



# Application Instructions

For product description refer to product data sheet

## HEMPADUR® 85671

BASE 85675 with CURING AGENT 97371

### Scope:

These application instructions cover surface preparation, application equipment, and application of HEMPADUR 85671.

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

### Steel work:

For optimum performance, the following is recommended:

All welding seams must have a surface finish which ensures that the quality of the paint system will be maintained in all respects. Holes in welding seams, undercuts, cracks, etc. should be avoided. If found, they must be remedied by welding and/or grinding.

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 built up on all surfaces. The radius of the rounding should be minimum 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, flame cutting, 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 cleaning, pits may typically contain contamination in the form of remnants of chemicals/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 "chemical bleeding" occurs as well as controls for water soluble salts (reference is made to separate instructions) are made. Special care should be taken in evaluating pitted areas - ask for special guidelines.

For optimum performance, gritblast to very near white metal, Sa 2½-3, ISO 8501-1:1988. 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 8503/1 rough MEDIUM (G).

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

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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.

**Shoppripped and previously painted surfaces:** All shopprimer or existing coating materials to be completely removed. Avoid the use of zinc shopprimer whenever possible.

However, 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.

**Note: Degree of steelwork finish and surface preparation are more detailed described in HEMPEL's Technical Standard for Tank Coating Work.**

### Application equipment:

HEMPADUR 85671 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)
Hoses:	To avoid excessive loss of pressure in long hoses, hoses with an internal diameter of up to 0.5" can be used

(Spray data are indicative and subject to adjustment).

### Thinning

**If required:** max. 10% of THINNER 08450. Additional thinning may be required at higher temperatures to counteract dry-spray. However, never use more thinner than required to avoid possible risk of solvent entrapment. Thinner only to be added to the mixed paint.

Spraying properties are influenced by the induction time (premix time). Too much "thixotropy" will disappear after a certain reaction of the mixed components.

### Cleaning of equipment:

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

### Mixing, pot life:

- 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: 158 parts by weight of base and 11.4 parts by weight of curing agent or by volume 8.8 parts by volume base and 1.2 parts by volume curing agent.
- Stir the mixed paint thoroughly by means of a clean mechanical mixer until a homogeneous mixture is obtained.



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- 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 paint's temperature as shown in table below (valid for a 20 litres can):

Temperature of mixed paint	(15°C/59°F <sup>1)</sup> )	20°C/68°F	25°C/77°F	(30°C/86°F <sup>2)</sup> )
Induction time	(25 minutes)	15 minutes	10 minutes	(5 minutes)
Spray application within	(4 hours)	3 hours	2 hours	(1 hours)

<sup>1)</sup> Below 15°C/59°F the viscosity can be too high for airless spray application.

<sup>2)</sup> Temperatures at 30°C/86°F and above should be avoided due to a risk of dry-spray.

### Application procedure:

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

**Film-build/continuity:** With this tank coating intended for aggressive service, 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 dry-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 stripe coat 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 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. First stripe coat is applied after the first full coat and second stripe coat after 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 (max. 450 micron below 15°C)/12-24 mils (max. 18 mils below 59°F).

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 a dry film thickness of 150 micron/6 mils in any area.**



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### Microclimate:

The actual climate conditions at the substrate during application:

### The minimum surface temperature until full cure is 10°C/50°F.

To ensure an all-over steel temperature of minimum 10°C/50°F, special attention should be paid to possible "cold bridges" eg stiffeners on deck.

In case of steel temperatures lower than 10°C/50°F there is a severe risk of incomplete curing, resulting in a too open film with reduced chemical resistance.

When the outside temperature is lower than 10°C/50°F, it is therefore recommended to use insulation mats on deck and in addition to aim at a general steel temperature of 15°C/59°F to minimise the risk of too low steel temperatures.

Furthermore, the steel temperature should be kept reasonably constant - within the range of  $\pm 3^{\circ}\text{C}/5^{\circ}\text{F}$  is recommended. Any changes of the outside temperature should therefore be carefully monitored and heating equipment calibrated accordingly.

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 night time. Application at higher temperatures 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.

The relative humidity should preferably be 40-60%, maximum 80%. In confined spaces, supply an adequate amount of fresh air during application and drying to assist the evaporation of solvent.

### Drying and curing, ventilation:

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 85671 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.

A good guideline for tank coating work is to ventilate to a calculated 10% of LEL during application and until the coating is dry.

One litre undiluted HEMPADUR 85671 gives off in total 81 litres solvent **vapour** until it is completely dry.

The lower explosive limit, LEL, is 1.0%.

To reach a common safety requirement of 10% LEL, the theoretical ventilation requirement is 81 m<sup>3</sup> per litre paint.

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

During the following period until full curing a few air shifts per hour will suffice. Take actions to avoid "pockets" of stagnant air.

Please contact HEMPEL for further advice.

Actual safety precautions may require stronger ventilation.

### 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	40°C/104°F
Curing time	18 days	14 days	10 days	8 days	7 days	6 days	4 days



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### Post curing:

The chemical resistance of the coating can be extended by **post curing**, which must take place within the first year in service.

Post curing is accomplished by carrying a hot cargo of mineral lube oil, vegetable oil or animal oil at minimum 50°C/122°F. The curing time is 8 days at 50°C/122°F and 4 days at 60°C/140°F.

Post curing of double-hull tankers may also be accomplished by using tank cleaning machines to spray hot, clean fresh water to achieve a minimum steel temperature of 60°C/140°F and maximum 80°C/176°F. The curing time is 16 hours at 60°C/140°F and 3 hours at 80°C/176°F. **All adjacent ballast tanks must be empty and all adjacent cargo tanks must be either empty or carrying a liquid cargo of minimum 40°C/104°F.**

Contact HEMPEL for detailed advice about post curing.

### Recoating intervals:

Provided observance of the above stated ventilation and relative humidity for 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	35°C/95°F
Minimum, non-potable water service						
- between the first and the second coat	90 hours	60 hours	36 hours	24 hours	18 hours	14 hours
- between the second and the third coat	60 hours	40 hours	24 hours	16 hours	12 hours	9 hours
Potable water service, all coats; minimum:**	7½ days	5 days	3 days	2 days	36 hours	30 hours
Maximum	47 days	34 days	21 days	16 days	14 days	11 days

\* Absolute minimum temperature recommended.

\*\* The approval from Folkehelseinstituttet, Norway will apply provided a minimum recoat interval of 6 days (20°C/68°F).

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 cm/1 foot 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, must be free from pinholes and other defects 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 saggings, 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 damaging 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.



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### Control of dry film thicknesses:

For the standard specification following applies to the dry film thickness:  
The minimum dry film thickness is 300 micron/12 mils, maximum recommended thickness is 600 micron/24 mils (below 15°C/59°F: 450 micron/18 mils). The minimum dry film thickness is evaluated according to the "80-20" rule, ie no more than 20% 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 80% of minimum dry film thickness, ie 240 micron/9.6 mils. The maximum dry film thickness can also be evaluated according to the "80-20" rule.  
Dry film thickness control must not be carried out within the first 24 hours after application of final coat (20°C, sufficient ventilation). The measurement must be carried out using an electromagnetic dry film thickness gauge calibrated with shims placed on a smooth steel substrate.

### Taking into use:

Do not use the tank or pipeline before the coating is properly cured. Reference is made to curing time on page 5.

Being a solvent borne paint HEMPADUR 85671 does contain traces of solvents after full curing. These solvents will leach out into the surrounding media during service. In order to keep the concentrations below acceptable levels the following conditioning procedure is recommended for HEMPADUR 85671 in contact with **potable water**: When cured for 1 month (20°C/68°F), but before taking the tank into use for **potable water**, fill twice with water at 60°C/140°F each time for a period of no less than 24 hours and finally flush with fresh water.

For tanks larger the 100.000 litres/26.000 US gallons flush the surface with fresh water (min. 15°C/59°F) for two days. Then wash the tank thoroughly with soap water, followed by brushing with water or steam cleaning.

On vessels adjacent tanks must be empty during the conditioning.

### Repairs:

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

Repair shall be started 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 should 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 tank top 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 to full film thickness with minimum 3 coats of HEMPADUR 85671.

#### 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 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 to full film thickness with minimum 3 coats HEMPADUR 85671.

#### Areas above 1 sq.m. or areas where several damaged spots are concentrated:

**Treatment:** Repeat the original specification.



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### 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. Avoid inhalation, avoid contact with skin and eyes, and do not swallow. Take precautions against possible risks of fire or explosions as well as protection of the environment. Apply only in well ventilated areas.

ISSUED BY:

HEMPEL A/S - 8567111630CR002

*This Product Data Sheet supersedes those previously issued.*

*For explanations, definitions and scope, see "Explanatory Notes" in the HEMPEL Book.*

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