Coating work in adverse conditions

Introduction

Field repair of local damage and refurbishment of aged and degraded coating systems will often pose special problems compared to the original coating process in a controlled environment. Achieving the same quality as during new build may be costly at best or even unrealistic at site. The systems applied during new building will typically be according to e.g. ISO 12944 or Norsok M501 with corresponding long expected durability exceeding 15 or 25 years. This durability is due to high quality in all steps of the process:

- Surface preparation by abrasive blasting
- Specification of systems with enough layers and sufficient total DFT (as well as products of good quality)
- Multiple specifications optimized for each area and service condition
- Application by airless spray and curing in controlled circumstances
- Thorough inspection and quality control throughout the process

At site several of these factors may not be realistic and the same durability cannot always be expected. Some coating products may be optimised for this but no coating can fully compensate for e.g. substandard surface preparation.

The work should be planned and executed to have minimum impact on the operation of the installation. Furthermore frequently encountered circumstances pose challenges. Among others these include

- Surface preparation by power tool or manual toll only
- Limited storage – only a few coating products have to cover all areas to reduce complexity
- Adverse weather conditions and challenges maintaining a suitable climate during surface preparation, application and overcoating intervals
- Early exposure to water/humidity e.g. rain and tidal zone
- Difficult access
- Limited labour available
- Fresh water is a limited resource e.g. off-shore

Safety

Use adequate personal safety equipment and follow sound procedures. Apply 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 applied.

Scope

As starting point the recommendation is to reinstall the original coating system in the same quality. Where the circumstances or cost does not allow this it will be necessary to make compromises on the quality of the work. This guideline seeks to offer some advice on options to achieve the best possible result in the circumstances and with the available resources and how to best compromise between the above mentioned parameters.

Many Hempel coating products may be relevant and will not be dealt with here in detail. Of particular relevance are

- Blast primer: Hempadur 15570
- High build epoxies: Hempadur 35560, Hempaprime Strength 530

Surface preparation - Alternatives to abrasive blasting

High pressure water jetting
On areas with intact coating and limited corrosion high pressure water jetting may be a good alternative and provide the same result as abrasive blasting. The method will simply remove the aged coating to expose the original blast profile from the new building stage. The method will also remove any soluble salts provided clean fresh water is used. Flash rusting (ISO 8501-4:2006) should be controlled. This may be done by applying the specified primer shortly after the surface is dry or alternatively apply 50-75µm Hempadur 15570 as a blast primer.

Power tool cleaning
Various power tools exist and the resulting surface vary greatly depending on the method employed. When selecting power tools cleaning it is recommended to focus on getting the best possible sharp & dense roughness profile. Grinding with a hard disc and wire brush is not recommended as this tends to result in a smooth polished surface. Better alternatives are

- Bristle blaster or similar type
- Grinding with a flexible disc in a cross pattern to maximise the roughness

For best result seek to prepare to a cleanliness degree equivalent to St3 according to ISO 8501-1:2007 with a surface profile as close as possible to ISO Comparator Rough Medium (G), Rugotest No.3 equivalent to BN10a or Keane-Tator Comparator 3.0 G/S.

Intact coating in surrounding areas being repaired must be feathered and adjacent surface must be sanded in order to ensure good adhesion of the newly applied coating system.

See also Hempel's separate Technical Guideline for spot repair.

Old steel:
On old steel surfaces having been exposed to salt water, excessive amounts of salt residues in pittings may call for dry abrasive blasting, high pressure fresh water hosing, drying, and finally, dry abrasive blasting again. Alternatively, water jetting may be used, provided the exposed steel surface has a surface profile as described above.

Specification - Alternatives to 3-layer specifications

The traditional 3 layer specifications are often not preferred for use in difficult application situations. 3 layers require more labour time as well as 2 overcoating intervals with risk of adverse conditions or contamination before completing the process.
An attractive alternative can be a single layer high build barrier coating such as Hempadur 35560 or Hempaprime Strength 530. These high solids or solvent free epoxies can be applied up to 500µm or higher dry film thickness in a single layer and are tolerant to moisture immediately after application. An optional UV resistant topcoat can be applied as required.

Application - Alternatives to airless spraying

Where airless spray application cannot be done or is not desirable, roller application may need to be considered. It should be noted that roller application is not suited to wet out a difficult substrate e.g. old steel with significant corrosion. On more regular smooth steel roller application can give a good result although several layers will typically be needed to achieve sufficient film thickness. However, specialised maintenance products like Hempaprime Strength 530 can achieve up to around 200µm film thickness with roller. If the coating is allowed time to flash off most of the solvent the painter can return to the area and apply a second coat "wet in wet". This way a skilled painted may achieve 350-400µm dry film thickness in one process with roller.

Early immersion/exposure to moisture

The high build epoxies Hempadur 35560 and Hempaprime Strength 530 are resistant to early water exposure (e.g. immersion in tidal zone or rain) and will continue to cure in wet conditions/under water. This will have no negative impact on corrosion protection. Some discolouration is to be anticipated but this is a surface phenomenon and only of cosmetic nature.

Soluble salts

The marine environment naturally contains soluble salts mainly in the form of NaCl. Before coating soluble salts have to be reduced by freshwater flushing. Norsok M501 require max 20 mg NaCl/m^2 while IMO PSPC allows up to 50 mg NaCl/m^2 Since freshwater is a limited recourse usually and on off-shore installations needs to be brought in from land in tanks it may be difficult and costly to achieve this. In Hempel's experience it is possible to allow higher salts levels depending on the service conditions without significant reduction in durability

Critical areas: max 40 mg NaCl/m^2

- Tanks for fresh water and distilled water
- Decks etc with pooling rain water
- Chemical tanks

Medium areas: max 110 mg NaCl/m^2

- Areas immersed in saltwater

Non critical areas: max 320 mg NaCl/m^2

- General atmospheric steel

Certain water based coatings may be more tolerant to soluble salt contamination. Please contact Hempel for more details.

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