

Application on hot substrate

Introduction

In many cases it is desirable to apply coatings whilst the equipment is still in operation. This can be for a variety of reasons but usually to avoid the cost of shutting down process equipment. This is particularly the case when carrying out coating work to prevent Corrosion Under Insulation (CUI) which generally occurs at elevated temperatures. Applying coatings to hot surfaces is not the same as at ambient temperature. Failure to follow these guideline may impact the coatings performance.

Safety

Always use adequate personal safety equipment, follow sound procedures and provide adequate ventilation. Refer to safety data sheets for the relevant product(s).

Application of solvent containing organic coatings on hot substrate has significant safety implications. The warm conditions will cause the solvent to evaporate fast and may reason in much higher vapour concentrations than would be experienced at ambient conditions. It is important that prior to commencing work the persons responsible for the work complete a through risk assessment including reviewing the control of any substances hazardous to health.

This should always be done in co-ordination with the facility operator.

Key risk to be considered include but are not limited to:

- Solvent inhalation due to increased solvent release during application to elevated temperature surfaces.
- Explosion risk of the air/solvent mixture.
- Burn injuries due to contact with the hot surface to be coated.

Specific rules may apply to the use of spray equipment in operating environments, especially those containing potential flammable atmospheres.

Scope

Hot substrate is in this context defined as steel on pipes and process equipment with an internal heat source causing temp be higher than natural environment can create - typically steam pipes. The operating temperature is typically above 120°C [250°F] and the guidance here is valid up to 200°C [392°F].

The methods described here, concerns specific products for hot service and designed to prevent corrosion under insulation.

Versiline CUI 56990 is a MIO pigmented, fibre reinforced, inorganic co-polymer coating that cures to an inert polymer matrix, able to resist temperatures up to 650°C [1200°F] and thermal shock/cycling in dry or dry/wet service. Conforms to NACE SP0198 - 2017 systems SS-5, CS-6 and CS-8.

Hempaprime CUI 275, 17530 is a fast drying, alkylamine cured epoxy paint. It provides long lasting barrier protection in coating systems for severe corrosive environments, including high temperature and wet conditions found beneath thermal insulation.

Other products This guidance is intended for the abovementioned products only. If other Hempel products are relevant in specific cases please consult your local Hempel representative.

Surface preparation

It is recommended to check the specification for pre-treatment prior to application and/or the technical guidelines for surface preparation. The nature of the work in an operational environment may limit the type of surface preparation that can be carried out and the type of tools that can be used. Where surface preparation is carried out by "wet" means such as wet abrasive blasting or high or ultra-high pressure water jetting the presence of flash rusting shall be limited to maximum Light.

Spray application

Application to hot surfaces should always be carried out by spray application whenever possible.

Specific details containing the general application parameters for each individual product can be found on the relevant product data sheet.

Film thickness and finish related

The minimum specified dry film thickness of the coating scheme shall be applied. However the number of coats and overcoating interval may change dramatically compared to coating work carried out at ambient temperature. The total film thickness shall be built up in a number of thin layers with a wet film thickness equivalent to 50-75 µm dry film thickness per coat. This will vary for each product and is shown in Table 1. Due to the elevated temperature of the substrate this will result in rapid drying of the coating and very short minimum overcoating times. The final film thickness should be achieved "in one process" by spraying the necessary number of passes within a few minutes. In each step only coat as much surface area as can be repeatedly overcoated immediately. Note that for spray application of Hempaprime CUI 275, a short interval of 7 – 10 seconds should be maintained between each pass. This allows the solvent to evaporate and minimizes issue with solvent entrapment resulting in uneven finish. Application requires a high degree of awareness and experience from the applicator. Care should be taken to ensure an even, consistent coat as the opportunity to carry out QA/QC inspection may be limited.

Table 1: Maximum application temperature and recommended wet film thickness.

Product	Maximum substrate temperature	Volume solids	Wet film thickness per layer
Versiline CUI 56990 Shade 15732	200°C [392°F]	75%	65-100µm
Versiline CUI 56990 Shades 10710, 19360	200°C [392°F]	70%	70-110µm
Hempaprime CUI 275	200°C [392°F]	66%	75-115µm

Manual application

Application by brush or roller is extremely difficult and should only be carried out where absolutely necessary and only for small areas < 0.1 m². Care should be taken to ensure that the coating is applied in an even consistent layer.

Control of film thickness

Due to the exceptionally short drying times the use of a wet film gauge may not be possible. As such wet film thickness checks shall be carried out on sample panels at ambient temperature located immediately adjacent to the work area. These shall be applied in exactly the same manner as the work area itself.

To assist with the correct tip selection, air pressure and application technique the application may be practised on an item resembling the same size and geometry as the work area.

Quality control

Due to the nature of the application there is an increased likelihood for certain defects such as porosity, voids, misses and uneven film thicknesses. Bubbling of the solvent may result in cratering. Quality control shall consist of:

Visual inspection. A close visual inspection of the entire work area shall be carried out. Any defects shall be corrected.

Dry film thickness. A complete dry film thickness inspection shall be completed according to ISO 19840-1 calibrated on a smooth surface at ambient temperature.

As the paint film may be soft at elevated temperatures care should be taken when carrying out any test method which involves contact with the coated surface.

Overlapping on existing paint

As application onto hot surfaces is often carried out in a maintenance situation, overlapping onto existing paint should be after proper cleaning of oil/grease, dirt, dust, loosely adhering matter and a proper roughening of the existing coating in the overlap zone.

When overcoating materials of different chemistry types it is advisable to ensure compatibility via a simple field adhesion test. An area of 0.1 m² shall be overcoated and subjected to adhesion testing according to ISO 16276-1 or 2 (X-cut) depending upon the nature of the material. Testing shall be carried out at ambient temperature on panels separate to the work area.

The type of test and acceptance criteria is shown in Table 2.

Table 2: Field adhesion test method and time to reinsulate at 120C.

Product	Test method ISO 16276	Acceptance criteria	Minimum time to reinsulate
Versiline CUI 56990	Part 2	Level 0 - 1	3 hours
Hempaprime CUI 275	Part 1	> 5 MPA No A/B failure	1 hours

Note: A field adhesion test is only evidence of compatibility of the coatings. It is not a measure of final coating performance.

Time to reinsulate

As application to hot surfaces is often accompanied by reinstatement of thermal insulation it is important that the coating is allowed to dry/cure for a period of time prior to reinsulating. Failure to comply may result in increased adhesion between the coating and the insulation making the insulation difficult to remove when required.

Abrasive insulation materials such as cellular glass shall be internally coated to minimise abrasion.

This document is intended for professional use and provides generic advice in respect of the subject matter only. It is not intended to be used as a comprehensive guide. The buyer/applicator should always read the relevant Product Data Sheet (“PDS”) and Safety Data Sheet (“SDS”) relating to the Products ordered which are available for download on www.hempel.com. If in doubt, please contact your local Hempel representative for further advice. To the extent relevant, the disclaimer set out in the relevant PDS(s) applies to this document.