Mixing and thinning

Introduction

In order to achieve a good result when applying Hempel's products it is important to handle and prepare them correctly before application. Wrong mixing ratio or use of thinner may greatly influence the application process as well as performance of the final coating system. This document describes in general terms when to use thinner and when not to use thinner.

Safety precautions

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

The advice in this document is relevant to all Hempel's coating products.

Mixing

For multi-component products, it is very important that the individual components are combined in the correct ratio as stated on the product data sheet. Generally products are delivered in fixed kits with the components in the correct mixing ratio.

Take care to scrape the can with curing agent in order to transfer all. If thinner is to be added the thinner may be used to flush the can with curing agent to help get all curing agent transferred.

It is generally recommended to always mix complete kits if possible. This reduces the risk of having wrong mixing ratio. If less paint is needed smaller amount may be mixed in a suitable vessel. Great care should then be taken to achieve the correct mixing ratio.

As a general rule, the curing agent should be added to the base, not the opposite.

Once the material has been mixed, curing will begin. At this stage, the temperature of the mixed product often rises, which may affect pot life. Therefore, prepare only the quantity to be used within the pot life of the mixture.

Thinning

Solvent (or water for water borne products) in a paint has one main purpose, to adjust the consistency of the paint and help it form a uniform thin film in the desired thickness on the surface to be painted. Generally, once the paint is on the surface, the solvent evaporates.

Water is strictly speaking not a solvent but serves the same purpose in water borne products.

Apart from a some special situations, thinning is not necessary. Paints are designed to be applied out of the can, so once the paint has been thoroughly mixed (together with a curing agent if appropriate), there should not be a general need for the addition of thinner.

There are general reasons for when to use thinner and when not to use thinner.

Use only Hempel's recommended thinner(s). The addition of wrong thinner may retard curing, provoke incompatibility or other defects as well as pose a safety hazard. If the recommended thinner is not available consult Hempel for advice.

Solvent free products should not be diluted

When to use thinner

The amount of thinner required depends on the prevailing temperature, application method, etc. The usual maximum percentage of thinner is indicated for the respective application method (see section on *Application method* below). Unnecessary thinning should be avoided. For many products, thinning is only recommended in exceptional cases. If more thinning is deemed necessary under special circumstances, consult Hempel.

Brush and roller marks
Heavy duty paints are often made viscous or 'thick' to enable application of high film thicknesses in one go.

However, when applied manually using brush or roller, the high viscosity often results in brush or roller marks left in the surface of the paint.

Adding a small amount of thinner (just a few percent) will lower the viscosity, help flow of the paint and result in a smoother surface when applied manually. An alternative to using thinner to avoid marks, is not to brush or roll the surface excessively. For further advise see also Hempel's Technical Guideline for "Brush and roller application"

Flow
Thick paint may have difficulty in flowing down into a very even surface. Adding a very small amount of thinner will help this flow and ease the distribution of paint on the surface.

Dry spray and finish
Thinner can also have a positive effect on surfaces with risk of dry spray. In such cases, adding a few % thinner will keep the paint "open" longer, which means that e.g. on surfaces with a relative high temperature the tendency to dry spray can be eliminated/ reduced.

How to add thinner
In general, do not add thinner to the mixed paint to start with and never to the separate paint components.

Initially, mix the paint thoroughly at the correct temperature (around 20°C [68°F]) and try the application before adding any thinner.

If viscosity is too high for proper application, start by adding thinner gradually since (obviously) too much added thinner cannot be removed again.

When not to use thinner

Temperature
When paint is cold (< 10°C [50°F]), it will be thicker than normally. In this case, addition of thinner is not the preferred solution to reduce viscosity. Instead, to raise the temperature to around 20°C [68°F]. This can be achieved by storing the paint in a heated storage or using spray equipment with line heaters. This will lower the viscosity and make application easier.

Film thickness
Thinning the paint might seem to make the application quicker, but the film that is applied will be of lower thickness and more coats will be needed to reach the specified film thickness and provide the proper protection.

Sagging
Thinning the paint will increase the risk of sagging when a high film thickness is applied. When the paint sags, there will be very little paint above the sag and too much paint on the sag.

Topcoats
Note that many topcoats or finishing coats have a lower viscosity than other paint types. Most often, it is not necessary to thin these paints.

Solvent free products
Solvent free products have been formulated to be applied as delivered. This gives certain advantages as well as limitation. Typically they cannot be applied at low DFT or low temperature. While it may be tempting to dilute to alleviate these limitation this may lead to other issues such as solvent entrapment. For specific projects consult Hempel for advice.

Solids – Effect of adding thinner

There is a relation between the applied wet film thickness and the dry film thickness of final cured/dried film. The Volume Solids stated on the product data sheet can be used for calculations according to this formula

$$\text{Wet film thickness} = \frac{\text{Dry film thickness (specified)}}{\text{Volume solids (\%)}} \times 100\%$$

This calculation refers to the products as they are delivered, i.e. without adding thinner.

Adding a small percentage of thinner will result in no measurable difference in the film thickness. However, when a higher degree of thinning is necessary, it should be kept in mind that adding thinner increases the quantity of liquid paint without increasing the solids content. Consequently, a proportionally higher wet film thickness must be applied in order to obtain the specified DFT. The volume solids content after thinning is calculated using this formula:

$$\text{Volume solids (\%) (after thinning)} = \frac{\text{Volume solids (\%)(PDS)} \times 100\%}{\text{\% thinner added} + 100\%}$$

E.g. if a paint with VS% of 56 when delivered, and 15% (on volume) thinner is added, the new VS% will be:

$$\frac{56\% \times 100\%}{100\% + 15\%} = 49\%$$

Having established that the new VS% is 49% the wet film thickness is calculated using the formula shown above, for a specified dry film thickness of 75 µm:

$$\frac{75\mu m}{49\%} \times 100\% = 153\mu m$$

(rounded off to 150 micron).

Thinners with catalyst (accelerator)

Certain thinners serves an additional purpose beyond adjusting viscosity. They contain a catalyst (sometimes called an accelerator) that promotes the curing reactions. These special thinners may be used to achieve faster curing e.g. in adverse climatic conditions.

Zinc silicates (Galvosil)
Inorganic zinc silicate coatings (Hempel's Galvosil range of products) cure through reaction with humidity in the air. In situations with low humidity Hempel's Accelerator & Thinner 0870M can be added (up to max 30%) to speed up the curing of the film.

Don't use Hempel's Accelerator & Thinner 0870M when curing speed is satisfactory. This may increase the tendency to mud cracking and reduce the DFT limit where this happens.

Polyurethanes (Hempathane)
Polyurethane coatings are 2 component coatings (Hempel's Hempathane range of products) and cure through chemical crosslinking reactions between the base and curing agent. The reaction speed is temperature dependent and may be significantly impaired at low temperature.

Hempathane Accelerator 99070-00001 may be added (0.25-1%) to speed up the curing of Hempathane topcoats and enamels in order to obtain faster dry to handle time and to decrease the time during drying/curing where the coatings are sensitive to moisture.

Addition of Hempathane Accelerator 99070 will reduce the practical potlife.
Don't use Hempathane Accelerator 99070-00001 when curing speed is satisfactory. This will reduce potlife.

Epoxy (Hempadur etc)
Epoxy coatings are 2 component coatings (Hempel's Hempadur range of products and others) and cure through chemical crosslinking reactions between the base and curing agent. The reaction speed is temperature dependent and may be significantly impaired at low temperature.

Hempadur Accelerator 99011 may be added (5-10%) to speed up the curing of Hempel's epoxy coatings in order to obtain faster dry to handle time.

Addition of Hempadur Accelerator 99011 will reduce the practical potlife.
Don't use Hempadur Accelerator 99011 when curing speed is satisfactory. This may result in solvent entrapment and subsequent increased tendency to internal stress, embrittlement and eventually cracking or mechanical damage.

Summary

- Store the paint correctly before use and ensure they have the recommended temperature for good application
- Stir each component separately until homogeneous. If pigments etc have settled mechanical agitation may be necessary to redisperse them
- Combine the components in a vessel big enough to contain all and allow mixing without spillage. Usually the can with Base is suitable.
- Stir until homogeneous
- Add thinner if required. Never thin individual components before mixing. Stir again

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.