	100°F	108°F
70%	31°F	40°F	50°F	60°F	68°F	78°F	88°F	96°F	105°F
65%	29°F	38°F	47°F	57°F	67°F	76°F	85°F	94°F	103°F
60%	27°F	36°F	45°F	55°F	63°F	73°F	83°F	92°F	101°F
55%	25°F	34°F	43°F	53°F	60°F	70°F	80°F	89°F	98°F
50%	23°F	31°F	40°F	50°F	57°F	67°F	77°F	86°F	94°F
45%	21°F	29°F	37°F	47°F	54°F	64°F	73°F	82°F	91°F
40%	18°F	26°F	35°F	43°F	51°F	61°F	69°F	78°F	87°F

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