

General guidelines for application of Hempaguard/Hempasil coating systems

Introduction

Hempaguard/Hempasil is a fouling release system and not a conventional self-polishing antifouling. Therefore when applied special care should be taken. This document is both the guidelines for Hempaguard/Hempasil application in full refurbishment scenario and also describes the requirements, essential for all other application scenarios, to ensure a successful completion of such applications with the use of Hempel's Nexus II or Hempel's X-Tend 27500. It is advised to share the document with the owner and the shipyard prior to dry docking in order to optimize the application process.

Safety

Use adequate personal safety equipment and follow sound procedures. Observe all safety instructions from water jetting and wet-abrasive blasting equipment manufacturers including proper electrical grounding of all relevant equipment.

Scope

This document serves as guidelines for full refurbishment scenario and provides an overview of the practical requirements, essential for other application scenarios. In case of other scenarios than full refurbishment, this guideline must be used together with the relevant technical guideline.

Products covered under current document:

- Anticorrosion products: according to the specification
- Tiecoats: Nexus X-Primer 27100, Nexus 27302, Nexus II 27400, Nexus X-Tend 27500, Nexus X-Line 27700
- Topcoats : Hempasil X3+ 87500, Hempaguard X5 89700, Hempaguard X7 89900, Hempaguard X8

Note: Please make sure that you always use the latest version of this guidelines. You can download it from below link:

[General guidelines for application of Hempaguard/Hempasil coating systems](#)

Content

1. Preparation prior to in-docking

- Pre meeting must be held with the owner, shipyard, relevant sub-contractors and Hempel's technical representative(s) to present Hempel's related silicone application procedures, agree on the process as well as roles/responsibilities of the project stakeholders.
- Hempel representative(s) shall confirm that a copy of this guideline and Hempel's Technical Guidelines for related silicone application has been delivered to all stakeholders.
- **Selecting painters:** The application of the Hempaguard/Hempasil system must be assigned to highly experienced paint sprayers. Emphasis must be given on performing a high quality spray work with no runs or sags and on achieving the specified thickness.
- For time-saving and ensuring a good quality paint work, the below equipment is recommended to be ready and immediately available prior to in-docking:
 - High pressure fresh water washing (HPFWW) machines with a capacity to supply a minimum of 300 bar (4,500 Psi) 'at the nozzle'.
 - If patina/verdigris (basic copper carbonate) deposits are present on the existing antifouling, the possibility to apply a pressure of 600 bar (9,000 Psi) 'at the nozzle' must be available, together with fan or rotating nozzles (if using a rotating nozzle extra care must be taken so as not to damage the existing AF)
 - Water jetting equipment that can deliver 2500 bar (36,000 Psi) or abrasive blasting equipment with small-medium size nozzles.
 - Newly serviced fully functional pumps with adequate capacity and new or clean filters.
 - New feed hoses for pumps.
 - Clean stirrers. (No old paint or contamination on stirrers)
 - New or completely clean paint hoses.
 - New tips of varying sizes for edges, small and large area application (Recommended size of tips can be found in product datasheet. Use of incorrect tips will result in paint film defects such as runs, sags and poor film formation).
 - Light weight plastic sheet for masking.
 - Sufficient lighting should be provided during surface preparation and during application.
 - Lifts (scissor or cherry pickers) for access during preparation and application.
 - Neutral pH water-soluble detergent for cleaning and removal of grease or oil contamination.
 - Soft brushes (as used for cleaning by hand) for application of detergent.
 - For all coats: Handguns only for vertical bottom, short pole guns may be used on the Flat Bottom.

2. Vessel's Arrival Condition Inspection

- Upon arrival of the vessel, a thorough inspection of the condition of the underwater hull should take place and be reported accordingly.
- All ballast tanks should be emptied to minimize the risk of condensation. Any steel repairs, either external or internal that will cause damages to the underwater area, must be completed prior to the commencement of any coating work. Any tank cleaning that requires the use of elevated temperatures (e.g. steam) that will heat up the outer hull must be completed prior to the commencement of any coating work.

3. Washing

The entire vessel must be high pressure washed using fresh water (HPFW) to remove contaminants, salts and fouling. Extra effort, and if necessary higher pressure, should be used on any areas where mechanical damages have exposed bare steel to ensure that all the salt is removed from these areas. If necessary, a degreasing agent should be used to remove any oil or grease deposits on the hull prior to starting the high pressure washing.

4. Surface Preparation

- After washing and completion of all hot work, then abrasive blasting should proceed. The surface should be abrasive blasted to the specified standard using a clean dry abrasive and clean dry air. All oil and water separators on the air supply should be in good working order. The abrasive should not leave deposits or contamination (impingement) on the surface. It may be necessary to abrasive blast the area in several stages and use a holding primer.
- Alternatively, the surface can be prepared by means of ultra-high-pressure water jetting (UHPWJ) to the specified standard. The application must be carried out prior to flash rust degree becomes higher than Light 'L' according to ISO 8501-4. If flash rust degree becomes Moderate "M" to Heavy "H", high-pressure water washing with 200 bar pressure to be executed prior to paint application.
- In case the vessel is docked in a floating type dock, and in the unexpected event of high wind speeds occurring before the application of any coat, testing of soluble salt contamination is mandatory to be performed. To avoid premature coating failures such as blistering or detachment due to salt contamination, it is critical to ensure that the amount of soluble salts present on the surface to be coated does not exceed acceptable levels. The extraction of soluble salt contaminants for analysis is performed in accordance with ISO 8502-6 the Bresle method. The acceptable salt content on the surface to be coated is

max 110 mg/m² on steel and 50 mg/m² between coats. In case salt content is above the acceptable level, fresh water washing is required to remove the salt contamination.

- Finally, the hull should be inspected to ensure that no splashes of contaminated water have deposited on the surface, and if necessary it should be HPFW washed again.

5. Coating Application

Preparation prior to application

- Make sure that the surface is fully dry before starting the application of each coat. This is of special importance to check on the flat bottom before application of primer, when water jetting is the surface preparation method.
- The cleanliness of the equipment is of major importance for the application of the Hempaguard/Hempasil coating systems. All equipment must be clean and free from all old paint deposits and any type of contamination.
- Mixers and pumps must be cleaned by mechanical and or chemical means (thinner), using HEMPEL'S TOOL CLEANER 99610 (or other solvent mixture) to dissolve the old paint deposits, and then rinsed with HEMPEL'S THINNER 08080 prior to use.
- All pumps used should have been recently serviced, the filters cleaned or replaced and the surge pot cleaned. There should not be any traces of paint on the ball valves or seats. All hoses must be either new or totally clean. The feed hose on the wet end must also be either new or totally clean. The pump and hoses should be flushed with a solvent system stronger than that in the Hempaguard/Hempasil system (such as HEMPEL'S TOOL CLEANER 99610 or HEMPEL'S THINNER 08450) for several hours to ensure that the pump and hoses are clean, and then rinsed with HEMPEL'S THINNER 08080 prior to use.



Figure 1. Non-acceptable condition of wet end of the suction pipe and stirrer. All components must be thoroughly clean prior to application

Masking

The masking has a dual purpose:

- To prevent silicone contamination of surrounding areas such as the topsides

- To prevent contamination on the area to be coated with silicone, (e.g. flat bottom, Vertical sides, boottop), which could lead to adhesion problems of the fouling release coating system.

Plastic sheets should be used for masking. The extent of masking and distance from the Hempaguard/ Hempasil area will be dependent upon location and conditions, but a minimum of 1½ meters (5 ft.) is recommended.

It should be noted that a lot of spray-dust can be generated during application of silicone fouling release products and this can travel a long way. If other paint work is not completed then a larger area must be masked. It is, however, recommended that all other paint work is finished prior to masking and application of the Hempaguard/Hempasil system. The plastic should be properly secured so that it does not fall or blow into any freshly applied paint. The masking must be checked prior to every application to make sure that it is secure. In some areas it may be advantageous to 'tent' the area in.

Paper masking tape or 'gaffer' tape seems to be best for attaching the plastic. Avoid the 'waxed' paper tape, the glue on this is too strong and it sometimes removes some of the underlying paint system when removed. Magnets can be used in combination with tape, but not on its own, as it does not form a tight seal. Use of double width tape is an advantage.

Prior to application

- Prior to commencing application, Hempel rep. will be available to brief the site foremen, pump men and sprayers before starting application in order to ensure that all parties involved understand and implement proper mixing and application procedures.
- Only lance guns (3 foot as a maximum) or hand guns to be used on flat bottom. Only hand guns are allowed for the vertical bottom application.
- Make sure that spare application equipment and cherry pickers are available during application of silicone products in case needed.
- Make sure all are aware of the importance of checking WFT during application. It is very important that the sprayer and cherry picker operator have same awareness about the significance of WFT control and uniform application. All supplied paint should be applied and the required WFT must be achieved.

During Application

Anticorrosive System

- Any steel repairs, either external or internal, that will cause damages to the underwater area must be completed prior to the commencement of any coating work. Any tank cleaning that requires the use of elevated temperatures (e.g. steam) that will heat up the outer hull must be completed prior to the commencement of any coating work.
- Application of the epoxy coat(s) should proceed normally with attention on obtaining a smooth, uniform finish and ensuring the correct thickness. Care should be taken to avoid defects such as sagging and orange peel as they will shine through the system and detract from the resulting finish.

- On completion of abrasive blasting and priming, the entire hull should be washed down to remove dust and contaminants. The dock must be cleaned to remove any abrasive and dust. It is also recommended to clean the deck of the vessel at this stage. Any equipment in the dock such as staging, lifts, compressors etc. must also be cleaned. If staging is present then all planks should be individually cleaned and turned, all unplugged ends must be cleaned and plugged (plugging is not sufficient), any staging must also be adjusted to ensure that it is not too close to the surface to be coated creating shadows and blind spots. The dock side should also be cleaned to remove traces of abrasive material and dust that could be deposited into the wet coating film during application. Note that after cleaning there must not be any possible sources of contamination in the dock, surrounding the dock or on the vessel.
- Depending on the coating application specification second coat of primer should be applied on designated areas according to the specification.

Nexus / X-Tend tie-coats & Hempaguard/Hempasil System

- Paint drum distribution

The paint must be split up into areas in a 'volume area control' style but it should be noted that it is not enough to apply a certain volume of paint on a certain area - the specified dry film thickness (WFT and DFT) must be achieved.

Draw /mark using paint on dry-dock side the areas where each individual sprayer will start and stop.

- Environmental conditions – Application Plan

The application of Hempaguard/Hempasil must take place during daylight hours. Weather conditions during application are important, and should be dry and calm. If not, the application must be postponed until the conditions are more favourable. Wind speeds should never be over 3 m/s (11 km/h) and preferably under 2 m/s (7 km/h).

The paint drums should be opened with care. Presence of water, dirt or used blasting media on the lid must be removed to prevent the contamination of the paint upon opening.

The substrate must be completely dry and have a temperature of at least 3°C above the dewpoint before and during paint application. Condensation on the surface can lead to detachments if overcoated, therefore the dew point calculations should be confirmed with a visual inspection by wiping the surface with a soft lint free cloth. Ensure that all scuppers and deck drains above the area are properly plugged so that any spillage or rain will not run down over the newly painted surface.

- **Important note about application of Nexus tie-coat**

Exposure of Hempel's Nexus II to rain after application must be avoided as it will impair the adhesion of the Hempaguard/Hempasil topcoat. In the event of unexpected rain, an intermediate coat of Nexus X-Tend 27500 is necessary before application of topcoat, but only

if the duration of rain exceeds 1 hour in total. If the rain occurs within the initial 3 hours of curing, X-Tend must always be applied.

Application of Nexus II over dry Nexus II is not allowed. The maximum self-overcoating interval (i.e. Hempel's Nexus II to Hempel's Nexus II) is 1 hour in the temperature range 0°C to 40°C. Instructions how to overcome this is described in the following and an example is shown in Figure 2.

The position of sprayers should be such to avoid exceeding the maximum self-overcoating interval, i.e. if two sprayers are used then they should both start from the bow (or stern) area and each paint on their own side (at portside and at starboard side) until they meet each other again at the stern (or bow). If four sprayers are used then two should start at the bow (one at portside and one at starboard side) and two should start at the stern (also one port and one starboard) and they should work towards each other and meet at amidships. If eight sprayers are used then the first four should start as above and the additional four should start at amidships, two on each side one working fore and one aft.

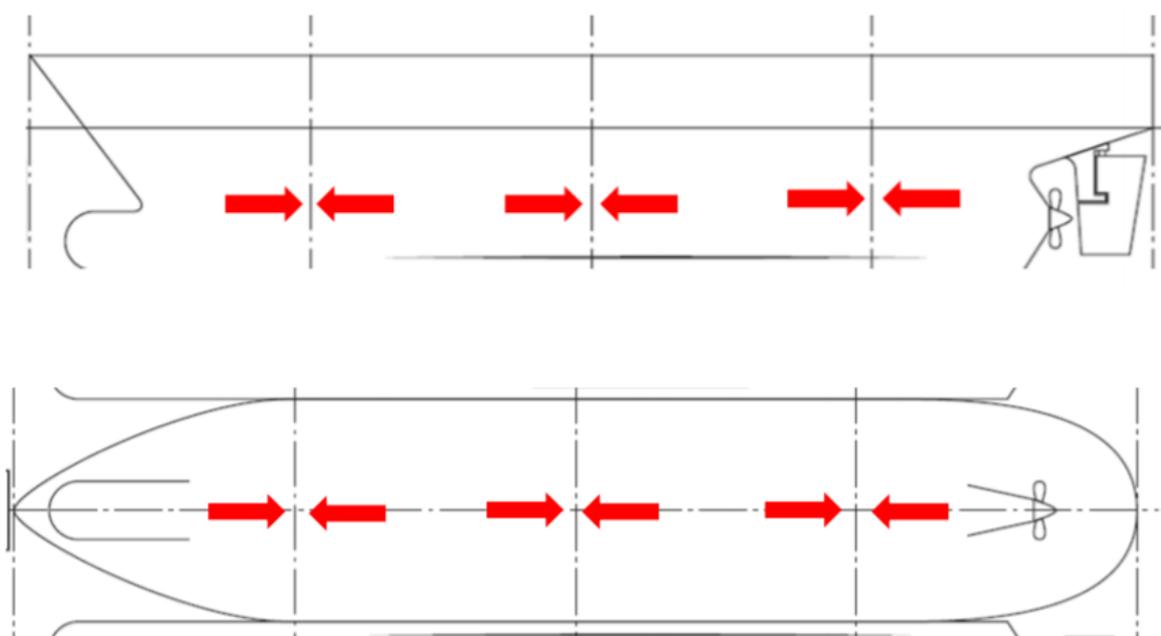


Figure 2: Example of recommended painting scheme for large structures to avoid exceeding maximum self-overcoating interval of Hempel's Nexus II (vertical sides and flat bottom)

If there is Nexus II tie-coat mixed and remaining after the application, do not apply it. Care should be taken with consumption to make sure that the product is not over applied.

In order to minimize the risk of different contamination and unexpected rain, it is recommended to complete the application of Nexus II 27400 and Hempaguard/Hempasil topcoat on the same day in the relevant specifications.

- Mixing

When mixing Hempel's NEXUS II (in full application scenarios), the additive should be added to the base first and the two components mixed. The curing agent should then be the last component added and the paint must be thoroughly mixed.

Note that the viscosity of Nexus II tiecoat and Hempaguard/Hempasil products do not change significantly after exceeding the pot-life, which is 1 hour at temperatures between 0°C and 40°C. If the pot-life is exceeded, the paint must not be used. For this reason, only mix the amount of paint that is to be used and spray it immediately after mixing. Do not mix several units at once; only mix them when they are required. When the drum is nearly empty, tilt it to consume the remainder of the paint, and then move the feed pipe into a freshly mixed drum. Do not pour any remaining Nexus tiecoat into the next drum. Do not open any drum that it is not going to be mixed and used immediately. Avoid as much as possible to re-use leftovers from other pump stations during the last part of the application.

- Application and control of wet film thickness

Any minor runs or sags (or marks caused by contact with the wet paint surface) can be smoothed out using a small brush with HEMPEL'S THINNER 08080. No other solvents are allowed as they can interfere with the curing mechanism. This has to be done while the paint is still wet (within 30 minutes). After this period, repairs of cosmetic defects are not advised.

It is important to check WFT's during application to ensure specified thickness is achieved.

After this application is finished, the pump should be cleaned thoroughly with HEMPEL'S THINNER 08080. The same pump and hoses can be used for the application of the top coat.

After application

Cleaning of equipment

After the application, all brushes and rags used should be thrown away, as should any drums used. Any attempt to use these will result in silicone contamination. The equipment should be thoroughly cleaned; this includes again removal of the filter and recirculation with thinner. Running old paint through (old is not a requirement, but just something that will not be used for any other purposes) helps remove the last of the silicone.

Once the Hempaguard/Hempasil topcoat is dry to touch (as per Product Data Sheet), the marking paint (according to the specification) may be applied.

6. Winter Specification (0 – 10 °C)

Hempaguard/Hempasil specifications during winter season (i.e. application and curing temperatures below 10°C) MUST include one additional tiecoat: Hempasil Nexus X-Tend 27500.

This specification can also work at higher temperatures (>10 °C) however under these conditions only the use of Nexus II tiecoat is recommended.

Below is an example of specification for winter applications (i.e. applications below 10°C) :

1-2 layer(s) of topcoat depending on the specification	
4th tiecoat layer	X-Tend 27500 – 100 µm DFT
3 rd tiecoat layer	Nexus II 27400 – 100 µm DFT
2 nd A/C layer	e.g. 17634 - 125 µm DFT
1 st A/C layer	e.g. 17634 - 125 µm DFT

Figure 3. Winter specification with Nexus X-Tend 27500

7. Inspection

- After drying the DFT survey should take place to make sure that the specified thickness is achieved and be documented in the final report.
- Check the coating condition after drying and the quality of works done after topcoat application. This includes condition of topcoat after drying and marking paint, etc.

Masking removal and marking application

- Once the Hempaguard/Hempasil topcoat is hard dry (according to data sheet) remove the masking covering the Boottop area.
- Once the Hempaguard/Hempasil topcoat is hard dry then markings can be applied according to the specification.

Undocking/ Filling of the dock

- The time to immersion or undocking must be followed as per HEMPEL's working specification.

8. Undocking

The undocking should take place according to the project specification.

If the ship is to be at quay at the shipyard after being launched it is recommended that suitable fenders are to be used in order to prevent mechanical damages in the Boottop area. Fenders of the Yokohama and cylindrical type are recommended while Cone and Arch fenders could cause more mechanical damages. Independently of which fenders are used the installation of sprinklers with continuous water spraying of the fenders will further reduce the risk of mechanical damages until the coating is fully cured.

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APPENDIX 1. Application Checklist

Prior to application

- Has a working specification been issued and agreed by all parties (HEMPEL TSD, Customer and Contractor(s)).
- Can the surface preparation be carried out according to the requirements of the working specification? Refer also to surface preparation in painting specification.
- For non-ideal application conditions, additional equipment/preparation may be necessary:
 - In adverse weather conditions (wind, rain) "tenting" may be necessary.
 - At low temperatures ($<5^{\circ}\text{C}$), "tenting", heating and ventilation are necessary.
 - Screening/masking/tenting may be necessary to prevent overspray onto adjacent areas or other vessels. Re-check all masking placed prior to application.
 - Note: If "tenting" is used, explosion proof lighting and sufficient ventilation is necessary.
- If the application conditions dictate the use of additional equipment/preparation as stated in third point, can this be provided by the yard or paint contractors?
- Is there experienced personnel (sprayers) available to apply Hempaguard/Hempasil system?
- All personnel involved have been informed of the paint requirements according to the working specification and the necessary procedures involved.
- Have sufficient paint and correct thinners arrived for the application and been stored correctly in a dry area at the correct temperature.
- Is a suitable contrasting colour of Hempasil available for the draft markings?
- Have all quality numbers, shades and batch numbers been recorded?
- Is the necessary application equipment available?
 - Airless pump, lines, suction hose, gun and tips (new or alternatively) in good clean condition according to requirements (e.g. Graco King 45:1)
 - Clean paint mixer
 - Clean mesh for sieving (important for hot & humid conditions where skin over will occur faster)
 - Clean empty cans for cleaning purposes
- Is the following inspection equipment available:
 - RH/dew point/temperature meters, WFT gauge, DFT gauge, Shims for measurement of "DFTs" when coating is soft
 - "Cling-film" or plastic for masking intact areas (repair areas)
 - Recording materials (camera, film, notebook)
- When starting the application of the Nexus II tiecoat and X-tend 27500 sealer, will weather conditions and time available allow for the necessary overcoat interval for Hempaguard/Hempasil application?
- Ensure that the dock bottom is clean, tidy, safe and free of any dust or detriment that may damage or contaminate the coatings on the hull.
- If the dock is very dusty and cleaning up of the dust is not cost effective, keep the dust levels down by wetting the dock bottom with fresh water. Be careful and avoid contaminating the hull during this process.

During Application

- Has the required preparation standard been achieved, according to the working specification?
- Has the necessary equipment been set-up according to point 3 above (sheeting, tenting, etc.)
- Make sure both applicators and advisors are checking WFT throughout the application. It is extremely important during the application of Hempaguard that the required WFT is met!
- The cans of the tie-coats and Hempaguard/Hempasil should only be opened just prior to application. The products cure in the presence of moisture.
- Once mixed, the drums should be left to stand for a few minutes to ensure trapped air is expelled
- Clean THINNER 08080 should be flushed through the pump and lines immediately after application of Hempaguard/Hempasil products.
 - IMPORTANT:** Thorough cleaning of spray equipment is necessary if the next paint to be applied is non-silicone based.
- In the event that sagging/running/sliding occurs, are brushes and thinner available to repair. Brush dipped in 08080 thinner should be used to brush out the defect.
- Is any "ordinary" paint available to flush the equipment after application (e.g. alkyd or acrylic)