

Application Guide



Tankguard Storage

Product description

This is a two component polyamine cured phenolic/novolac epoxy coating. It is a specially designed tank lining with excellent chemical resistance. Can be used as primer, mid coat or finish coat in atmospheric and immersed environments. Suitable for properly prepared carbon steel, galvanised steel, stainless steel and concrete substrates.

Scope

The Application Guide offers product details and recommended practices for the use of the product.

The data and information provided are not definite requirements. They are guidelines to assist with efficient and safe use, and optimum service of the product. Adherence to the guidelines does not relieve the applicator of responsibility for ensuring that the work meets specification requirements. Jotuns liability is in accordance with general product liability rules.

The Application Guide (AG) must be read in conjunction with the relevant specification, Technical Data Sheet (TDS) and Safety Data Sheet (SDS) for all the products used as part of the coating system.

Projects specified to the requirements in Performance Standard for Protective Coatings (PSPC)

For application and repair / maintenance requirements according to IMO MSC.215 (82) for dedicated Sea Water Ballast Tanks (WBT), and/or to IMO MSC.288 (87) for Cargo Oil Tanks of Crude Oil Tankers (COT) reference is made to the PSPC Appendix in this document.

Referred standards

Reference is generally made to ISO Standards. When using standards from other regions it is recommended to reference only one corresponding standard for the substrate being treated.

Surface preparation

The required quality of surface preparation can vary depending on the area of use, expected durability and if applicable, project specification.

When preparing new surfaces, maintaining already coated surfaces or aged coatings it is necessary to remove all contamination that can interfere with coating adhesion, and prepare a sound substrate for the subsequent product.

Inspect the surface for hydrocarbon and other contamination and if present, remove with an alkaline detergent. Agitate the surface to activate the cleaner and before it dries, wash the treated area using fresh water.

Paint solvents (thinners) shall not be used for general degreasing or preparation of the surface for painting due to the risk of spreading dissolved hydrocarbon contamination. Paint thinners can be used to treat small localized areas of contamination such as marks from marker pens. Use clean, white cotton cloths that are turned and replaced often. Do not bundle used solvent saturated cloths. Place used cloths into water.

When the surface is an existing coating, verify with technical data sheet and application guide of the involved products, both over coatability and the given maximum over coating interval.

Process sequence

Surface preparation and coating should normally be commenced only after all welding, degreasing, removal of sharp edges, weld spatter and treatment of welds is complete. It is important that all hot work is completed before coating commences.

Soluble salts removal

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Soluble salts have a negative impact on the coating systems performance, especially when immersed. Jotun's general recommendations for maximum soluble salts (sampled and measured as per ISO 8502-6 and -9) content on a surface are:

Chemical tanks: 50 mg/m²

For areas exposed to (ISO 12944-2):

C1-C4: 200 mg/m²

C5: 100 mg/m²

Im1-Im3: 80 mg/m²

Carbon steel

Initial rust grade

The steel shall preferably be Rust Grade A or B (ISO 8501-1). It is technically possible to apply the coating to rust grades C and D, but it is practically challenging to ensure specified film thickness on such a rough surface, hence risk of reduced lifetime of the coating system. When steel of Rust Grade C or D is coated, the frequency of inspection and testing should be increased.

Metal finishing

For areas in corrosivity category C1 to C4 (ISO 12944-2) all irregularities, burrs, slivers, slag and spatter on welds, sharp edges and corners shall conform to minimum grade P2 (ISO 8501-3) Table 1, or as specified. All edges shall have a rounded radius of minimum 2 mm subjected to three pass grinding or equally effective method.

For areas in corrosivity category C5 and Im1-3 the requirement are for the steel to conform to grade P2 (ISO 8501-3) Table 1. All edges shall have a rounded radius of minimum 2 mm subjected to three pass grinding or equally effective method. One may use a mechanical grinder fitted with a suitable abrasive disc. All sharp irregularities, burrs, slivers, slag and spatter on welds, whether apparent before or after blast cleaning, shall be removed before coating application. Welding smoke is water soluble and it is most efficiently removed by water cleaning.

Defective welds shall be replaced and treated to an acceptable finish before painting. Temporary welds and brackets shall be ground to a flat finish after removal from the parent metal.

Surface preparation and coating should normally be commenced only after all metal finishing and degreasing of a specific area is complete. It is important as much hot work as possible is completed before coating commences.

Pitting repair

Pittings in steel can be difficult to cover fully with most coatings. In some areas it is practically feasible to use filler to fill pittings. This should then be done either after the initial surface preparation or after application of first coat. For tank coating and lining used for chemical exposure the recommendation is to fill pits through welding, since using fillers may negatively affect the coating systems' chemical resistance and flexibility.

Abrasive blast cleaning

Application of protective coating shall commence before degradation of the surface standard occurs.

Cleanliness

After pre-treatment is complete, the surface shall be dry abrasive blast cleaned to Sa 2½ (ISO 8501-1) using abrasive media suitable to achieve a sharp and angular surface profile.

Surface profile

Recommended surface profile 50-85 µm, grade Medium G (ISO 8503-2).

Measure the achieved profile with surface replication tape (Testex) (ISO 8503-5) or by surface roughness stylus instrument (ISO 8503-4).

Abrasive media quality

The mineral abrasive may be of any material that meets the specified requirements. It shall be composed of clean, sound, hard particles free from foreign substances such as dirt, oil, grease, toxic substances, paint, organic matter and water soluble salts. (According to ISO 11125 and ISO 11126).

The moisture content for material delivered shall not exceed 0.5% (by weight) and the conductivity when tested according to ISO 11127-7 shall not exceed 250 µS/cm.

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Compressed air quality

The supply of clean air to blasting pots must be secured to avoid contamination of abrasive and thereby of blast cleaned surfaces. Compressors must be fitted with sufficient traps for oil and water. It is also recommended to fit two water separators at the blasting machine to ensure a supply of moisture-free air to the abrasive chamber.

Dust contamination

On completion of abrasive blasting, the prepared surface shall be vacuum cleaned to remove residues of corrosion products and abrasive media, and inspected for particulate contamination. Maximum dust quantity rating 1 (ISO 8502-3). Dust size no greater than class 2. Continue cleaning until testing shows the required result.

Hand and Power Tool Cleaning

Power tool cleaning

Minor damage of the coating may be prepared to St 3 (ISO 8501-1). Suitable method is disc grinding with rough discs only. Ensure the surface is free from mill scale, residual corrosion, failed coating and is suitable for painting. The surface should appear rough and mat.

Overlapping zones to intact coating shall have all leading edges feathered back by sanding methods to remove all sharp leading edges and establish a smooth transition from the exposed substrate to the surrounding coating. Consecutive layers of coating shall be feathered to expose each layer and new coating shall always overlap to an abraded existing layer. Abrade intact coatings around the damaged areas for a minimum 100 mm to ensure a mat, rough surface profile, suitable for over coating.

Mechanical repairs are only accepted for minor areas of damage where abrasive blasting is expected to create more damage to the coating system than actual benefit to the performance of the coating system.

Galvanised steel

Abrasive blast cleaning

After removal of excess zinc and surface defects the area to be coated shall be degreased to ISO 12944-4, Part 6.2.4 Alkaline Cleaning. The galvanised surface shall be sweep blast-cleaned with the nozzle angle at 45-60° from perpendicular at reduced nozzle pressure to create a sharp and angular surface profile using approved non-metallic abrasive media. As a guide, a surface profile 25-55 µm, grade Fine G; Ry5 (ISO 8503-2) should be achieved.

Care must be exercised when sweep blasting. The zinc coating thickness should be reduced as little as possible, preferably not more than 10 µm.

Smaller areas can be lightly treated with abrasive paper.

Finished surfaces shall be dull, profiled and show no areas of shiny metal.

After removal of excess zinc and surface defects the area to be coated shall be degreased with an alkaline detergent, washed by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard and the surface abraded using mechanical or hand sanding methods using non-metallic abrasives or bonded fibre abrasive pads to remove all polish and to impart a scratch pattern to the surface. Do not use high speed rotational sanders.

Hand and Power Tool Cleaning

After removal of excess zinc and surface defects the area to be coated shall be degreased with an alkaline detergent, washed by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard and the surface abraded using mechanical or hand sanding methods using non-metallic abrasives or bonded fibre abrasive pads to remove all polish and to impart a scratch pattern to the surface. Do not use high speed rotational sanders.

Water jetting

Inspect the surface for process residues, hydrocarbon contamination and corrosion by products. If present, remove with an alkaline detergent. Agitate the surface to activate the detergent and before it dries, wash the treated area by Low-Pressure Water Cleaning (LPWC) to a grade corresponding to the description of Wa 1 (ISO 8501-4) or higher standard using fresh water.

Optimum performance is achieved with preparation to a grade corresponding to the description of Wa 2½.

Minimum preparation grade is Wa 1.

Aluminium

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Abrasive blast cleaning

The surface to be coated shall be dry abrasive blast cleaned as required for the specified surface profile using approved non-metallic abrasive media which is suitable to achieve a sharp and angular surface profile. As a guide, a surface profile corresponding to 25-55 µm, grade Fine G; Ry5 (ISO 8503-2) should be achieved.

Examples of recommended abrasives are:

- Ferrite free almandite garnet grade 30/60 and 80 grade (US Mesh size)
- Aluminium oxide grade G24

Stainless steel

Abrasive blast cleaning

The surface to be coated shall be dry abrasive blast cleaned as required for the specified surface profile using non-metallic abrasive media which is suitable to achieve a sharp and angular surface profile. As a guide, a surface profile corresponding to 25-55 µm, grade Fine G; Ry5 (ISO 8503-2) should be achieved. Examples of recommended abrasives are:

- Ferrite free almandite garnet grade 30/60 and 80 grade (US Mesh size)
- Aluminium oxide grade G24

Chlorinated or chlorine containing solvents or detergents must not be used on stainless steel.

Concrete

Concrete should be a minimum of 28 days old, applying any coating before this time will greatly increase the chance of the coating de-bonding. The moisture content of the concrete should be checked prior to the application of the coating and should not be greater than 5%. Concrete substrates should be mechanically prepared to leave a clean, sound and dry base on which a coating system can be applied.

Clean – Free of oils, grease, dust, dirt, chemicals, loose coating, curing compounds, form release oils, sealers or hardeners.

Sound – Concrete that has unsound areas (voids, hollow spots, and friable surface) may have to be removed, replaced or repaired with materials that are compatible with the selected coating system.

Dry – It is important to address dryness because most coatings require a dry surface for proper adhesion.

Moisture contained within the concrete that moves towards the surface through the pores of the concrete may prevent adequate coating adhesion.

Dry abrasive blast cleaning to SSPC-SP 13/NACE No. 6. Where the concrete has become contaminated with oils, grease, or fuels, water emulsifiable degreasers-cleaners may be used to remove these contaminants. It is important to only clean an area that can be fully washed down after degreasing before any of the cleaner can dry on the surface.

Ultra high pressure water jetting can be used to remove laitance and reveal blowholes and imperfections. Ensure concrete is dry before coating application.

Blast cleaning

Dry abrasive blast cleaning to SSPC-SP 13/NACE No. 6. All prepared surfaces should then have all "blow holes" and other surface defects filled with suitable filler that is compatible with the primer and finish coat system to ensure that the coating can be applied over a smooth and regular substrate.

Diamond disc grinding

Diamond grind the surface to remove all laitance and expose the aggregates.

Coated surfaces

Over coating

When applied on coatings past maximum intercoating interval light abrading may be required to achieve proper intercoat adhesion.

Organic primers/intermediates

Approved holding primers are available for this product. A holding primer must be clean and dry before being over coated.

When the surface is an existing coating, verify with technical data sheet and application guide of the involved products, both over coatability and the given maximum over coating interval.

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Shop primers

Shop primers are accepted as temporary protection of steel plates and profiles. However the shopprimer should be completely removed through blast cleaning to minimum Sa 2½ (ISO 8501-1) using abrasive media suitable to achieve a sharp and angular surface profile 50-100 µm, grade Medium to Course G; Ry5 (ISO 8503- 2).

Application

Acceptable environmental conditions - before and during application

Before application, test the atmospheric conditions in the vicinity of the substrate for the dew formation according to ISO 8502-4.

Air temperature	10 - 60	°C
Substrate temperature	10 - 60	°C
Relative Humidity (RH)	10 - 85	%

The following restrictions must be observed:

- Only apply the coating when the substrate temperature is at least 3 °C (5 °F) above the dew point
- Do not apply the coating if the substrate is wet or likely to become wet

Product mixing

Product mixing ratio (by volume)

Tankguard Storage Comp A	6.5 part(s)
Tankguard Storage Comp B	1 part(s)

Induction time and Pot life

Paint temperature	23 °C
Induction time	20 min
Pot life	4 h

The temperature of base and curing agent is recommended to be 18 °C or higher when the product is mixed.

Thinner/Cleaning solvent

Thinner: Jotun Thinner No. 23

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Application data

Spray application

Airless Spray Equipment

Pump ratio (minimum) :	42:1
Pressure at nozzle (minimum) :	150 bar/2100 psi
Nozzle tip (inch/1000) :	17-21
Nozzle output (litres/minute) :	1.3-1.9
Filters (mesh) :	70

Several factors influence, and need to be observed to maintain the recommended pressure at the nozzle. Among factors causing pressure drop are:

- extended hoses or hose bundles
- extended hose whip-end line
- small internal diameter hoses
- high paint viscosity
- large spray nozzle size
- inadequate air capacity from compressor
- incorrect or clogged filters

Plural component (Twin Pump) airless spray equipment

When using plural spray equipment, Jotun recommends the use of either a pump with computerised pump ratio settings or fixed ratio settings in combination with a flow meter for each pump to monitor the proper delivery ratio of the coating components is maintained during use.

Recommended data for pump output, pressure at nozzle, nozzle tip and filters are the same as for airless spray equipment.

Other application tools

Brush application

Suitable for application by brush. Recommended for first coat or stripe coating application in corners, on edges and other areas difficult to reach. A stiff brush is recommended. It will be necessary to apply additional coats to achieve a similar dry film thickness as when the coating is applied by airless spray.

Roller application

Suitable for application by roller. The addition of a small volume of thinner is recommended to achieve improved flow. In tanks roller is recommended for scallops and rat holes only.

Film thickness per coat

Typical recommended specification range

Dry film thickness	100 - 200	µm
Wet film thickness	160 - 320	µm
Theoretical spreading rate	6.3 - 3.2	m ² /l

This product can be applied up to 50 % higher than maximum specified film thickness without loss of technical properties.

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Film thickness measurement

Wet film thickness (WFT) measurement and calculation

To ensure correct film thickness, it is recommended to measure the wet film thickness continuously during application using a painter's wet film comb (ISO 2808 Method 1A). The measurements should be done as soon as possible after application.

Fast drying paints may give incorrect (too low) readings resulting in excessive dry film thickness. For multi layer physically drying (resoluble) coating systems the wet film thickness comb may give too high readings resulting in too low dry film thickness of the intermediate and top coats.

Use a wet-to-dry film calculation table (available on the Jotun Web site) to calculate the required wet film thickness per coat.

Dry film thickness (DFT) measurement

When the coating has cured to hard dry state the dry film thickness can be checked to SSPC PA 2 or equivalent standard using statistical sampling to verify the actual dry film thickness. Measurement and control of the WFT and DFT on welds is done by measuring adjacent to and no further than 15 mm from the weld.

Application / Drying / Curing considerations

Pay close attention to both spraying technique and the correct setting of equipment during application in order to achieve an even, pinhole free film. A combination of the correct inbound air / outbound material pressure, correct airless tip or spray set up and a 30-50 cm gun to substrate distance is recommended. Apply the coating in even and uniform parallel passes and overlap each pass 50% to achieve an even film. Use a painter's wet film comb during application to control the wet to dry film thickness of the coating.

Ventilation

When a solvent containing coating is applied in a confined space, for example a cargo tank, the solvent will evaporate and make an explosive atmosphere unless the solvent concentration is immediately reduced to a not-explosive level. Hence, artificial ventilation will be required. This ventilation must be maintained during the paint application and drying in accordance with the TDS data. The ventilation shall ensure that the solvent concentration in the tank at no time exceeds the maximum permitted (i.e. 0.1%).

Detailed background information about ventilation arrangements and calculations is given in the Code of Practice for Tank Coating, available at the TSS home page. There one will also find a "Ventilation calculator" that can be used for different coatings and thinners.

The Required Air Quantity (RAQ) is the amount of air needed to prevent that the solvent content of the drying paint makes the air explosive. For a typical tank coating the RAQ is 60 m³ of air per litre of paint. This means that for every litre of paint used one must ensure that this amount of air is made available so that the solvents in the paint can be diluted to a no longer dangerous concentration. If the paint is diluted with a thinner this will require additional fresh air. Thinner No. 23 requires 200 m³/litre.

Note that it is the responsibility of the Yard or Paint Application Contractor to ensure that there is a safe work environment in the tank. However, Jotun may assist in calculating RAQ, and design of the ventilation. Therefore, the Coating Advisor may be asked for advice.

The input of fresh air to the tank can be calculated provided the RAQ of the paint (and thinner, if used) is known :

Ventilation, m³ air input per minute = $[P \cdot RAQA + Q \cdot RAQB] / t$
where

P = paint to be used in the tank, litres

Q = additional thinner used in this paint, litres

RAQA = RAQ, (m³/l) for the paint

RAQB = RAQ, (m³/l) for the thinner (if added)

t = (application + surface dry) time in minutes

Note that the ventilation fans must run until the coating is Through dry / Walk-on dry (cf. the TDS). The ventilation may run also after the coating is through dry, i.e. until the coating is cured. The need for ventilation

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is highest during the paint application process, when solvents evaporate both from the paint spray and the wet paint surface. When the coating is Surface (touch) dry the solvent evaporation rate is much lower and the fan speed may be reduced.

Example:

A 650 m³ tank is coated with one coat of a 70 % VS tank coating, 125 µm DFT.

The tank has a calculated surface area of 1260 m².

The paint will be thinned 2 % (Thinner no. 23).

Application speed is 3.5 litres per minute.

How much fresh air must be blown into the tank per minute to eliminate the explosion risk?

The steel temperature is 23°C.

Answer: $125 \mu\text{m}/0.70 * 1260 \text{ m}^2 = 225$ litres of paint. 2 % to this is 4.5 litres thinner.

This requires $225*60 + 4.5*200 = 14400$ m³ fresh air. (225+4.5) litres / 3.5 litres sprayed per minute = 66 minutes application time.

Time to Surface dry (as per technical data sheet) is 4 hours at 23°C.

The average ventilation rate for the most demanding period is therefore $14400 \text{ m}^3 / (66 + 4*60) \text{ min} = 47 \text{ m}^3 / \text{minute}$.

There is an alternative calculation of ventilation based on the "Number of air exchanges per hour" concept. In yard specifications one may, for example, find that during the paint application and drying, two or three air changes per hour in the tank is specified. This is a practical approach, but it does not take into account the solvent evaporation from the painting and drying process, and may lead to unsatisfactory results as to the elimination of the explosion risk.

As an example, using the figures above, one finds that "Three air exchanges per hour" corresponds to a ventilation rate of $3*650 \text{ m}^3/\text{hour} = 33 \text{ m}^3/\text{minute}$.

In this case the alternative approach under estimates the ventilation requirement. A way to come around this is to increase the air exchange rate, or reduce the application speed.

Stripe coating

The stripe coat sequence can be either of the following:

1. Surface preparation, full coat, stripe coat. This sequence can be used when a large substrate area has been prepared and leaving the substrate exposed for a long time while doing stripe coating could lead to surface deterioration.
2. Surface preparation, stripe coat, full coat.

In general Jotun recommends alternative 1 because it reduces the risk that "new" contamination will be introduced to the uncoated substrate.

Walking on the blast cleaned substrate in order to do the stripe coating presents a risk for such contamination. It is important to pay special attention to edges, openings, rear sides of stiffeners, scallops etc. and to apply a stripe coat to these areas where the spray fan may not reach or deposit an even film.

When applying a stripe coat to bare metal use only a stiff, round stripe coating brush to ensure surface wetting and filling of pits in the surface.

Stripe coating shall be of a different colour to the main primer coat and the topcoat colour and should be applied in an even film thickness, avoiding excessive brush marks in order to avoid entrapped air. Care should be taken to avoid excessive film thickness. Pay additional attention to pot life during application of stripe coats.

Jotun recommends a minimum of one stripe coat. A second stripe coat will be beneficial in order to ensure that sufficient paint material is applied to the critical parts of the object.

Coating loss

The consumption of paint should be controlled carefully, with thorough planning and a practical approach to reducing loss. Application of liquid coatings will result in some material loss. Understanding the ways that coating can be lost during the application process, and making appropriate changes, can help reducing material loss.

Some of the factors that can influence the loss of coating material are:

- type of spray gun/unit used
- air pressure used for airless pump or for atomization
- orifice size of the spray tip or nozzle
- fan width of the spray tip or nozzle
- the amount of thinner added
- the distance between spray gun and substrate
- the profile or surface roughness of the substrate. Higher profiles will lead to a higher "dead volume"
- the shape of the substrate target
- environmental conditions such as wind and air temperature

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Drying and Curing time

Substrate temperature	10 °C	15 °C	23 °C	30 °C	40 °C
Surface (touch) dry	15 h	12 h	4 h	3 h	2 h
Walk-on-dry	24 h	20 h	10 h	8 h	4 h
Dry to over coat, minimum	24 h	20 h	10 h	7 h	4 h
Dried/cured for service	21 d	14 d	7 d	4 d	3 d

Drying and curing times are determined under controlled temperatures and relative humidity below 85 %, and at average of the DFT range for the product.

For storage of crude oil and clean petroleum products the tanks can be returned to service 48 hours after application of the final coat, when applied at temperatures 23 °C and above.

For a list of what constitutes clean petroleum products please refer to Jotun Product Resistance Guide.

Surface (touch) dry: The state of drying when slight pressure with a finger does not leave an imprint or reveal tackiness.

Walk-on-dry: Minimum time before the coating can tolerate normal foot traffic without permanent marks, imprints or other physical damage.

Dry to over coat, minimum: The recommended shortest time before the next coat can be applied.

Dried/cured for service: Minimum time before the coating can be permanently exposed to the intended environment/medium.

Maximum over coating intervals

Maximum time before thorough surface preparation is required. The surface must be clean and dry and suitable for over coating. Inspect the surface for chalking and other contamination and if present, remove with an alkaline detergent. Agitate the surface to activate the cleaner and before it dries, wash the treated area by low-pressure water cleaning using fresh water.

If maximum over coating interval is exceeded the surface should in addition be carefully roughened to ensure good inter coat adhesion.

Areas for atmospheric exposure

Average temperature during drying/curing	10 °C	15 °C	23 °C	30 °C	40 °C
Itself	30 d	30 d	30 d	30 d	30 d

Areas for immersed exposure

Average temperature during drying/curing	10 °C	15 °C	23 °C	30 °C	40 °C
Itself	30 d	30 d	30 d	14 d	14 d

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Other conditions that can affect drying / curing / over coating

Repair of coating system

Damages to the coating layers:

Prepare the area through sandpapering or grinding, followed by thorough cleaning/vacuuming. When the surface is clean and dry the coating may be over coated by itself or by another product, ref. original specification.

Always observe the maximum over coating intervals. If the maximum over coating interval is exceeded the surface should be carefully roughened in order to ensure good intercoat adhesion.

Damages exposing bare substrate:

Remove all rust, loose paint, grease or other contaminants by spot blasting, mechanical grinding, water and/or solvent washing. Feather edges and roughen the overlap zone of surrounding intact coating. Apply the coating system specified for repair.

Should small areas of the coating require repair then that area must be suitably cleaned and prepared by sanding or light blasting and ensuring thorough removal of dust and debris. Coating of the cleaned and prepared surface can be done by brushing the product having been thoroughly mixed in the specified mix ratio.

Areas with too low DFT:

Roughen the surface, vacuum and apply new coating according to specification.

Areas with too high DFT:

Areas with with DFT above maximum specified for isolated areas shall be ground down to acceptable thickness, or down to bare steel and recoated.

Repair of damaged areas

Repair of damaged areas for Tankguard EPOXIES:

Damage to the coating that exposes bare steel are recommended to be dry abrasive blast cleaned to Sa 2½ (ISO 8501-1) assuming it is practically viable, preferably by the use of vacuum blasting equipment.

Minor coating damage may be prepared to St 3 (ISO 8501-1:2007) with minimum 25 µm surface profile equivalent to SSPC SP11. This method of preparation is only recommended for small damages (less than 40 cm²) where abrasive blasting could cause excessive damage to surrounding coatings. Edges of intact surrounding coating should be feathered to ensure a smooth coating overlap and a thorough vacuum cleaning of the area should be carried out prior to application.

Coating film continuity

Jotun recommends that all coating systems for immersion shall be inspected for film continuity/defects by visual observation of pin hole rusting through the coating after tank hydro-testing or sea water immersion during sea trials. Alternatively, full immersion of tanks in combination with tanks fully saturated by tank cleaning machine(s), soaking all surfaces with sea water and creating a high condensation environment during sea trials.

All noted defects shall be repaired or reported as outstanding issues.

For onshore storage tanks or for tanks where sea water immersion may not be permitted or practical, coating shall be tested for film continuity/defects as described in ASTM D 5162, method A or B as appropriate for the coating thickness.

The recommended voltage is 500 volts per 100 µm DFT. The acceptance criterion is no defects. Defects found shall be repaired as per coating specification.

Performance Standard for Protective Coatings (PSPC)

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PSPC Appendix (COT)

Application requirements particular for coating according to Performance Standard for Protective Coatings (PSPC) of cargo oil tanks of crude oil tankers to IMO Resolution MSC.288(87)

Job specification

There shall be a minimum of two stripe coats and two spray coats, except that the second stripe coat, by way of welded seams only, may be reduced in scope where it is proven that the NDFT (nominal total dry film thickness) can be met by the coats applied in order to avoid unnecessary over thickness. Any reduction in scope of the second stripe coat shall be fully detailed in the CTF.

NDFT (nominal total dry film thickness)

NDFT 320 µm with 90/10 rule. (Minimum 90 % of all DFT measurements shall be greater than or equal to the NDFT and none of the remaining 10 % measurements shall be below 0.9 x NDFT).

Maximum DFT 2000 µm is acceptable for isolated spots only, and should not extend to more than 1% of the total tank area.

PRIMARY SURFACE PREPARATION

Blasting and surface profile:

Cleanliness minimum Sa 2½ (ISO 8501-1)
Surface profile 30-75 µm (ISO 8503-2)

Blasting shall not be carried out when:

- the relative humidity is above 85 %
- the surface temperature of steel is less than 3 °C above the dew point

Water soluble salts limit equivalent to NaCl

Maximum 50 mg/m² of sodium chloride (ISO 8502-6/9)

SECONDARY SURFACE PREPARATION

Steel condition

For steel preparation, PSPC makes reference to grade P2 (ISO 8501-3). All sharp edges are to be rounded to a radius of minimum 2 mm, subject to a three-pass grinding, or treated with an alternative process giving an edge profile that results in a dry film thickness retention corresponding to or better than a three pass grinding. Sharp edges mean all edges except natural rounded/rolled edges of sections.

Surface treatment

Cleanliness minimum Sa 2½ (ISO 8501-1) on damaged shop primer and welds.

Surface treatment after erection

Cargo oil tanks (COT), IMO Resolution MSC.288 (87)

Erection joints minimum St 3 or Sa 2½ (ISO 8501-1) where practicable.

For inner bottom:

- Damages up to 20 % of the area to be coated to be treated to minimum St 3
- Contiguous damages over 25 m² or over 20 % of the area to be coated, Sa 2½ shall be applied

For underdeck:

- Damages up to 3 % of area to be coated to be treated to minimum St 3
- Contiguous damages over 25 m² or over 3 % of the area to be coated, Sa 2½ shall be applied
- Coating in overlap shall be feathered

Profile requirements

In case of full or partial blasting surface profile 30-75 µm (ISO 8503-2).

Dust

Dust quantity rating 1 for dust size class 3 or larger (ISO 8202-3).

Lower dust size classes to be removed if visible without magnification on the surface to be coated.

Water soluble salts limit equivalent to NaCl after blasting/ grinding

Maximum 50 mg/m² of sodium chloride (ISO 8502-6/9).

Contamination

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No oil contamination.

Inspect the surface for contaminations and if present, remove with an alkaline detergent. Agitate the surface to activate the cleaner and before it dries, wash the treated area by Low-Pressure Water Cleaning (LPWC) to Wa 1 (ISO 8501-4) using fresh water.

Ventilation

Sufficient ventilation must be provided to remove the solvent evaporating from the coating. When mixed, this product requires exchange of 56 m³ air per litre paint in order to dilute the evaporating solvent to a safe concentration in the tank (i.e. less than 10 % of the Lower Explosion Limit, LEL). The solvent gas concentration in the tank must at all times be kept below this level, hence sufficient ventilation must be maintained during the whole application and drying periods.

Environmental conditions

Coating shall be applied under controlled humidity and surface conditions, in accordance with the manufacturer's specifications. In addition, coating shall not be applied when:

- the relative humidity is above 85 %
- the surface temperature is less than 3 °C above the dew point
- the surface is wet or is likely to become wet

Testing of coating

Destructive testing should be avoided.

Dry film thickness shall be measured after each coat for quality control purposes. The total dry film thickness shall be documented after completion of the final coat, using appropriate thickness gauges.

Repair and maintenance procedures relevant to coating according to Performance Standard for Protective Coatings (PSPC) of cargo oil tanks of crude oil tankers to IMO Resolution MSC.288(87)

Superficial damages not exposing bare substrate:

Prepare the area through sandpapering or grinding, followed by thorough cleaning/vacuuming. When the surface is dry and clean the coating may be over coated by itself or by another product, ref. original specification. Always observe the minimum and maximum over coating intervals. If the maximum over coating interval is exceeded the surface should be carefully roughened in order to ensure good intercoat adhesion.

Damages exposing bare substrate:

Choice of surface preparation and application methods shall be made in conjunction with Jotun and the actual Classification Society, following the guidelines in:

MSC.1/Circ. 1399 (COT)

- Chapter 4.1 for coating condition assessment
- Chapter 5 for coating maintenance
- Chapter 6 for coating repair

Quality assurance

The following information is the minimum required. The specification may have additional requirements.

- Confirm that all welding and other metal work has been completed before commencing pre-treatment and surface preparation
- Confirm that installed ventilation is balanced and has the capacity to deliver and maintain the RAQ
- Confirm that the required surface preparation standard has been achieved and is held prior to coating application
- Confirm that the climatic conditions are within recommendations in the AG, and are held during the application
- Confirm that the required number of stripe coats have been applied
- Confirm that each coat meets the DFT requirements in the specification
- Confirm that the coating has not been adversely affected by rain or other factors during curing
- Observe that adequate coverage has been achieved on corners, crevices, edges and surfaces where the spray gun cannot be positioned so that its spray impinges on the surface at 90° angle
- Observe that the coating is free from defects, discontinuities, insects, abrasive media and other contamination
- Observe that the coating is free from misses, sags, runs, wrinkles, fat edges, mud cracking, blistering, obvious pinholes, excessive dry spray, heavy brush marks and excessive film build
- Observe that the uniformity and colour are satisfactory

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All noted defects shall be fully repaired to conform to the coating specification.

Caution

This product is for professional use only. The applicators and operators shall be trained, experienced and have the capability and equipment to mix/stir and apply the coatings correctly and according to Jotun's technical documentation. Applicators and operators shall use appropriate personal protection equipment when using this product. This guideline is given based on the current knowledge of the product. Any suggested deviation to suit the site conditions shall be forwarded to the responsible Jotun representative for approval before commencing the work.

For further advice please contact your local Jotun office.

Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not inhale spray mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

Accuracy of information

Always refer to and use the current (last issued) version of the TDS, SDS and if available, the AG for this product. Always refer to and use the current (last issued) version of all International and Local Authority Standards referred to in the TDS, AG & SDS for this product.

Colour variation

Some coatings used as the final coat may fade and chalk in time when exposed to sunlight and weathering effects. Coatings designed for high temperature service can undergo colour changes without affecting performance. Some slight colour variation can occur from batch to batch. When long term colour and gloss retention is required, please seek advice from your local Jotun office for assistance in selection of the most suitable top coat for the exposure conditions and durability requirements.

Reference to related documents

The Application Guide (AG) must be read in conjunction with the relevant specification, Technical Data Sheet (TDS) and Safety Data Sheet (SDS) for all the products used as part of the coating system.

When applicable, refer to the separate application procedure for Jotun products that are approved to classification societies such as PSPC, IMO etc.

Symbols and abbreviations

min = minutes

h = hours

d = days

°C = degree Celsius

° = unit of angle

µm = microns = micrometres

g/l = grams per litre

g/kg = grams per kilogram

m²/l = square metres per litre

mg/m² = milligrams per square metre

psi = unit of pressure, pounds/inch²

Bar = unit of pressure

RH = Relative humidity (% RH)

UV = Ultraviolet

DFT = dry film thickness

WFT = wet film thickness

TDS = Technical Data Sheet

AG = Application Guide

SDS = Safety Data Sheet

VOC = Volatile Organic Compound

MCI = Jotun Multi Colour Industry (tinted colour)

RAQ = Required air quantity

PPE = Personal Protective Equipment

EU = European Union

UK = United Kingdom

EPA = Environmental Protection Agency

ISO = International Standards Organisation

ASTM = American Society of Testing and Materials

AS/NZS = Australian/New Zealand Standards

NACE = National Association of Corrosion Engineers

SSPC = The Society for Protective Coatings

PSPC = Performance Standard for Protective Coatings

IMO = International Maritime Organization

ASFP = Association for Specialist Fire Protection

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Disclaimer

The information in this document is given to the best of Jotun's knowledge, based on laboratory testing and practical experience. Jotun's products are considered as semi-finished goods and as such, products are often used under conditions beyond Jotun's control. Jotun cannot guarantee anything but the quality of the product itself. Minor product variations may be implemented in order to comply with local requirements. Jotun reserves the right to change the given data without further notice.

Users should always consult Jotun for specific guidance on the general suitability of this product for their needs and specific application practices.

If there is any inconsistency between different language issues of this document, the English (United Kingdom) version will prevail.

This Application Guide supersedes those previously issued.

The Application Guide (AG) must be read in conjunction with the relevant specification, Technical Data Sheet (TDS) and Safety Data Sheet (SDS) for all the products used as part of the coating system.
For your nearest local Jotun office, please visit our website at www.jotun.com.