

APPLICATION INSTRUCTIONS

For product description refer to the product data sheet

HEMPADUR* 15500

CURING AGENT 97580

Scope: These application instructions cover surface preparation, application equipment, and application of HEMPADUR 15500.

The following are general rules, which may be supplemented with more detailed descriptions when needed, for instance for major newbuildings/new constructions or extensive repair jobs.

Steel work: All welds must be free of pinholes and undercuts and must be of highest quality so that they can be protected by the paint. This means perfectly filled, smooth welds with a slightly wavy surface.

All weld spatters must be removed.

All sharp edges must be removed or rounded off in such a way that the specified film thickness can be build-up on all surfaces. The radius of the rounding should be approximately 1-2 mm.

The steel must be of first class quality and should not have been allowed to rust more than corresponding to grade B of ISO 8501-1:1988. Any laminations must be removed.

All steel work (including welding, flamecutting, grinding) must be finished before the surface preparation starts.

Surface preparation: Prior to abrasive blast cleaning of the steel, remove oil, grease, salts and other contamination with a suitable detergent followed by high pressure fresh water hosing. Alkali deposits on new welding seams as well as soap traces from pressure testing of tanks to be removed by fresh water and scrubbing with stiff brushes.

Control for absence of contamination according to separate guidelines.

On repair jobs, a rough blasting to remove all loosely adhering materials may be required before degreasing/washing is carried out.

Old steel: Even after a very thorough tank cleanings, pits may typically contain contamination in the form of remnants of old cargoes as well as water soluble salts. For this reason, repeated detergent washing plus abrasive blasting may be necessary. After the first blasting, a very thorough vacuum cleaning is carried out in order to see if any "cargo bleeding" occurs as well as controls for water soluble salts are made. Reference is made to separate instructions. Special care should be taken in evaluating pitted areas.

Grit blast to min Sa 2½, ISO 8501-1:1988, SSPC-SP-10.

To obtain full chemical resistance according to the CARGO PROTECTION GUIDE, the steel surface must be abrasive blast cleaned according to ISO 8501-1:1988, very near to white metal Sa 2½ (SSPC-SP-10)-Sa 3 (SSPC-SP-5). In practice, this requirement is to be understood as white metal Sa 3 at the moment of abrasive blasting, but allows a slight reduction at the moment of paint application.

The resulting surface profile must be equivalent to Rugotest No. 3, min. BN 10, Keane-Tator Surface Comparator, G/S min. 3.0 or ISO/DIS 8503/1 rough MEDIUM (G).

Use steel grit, silica sand, aluminium silicate, or similar sharp edged abrasives of a good quality free of foreign matters, soft particles, and the like. Control for possible contamination according to separate guidelines.

In case steel grit is used this must furthermore be controlled so that a proper grain size distribution is maintained.

Steel grit with particle sizes of 0.2 - 1.2 mm or aluminium silicate of 0.4 - 1.8 mm will usually create the desired surface profile when the air pressure measured at the nozzle is 6 - 7 bar/85 -100 psi.

The compressed air must be dry and clean. The compressor must be fitted with suitable oil and water traps.

When the abrasive blasting is completed, remove residual grit and dust by vacuum cleaning. Abrasive particles not removed by vacuum cleaning are to be removed by brushing with clean brushes followed by vacuum cleaning.

The importance of systematic working must be stressed when blasting. Poorly blasted areas covered with dust are very difficult to locate during the blast inspection made after the rough cleaning.

Shopprimed and previously painted surfaces: All shopprimer or existing coating materials to be completely removed. Avoid the use of zinc shopprimer. If the steel is shopprimed with zinc, it is very important that **all** zinc is removed by abrasive blast cleaning. Separate check procedures will be necessary to demonstrate the effectiveness of removal. More blast cleaning may be deemed necessary!

Use of a red zinc shopprimer will facilitate the visual check of the blast cleaning and is considered necessary in order to obtain an acceptable surface preparation.

Application equipment:

HEMPADUR 15500 is to be applied by airless spray equipment. Stripe coating and minor repairs can be carried out by brushing.

Airless spray equipment: A large pump is preferred, with a pump capacity of 8-12 litres/minute.

Pump ratio:	Min. 45:1
Nozzle orifice:	.018"-.021"
Nozzle pressure:	200 bar (2900 psi)

(Spray data are indicative and subject to adjustment).

Thinning:

If required: max. 10% of THINNER 08450, possibly higher if tendency to dust-spray will require more thinning eg at higher temperatures. Thinning should only be at the required level to avoid possible risk of solvent entrapment. Only add thinner to the mixed paint.

Cleaning of equipment:

The whole equipment to be cleaned thoroughly with HEMPEL'S TOOL CLEANER 99610 after use.

Mixing, pot life:

- a. Mix the entire content of corresponding base and curing agent packings. If it is necessary to mix smaller portions, this must only be done by weighing base and curing agent in the prescribed weight ratio: 93.8 part by weight of base and 6.2 part by weight of curing agent. The accuracy of the balance must be $\pm 1\%$.
- b. Stir the mixed paint thoroughly by means of a clean mechanical mixer until a homogeneous mixture is obtained.
- c. **Allow the mixed paint to prereact before application, see table below.**
- d. Use all mixed paint before the pot life is exceeded. The pot life depends on the temperature of the paint as shown in table below (valid for a 20 litres can):

Temperature of mixed paint	15°C/59°F ¹⁾	20°C/68°F	25°C/77°F	30°C/86°F ²⁾
Induction time	25 minutes	15 minutes	10 minutes	5 minutes
Pot life	4 hours	3 hours	2 hours	1 hour

- 1) At 15°C/59°F and below, the viscosity can be too high for airless spray application.
2) Temperatures above 30°C/86°F should preferably be avoided.

Application procedure:

The first full coat is usually applied immediately after vacuum cleaning. The first stripe coat afterwards.

Film-build/continuity: With this tank coating intended for aggressive cargoes, it is of special importance that a continuous, pinhole-free paint film is obtained at application of each coat. An application technique which will ensure good film formation and no dry-spray on **all** surfaces must be adopted.

It is very important to use nozzles of the correct size, ie not too big. Select small nozzles for spray application of complicated structures, while bigger nozzles may be used for regular surfaces.

A proper, uniform distance of the spray gun to the surface, 30-50 cm, should be aimed at. To obtain good and steady atomizing, the viscosity of the paint must be suitable and the spray equipment must be sufficient in output pressure and capacity. At high working temperatures, use of extra thinner may be necessary to avoid dust-spray.

The paint layer must be applied homogenously and as close to the specification as possible. The consumption of paint must be controlled and heavy layers must be avoided because of the risk of sags and cracks and solvent retention.

Furthermore, great care must be taken to cover edges, openings, rear sides of stiffeners etc. Thus, on these areas a stripecoat will usually be necessary.

The finished coating must appear as a homogeneous film with a smooth surface and irregularities such as dust, dry spray, abrasives, must be remedied.

Note: In the case of old, pit corroded steel, application of a diluted, extra first coat is recommended to obtain better "penetration" in the fine pits. For this purpose, it is relevant to dilute 5-10%. Application by brush is recommended and film thickness so low that the surface is "saturated" only.

Stripe coating:

All places difficult to cover properly by spray application should be stripe coated twice by brushing immediately before the spray application. Typically, first stripe coat is applied after the first full coat and the second stripe coat after the second full coat.

The second stripe coat with brush can be replaced with spray application with a small narrow nozzle, but still air slots and similar and possible undercuts (welds) and the like will require brush application.

Film thicknesses:

The final dry film thickness of the three coat system must be between 300-600 micron (450)/12-24 (18) mils.

Corresponding to 100 micron/4 mils dry film thickness, the wet film thickness must be 150-175 micron/6-7 mils and must be measured regularly.

Normally up to 200 micron/8 mils per coat may be accepted for 100 micron/4 mils specifications, but **at temperatures below 15°C/59°F, it is important not to exceed 150 micron/6 mils in any area.**

Micro climate:

The actual climate conditions at the substrate during application:

The minimum surface temperature is 10°C/50°F.

Issued:

June 1998/15500 - Page 3 of 6

The maximum surface temperature should preferably be below approximately 30°C/86°F. In a warm climate it is recommended to carry out application during nighttime. Application at high temperatures, up to approximately 40°C/105°F, is possible, but extra care must be taken to avoid poor film formation and excessive spray dust.

The steel temperature must be above the dew point. As a rule of thumb, a steel temperature which is 3°C/5°F above the dew point can be considered safe.

In confined spaces, supply an adequate amount of fresh air during application and drying to assist the evaporation of solvent.

Drying and curing:

In a dry film thickness of 100 micron/4 mils, with a steel temperature of 20°C/68°F, a relative air humidity of maximum 80% and adequate ventilation, HEMPADUR 15500 will be dry to touch after 4-6 hours. Under these drying conditions, the paint film will accept light traffic after approximately 16 hours.

Correct film formation depends on an adequate ventilation during drying. The following figures are indicative for obtaining adequate ventilation:

Size of tank painted	Number of air shifts per hour until the minimum recoating interval has elapsed
100 m³/3500 cbf	40
400 m³/14000 cbf	20
1000 m³/35000 cbf	15
4000 m³/140000 cbf	5

This ventilation must be maintained for a period corresponding to the minimum recoating interval. During the following period until full curing a few air shifts per hour will suffice. Take actions to avoid "pockets" of stagnant air.

Safety precautions may require stronger ventilation than indicated above.

One litre undiluted HEMPADUR 15500 gives off in total 82 litres solvent **vapour** until it is completely dry.

The lower explosive limit, LEL, is 1.0%.

The vapour from 1 litre of paint must be "diluted" with approximately 82 m³ air to fulfil common safety requirements.

Because solvent vapours are heavier than atmospheric air, effective ventilation requires forced ventilation with exhaust from the lowest part of the tank.

Curing time:

Provided that adequate ventilation, recommended relative humidity, specified film thickness, and recommended minimum recoating interval are kept, the following curing times are valid:

Steel temperature	10°C/50°F	15°C/59°F	20°C/68°F	25°C/77°F	30°C/86°F	(35°C/95°F)*
Curing time	18 days	14 days	10 days	8 days	7 days	(6 days)
Filling of tanks with water can be tolerated after	18 days	14 days	10 days	8 days	7 days	(6 days)

*Avoid application at elevated temperatures to avoid dry-spray and poor film formation.

Post curing:

Postcuring must take place within 3 months after final acceptance of the coating/delivery of the vessel.

Postcuring is accomplished by carrying a hot cargo of mineral lube oil, vegetable oil or animal oil at 60°C/140°F for 5 days or at 50°C/122°F for 10 days.

Postcuring may also be accomplished by carrying clean seawater of minimum 45°C/113°F and maximum 50°C/122°F **provided all adjacent ballast tanks are empty and all adjacent cargo tanks are either empty or carrying a liquid cargo of minimum 40°C/104°F**. In case of seawater, postcuring time is 14 days.

Recoating intervals:

Provided observance of the above stated ventilation and relative humidity the following recoating intervals in relation to the (steel) temperature are valid:

Steel temperature	10°C/50°F	15°C/59°F	20°C/68°F	25°C/77°F	30°C/86°F
Not to be used for potable water:					
Minimum after the first coat	90 hours	60 hours	36 hours	24 hours	18 hours
after the second coat	60 hours	40 hours	24 hours	16 hours	12 hours
To be used for potable water, all coats; minimum:	7½ days	5 days	3 days	2 days	36 hours
Maximum:	53 days	36 days	21 days	14 days	11 days

The maximum relative humidity before and between the coats should not exceed 80% and the steel temperature should always be above the dew point, in practice minimum 3°C/5°F above the dew point.

Conditions for paint application work:

Dry spray is not acceptable as this will reduce the protective characteristics of the paint and make later tank cleaning difficult. Dry spray can be avoided by using adequate stagings, spraying equipment and methods.

Hold spray gun at a right angle to and about 30-50 cm from surface making even parallel passes at a rate to produce the specified wet film thickness as per specification.

Avoid dry spray (overspray creating excessive paint mist), e.g. by using a smaller fan angle, and the lowest possible pressure. A small fan angle should also be used, if spray application is used, for "stripe coating" or for instance reverse sides of stiffeners.

Each layer must be applied homogeneously and as near above the specification of 100 micron/4 mils dry film thickness, as possible. The consumption of paint must be controlled, and heavy layers must be avoided because of the risk of sagging, cracks and solvent retention.

Surface irregularities such as dry spray, saggings, exaggerated thickness or embedded dust or abrasives will have to be remedied.

If a sandpapering between layers, for instance on the bottom, is needed, great care must be taken to avoid damage of otherwise intact surfaces. When using mechanical means only lightweight equipment should be used, orbital sander is recommended. Yet, avoid sandpapering on top of welds or irregularities or near to vertical surfaces.

The finished coating must appear as a homogeneous surface without pores, runners or pollution of any kind.

Control of dry film thicknesses:

For the standard specification the following applies to the dry film thickness:

The minimum dry film thickness is 300 micron/12 mils, the maximum thickness to be aimed at is approximately 600 micron/24 mils (below 15°C/59°F: 450 micron/18 mils). The minimum dry film thickness is evaluated according to the "90-5" rule, i.e. no more than 5% of the total number of individual measurements must be lower than the minimum dry film thickness, and the lowest individual measurement must be at least 90% of the minimum dry film thickness, i.e. 270 micron/10.8 mils. Dry film thickness control is not to be carried out within the first 24 hours after application of final coat (20°C/68°F, sufficient ventilation). The measurement must be carried out using an electromagnetic dry film thickness gauge calibrated with shims placed on a smooth

This Product Data Sheet supersedes those previously issued. For definition and scope, see explanatory notes to applicable Product Data Sheets.

Data, specifications, directions and recommendations given in this data sheet represent only test results or experience obtained under controlled or specially defined circumstances. Their accuracy, completeness or appropriateness under the actual conditions of any intended use of the Products herein must be determined exclusively by the Buyer and/or User. The Products are supplied and all technical assistance is given subject to HEMPEL's GENERAL CONDITIONS OF SALES, DELIVERY AND SERVICE, unless otherwise expressly agreed in writing. The Manufacturer and Seller disclaim, and Buyer and/or User waive all claims involving, any liability, including but not limited to negligence, except as expressed in said GENERAL CONDITIONS for all results, injury or direct or consequential losses or damages arising from the use of the Products as recommended above, on the overleaf or otherwise. Product data are subject to change without notice and become void five years from the date of issue.

Issued by HEMPEL'S MARINE PAINTS A/S.

*This is a corporate trademark of the Hempel Group.

1550011630CR005

Issued:

June 1998/15500 - Page 6 of 6

steel substrate. The maximum dry film thickness can be evaluated according to the "80-20" rule.

Taking into use:

Do not use the tank before the coating is properly cured. When cured, but before taking the tank into use for **potable water**, fill twice with water each time for a period of no less than 24 hours and finally flush with fresh water.

Repairs:

It is of great importance that all damage to the coating is repaired.

Repair must be started up as soon as possible. Repair of mountings for stagings, etc. must take place in connection with the dismantling of the stagings, the tempo of which shall be adjusted to the touch-up procedure.

It is important that the repaired areas, as well as the rest of the coated areas, are fully cured before the tank is taken into use or washed by the tank cleaning system.

The extent of damage to the coating can be evaluated by a seawater test. Wash the tanks with clean seawater by means of the tank cleaning machines until profiles and/or heating coils on tanktop is covered. Allow the water to stay for minimum 3 days, after which period the tank is emptied and cleaned with clean fresh water to remove salts.

The repair process:

General: Before mechanical treatment is started, surfaces to be repaired have to be cleaned for any salts and other contamination.

Areas less than 5 x 5 cm.

The surface preparation can be executed by grinding to a clean rough metal surface, feathering edges of intact coating and slightly sanding the adjacent surface.

Clean and wash with HEMPEL'S THINNER 08450.

Touch-up by brush to full film thickness with minimum 4 coats of HEMPADUR 15500.

Areas up to 1 sq.m.

The surface preparation must be executed by vacuum blasting or open nozzle blasting so that the steel has a proper roughness and a cleanliness to Sa 3 according to ISO 8501:1988. The overlapping zone must be sanded or sweep blasted to ensure a good adhesion of the new paint.

Clean and wash with HEMPEL'S THINNER 08450.

Touch-up by brush to full film thickness with minimum 4 coats or by spray 3 coats HEMPADUR 15500.

Areas more than 1 sq.m. or areas where several damaged spots are concentrated.

Treatment: Repeat the original specification.

Safety:

Handle with care. Before and during use, observe all safety labels on packaging and paint containers, consult HEMPEL Material Safety Data Sheets and follow all local or national safety regulations. Harmful or fatal if swallowed; immediately seek medical assistance if swallowed. Avoid inhalation of possible solvent vapours or paint mist, as well as paint contact with skin and eyes. Apply only in well ventilated areas and ensure that adequate forced ventilation exists when applying paint in confined spaces or when the air is stagnant. Always take precautions against the risks of fire and explosions.