Application in hot climates

Introduction

It is a general industry rule and common painting practice that the surface temperature does not exceed 40°C/104°F, however, this is not always realistic in some regions or specific projects. During summer, the temperature may be significantly higher in some parts of the world and steel temperature may be even higher if exposed to direct sun.
Normally the maximum surface temperature for application is not stated in the product data sheets and data for application is typically given for temperature up to 30°C/86°F or 40°C/86°F depending upon the product. Application at higher temperature might be acceptable as long as the paint has sufficient flow characteristics, the recommended film thickness can be achieved without sagging, the film formation is good and the substrate is properly wetted. In some situations, the elevated temperatures may result in challenges such as dry spray, sagging, reduced pot life, reduced overcoating interval and cosmetic properties. Specific precautions may help to achieve an acceptable result in such conditions.

Safety

Use adequate personal safety equipment and follow sound procedures for both surface preparation and paint application. Apply paint only in well-ventilated areas. Observe safety labels on packaging and paint containers and consult Hempel's Safety Data Sheets for the products to be stored, handled, and applied.

Scope

The document is relevant for application of most Hempel products at ambient condition in location with hot climate and possibly direct sun exposure. For application on surfaces additionally heated by external sources (e.g. on operating steam pipes) please consult Hempel's Technical Guideline "Application on hot surfaces" available on https://www.hempel.com/service-and-support/technical-guidelines and/or your local Hempel representative.

Challenges of application in hot climates

Both solvent free, solvent based, and waterborne products can be used in hot climates, typically local experience ensure that products and specifications are suited for the conditions and the applicator will be able to limit problems. However, some possible issues include the below.

Dry spray
Generally, the surface temperature should not exceed 60-65°C/140-149°F. Extra thinning will often be necessary to avoid dry spray and to keep the paint film fluid (open) long enough to enable it to flow together forming a uniform and coherent film.
Special thinners with lower evaporation rate should be used, however, these solvents must be compatible with the paint applied.

General slow-evaporation thinner recommendation for different generic types:

- Epoxy: Hempel's Thinner 08630 (in normal conditions the recommended is 08450)
- Polyurethane: Hempel's Thinner 08880 or 08710 (in normal conditions the recommended is 08080)
- Alkyd: Hempel's Thinner 08230 (in normal conditions sometimes 08080 is used)
- Acrylic (single pack): Hempel's Thinner 08700, 08740, 08710 or 08630 (in normal conditions the recommended is 08080) (see comments below regarding single pack paints).

Using slower evaporating thinner is preferred compared to using excessive thinning with standard thinner (mentioned above). This is often seen and may, to some extent, work. However, it may lead to other issues e.g. sagging or reduce gloss, especially relevant for topcoats. The resulting reduction in volume solids will require a higher wet film thickness to be applied to achieve the specified dry film thickness. The recommendation is to avoid exceeding the maximum percentage of thinning stated in the PDS of each paint product and instead swich to the slower evaporating alternative.

Sagging
There is a direct relationship between the temperature of the paint and its viscosity.

Higher temperatures will result in lower viscosity, this will usually provide better spraying properties, but it may also result in a higher tendency to sag. Thinning further increase the tendency to sagging.

Reduced pot life
Chemically curing 2 component paints (epoxies, polyurethanes) will show a reduced pot life as paint temperature increases. A simple rule of thumb the pot life is reduced by 50% for each 10°C/18°F increase in paint temperature. Storing the coating material in a cooled location until use will reduce this issue.

Orange peel
For chemically curing paints at temperatures above 40°C/104°F the finish may start to suffer in the sense that the film formation will be more uneven (orange peel etc.) and overlaps will not blend-in properly due to too fast drying. This can be limited by thinning and planning of the application beforehand.

Pinholes and popping
High surface temperature may result in a film with pinholes and popping due to the increased evaporation rate of the solvent or water or air bubbles being trapped when, the paint sets too fast and does not allow air vacuoles to be released from the paint film. Heavy thinning and application in multiple thin coats may compensate this negative effect to a certain degree.
Physically drying paints (acrylic, vinyl, and chlorinated rubber) should never be applied onto surfaces with temperatures higher than 40°C/104°F.
At higher temperatures introduction of bubbles and blistering in the paint film may easily occur (instant vacuole formation).

Gloss
Gloss may be reduced by the application at elevated temperatures due to uneven film formation, but the colour should not be affected.

Overcoating Intervals
At elevated temperatures overcoating intervals may not be available on the data sheet or in the specification. These intervals will be significantly reduced. Consult your local Hempel representative for more details regarding the system to be applied.

Recommendation

To minimize the possible negative effects of painting in hot environments, the following advice should be taken in consideration:

1. Avoid painting during the hottest hours of the day, usually it is better to plan early morning application. A good idea is to carry out surface preparation on the previous day, leave the area covered to minimize occurrence of flash rust overnight and only remove it early in the morning and apply the first specified coat as early as possible.
2. Late afternoon or evening applications may also be possible, however, consider that abrasive blasting during the day may even increase the heat on the steel surfaces.
3. Implement shades when possible: tenting, side nets, etc to minimize direct sunlight.
4. Plan the application according to the geometry of the object and the UV light exposure, e.g., paint as early as possible the areas that will be exposed to high heat first, leave the shady areas last.
5. Heat radiating from the substrate and strong winds may promote dry spray, paint as close as possible to the surface without allowing the pressure of the spraying to deform the wet coating on the surface.
6. To avoid dry spray, apply coats perpendicular to the substrate
7. On each pass of the spray gun apply a thinner than normal coat to facilitate dissipating the heat to reduce the likelihood of pinhole formation

Zinc silicates

This generic type of paint is prone to dry spray in general. At elevated temperatures, this negative effect is accentuated, and for this reason it is recommended to apply zinc silicates at temperatures below 30°C/86°F.

Temperature of the paint

It is highly recommended in all cases to keep coating material away from direct sunlight. Preferably keep them inside air-conditioned buildings or containers, if this is not possible, then keep them in shady areas (e.g., under the hull of a ship or big objects) and use tarps or nets to reduce the influence of hot ambient conditions. Also, a cooling container (e.g., a big container with water and ice) may help keep the temperature of the paint down during prolonged periods of paint application.

Some paints also contain components which are sensitive to hot temperatures during storage or application, this may affect the performance of these additives or even cause exudation.

The best storage conditions are at temperatures between 10°C/50°F and 30°C/86°F. Storage at high temperature may result in soft settlement of some pigments so thorough stirring of the paint is essential before use.