KEEPING YOUR SHIP IN EXCELLENT CONDITION

The laughing dolphin provides worldwide local service. It's unique!

Across the world, Transocean Coatings is active in the manufacture and supply of antifoulings, anticorrosives and other coatings for ships, off-shore installations and containers.

Extensive research and development work has provided Transocean Coatings with a series of products which professionals acknowledge to be complete and of high quality.

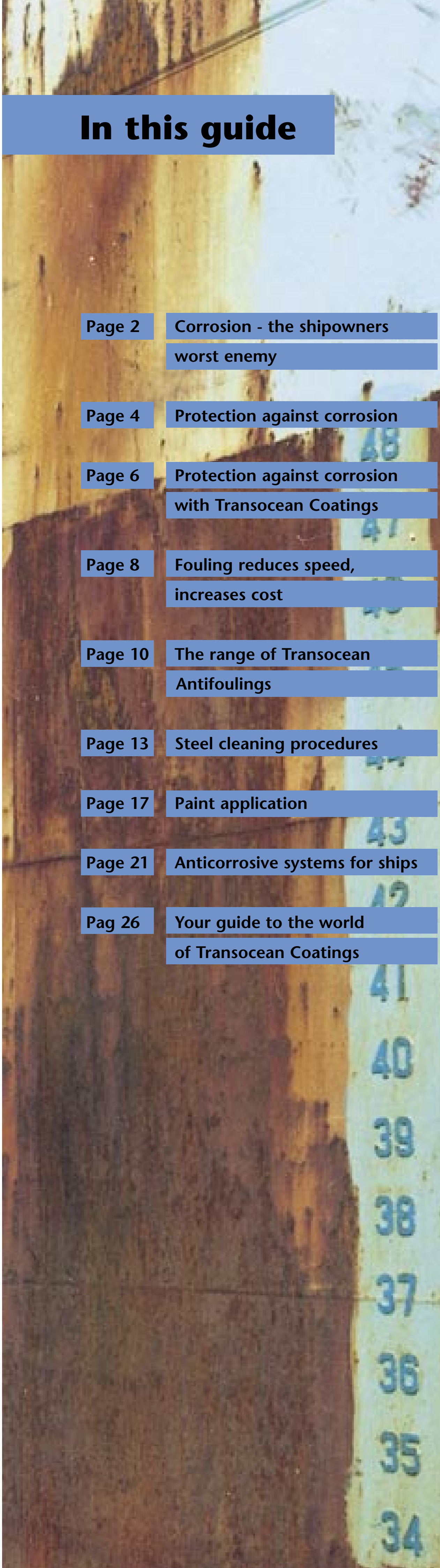
Transocean Coatings has a network of manufacturers, spread over all the continents, producing its range of products.

Manufacturing takes place using stringent formulations. Whether a product is supplied in Europe, Asia, North or South America, in Africa or Australia, the quality is guaranteed identical.

At any shore therefore, wherever in the world, you can rely on Transocean Coatings. And local service assures quick delivery of factory-fresh products at competitive prices.

That's unique!

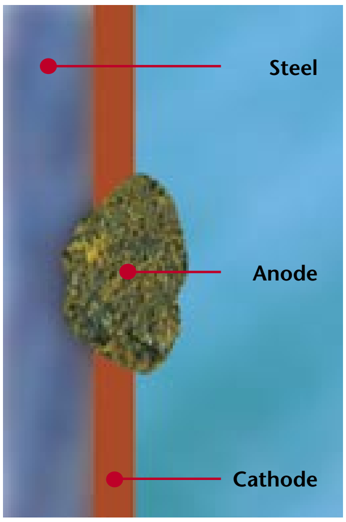
In this guide



Rust - steel showing i

Corrosion is a natural reaction where steel under the influence of water and air transforms to rust. The speed of corrosion is enhanced by the presence of salt. It will be clear that water, air and salt perfectly describe a marine environment.

A closer look at corrosion reveals an eletrochemical process requiring a flow of current between surfaces having a difference in potential. These electrical potential differences on steel surfaces arise from a variety of causes such as the presence or absence of millscale and/or local differences in the composition or treatment of steel. In a so-called corrosion



cell differences in electrical potential exist between the scale free areas that become anodic and the scale covered areas that become cathodic. The electrons generated by the potential difference flow from anode towards cathode. Corrosion then takes place at the anode whilst at the cathode there is little or no corrosion at all. Initial products from anodic

it's true colors

and cathodic sites are ferrous- and hydroxyl ions respectively. These ions diffuse from the surface and react to form ferrous hydroxide, $Fe(OH)_2$, which in turn is oxidised by dissolved oxygen to form ferric oxide, Fe_2O_3 (rust). In seawater, with low dissolved oxygen content black rust, Fe_3O_4, is formed. The formation of brown rust, $Fe_2O_3 \cdot nH_2O$ will occur at higher dissolved oxygen contents as is found for example near sea level.

Causes and effects

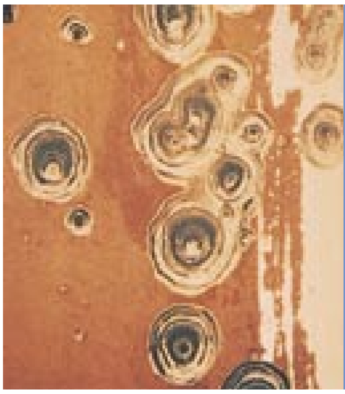
Corrosion can also occur when steel comes in contact with corrosive chemicals even when at first sight this is not expected. For instance coal in its basic form is harmless but coal ore may contain sulphur impurities, which in combination with moisture forms sulphuric acid, a strong corrosive chemical.

Another type of corrosion that deserves mention is biological corrosion caused by organisms such as the sulphate reducing bacteria (SRB).

SRB are wide spread over the world and start growing when conditions become favorable, especially when ▶

Buildi
marin

oxygen is absent. Such conditions can be found when structures are submerged or buried in soil but also in water-ballast tanks where often a layer of mud is deposited on the steel.
The exact process has not been elucidated yet but basically SRB use sulphate as their source of oxygen and in turn produce sulphide ions. Sulphide ions are highly corrosive and as a result steel corrodes to typical terrace-shaped craters with black ironsulphide on the crater bottom.



Pitting

In seawater, the corrosion rate of unpainted steel is quite low, 50-175 micron per year, and corrosion is only dangerous when accelerated. The danger arises from the presence of cathodes whose area is large in relation to the anodic areas - the conditions are then right for a high current density at the anodes and rapid metal loss (i.e. pitting). Chemical and biological corrosion are two good examples of such conditions.
Pitting is the most dangerous form of corrosion, because in its worst form it might cause total breakdown of the steel structure. However, overall light corrosion can also contribute to deterioration in ship performance, particularly when it affects the smoothness of the underwater hull.
By now it will be clear that protecting steel against corrosion requires a strategy where factors as steel exposure conditions and intended functional use of steel structures have to be considered. ■

TRANSOCEAN COATINGS

ng blocks for a typical
e paint system

Painting steel is an efficient method of preventing corrosion. By doing so, a barrier is formed against two factors needed for initiating the corrosion process: air (containing oxygen) and moisture. However, not all coatings can be used on steel or can withstand the harsh marine environment. It is also important to realise that where a corrosion cell exists, conditions at the cathode become alkaline and therefore protective paints should resist alkali. For some applications other requirements such as acid- and chemical resistance are important too. Therefore, marine coatings are specially developed and tested in order to protect ships against corrosion. Marine coatings can be divided into three groups according to their function in the coating system.

Primers

Primers contain inhibitive pigments that give protection against corrosion during the service life. Furthermore, they provide a good adhesion on sufficiently prepared steel and cleaned old coatings.

Primers should be easily recoatable with suitable buildcoats or finishes.

Buildcoats

These coatings are used as an intermediate coat in a coatings system in order to enhance the overall protection and to provide a good intercoat adhesion. Contents of a buildcoat depend on the part of the ship on which it is used.

In most cases they contain pigments which reduce moisture penetration and decrease oxygen permeability. Although in some applications they are left uncoated, they are normally designed to be easily recoatable with topcoats.

Topcoats

As a finishing layer, a topcoat gives the required colour and gloss and provides protection against various influences such as sunlight, weather, abrasion and chemical attack. ■

For to
the ri

Paint systems are generally classified by binder type. Seven generic types often used in marine coatings are outlined below.

Epoxy paints

Epoxy paints are two component products and dry or cure by a chemical reaction of the epoxy resin and a hardener. The speed of this chemical reaction is by nature temperature dependent, which explains why applications of conventional epoxy paints at temperatures below 10°C are generally not recommended. However, nowadays it is possible to overcome this problem by using specially developed hardeners. Blast cleaning as surface preparation is normally required for most epoxy paints. When properly cured, they adhere very well, show good mechanical and anticorrosive properties and offer an excellent resistance to water, chemicals, oils and many solvents. Minimum and maximum curing times must be carefully observed when recoating epoxy paints. Epoxy paints are versatile products and can be used in principle on all vessel areas.

Bituminous paints

Bituminous paints are physically drying paints with good wetting properties. Bitumen provides the coating with a good resistance to water and moisture but has the disadvantage of bleeding into a subse-

against corrosion with Transocean Coatings

p performance choose ght coating

quent paint coat. They are used as anticorrosive systems on underwater areas, in ballast tanks and so on.

Chlorinated polymer paints

Chlorinated polymer paints are one component, physically drying paints with good recoating properties. These paints are not saponifiable and therefore offer a good resistance against water and many chemicals but poor resistance against oils and solvents.

A good surface preparation such as blast cleaning is preferred. Suitable for application on under and above waterline areas.

Inorganic zinc silicates

These products consist of two components, a binder solution and a zinc dust base. Inorganic zinc silicates cure by a chemical reaction for which a minimum relative humidity is required. Blast cleaning to minimum Sa 2,5 grade is required as surface preparation. After complete curing they show an excellent resistance to corrosion, abrasion, heat and organic solvents. Inorganic zinc silicates are used on decks, in solvent tanks and also as a shopprimer.

Polyurethane paints

Polyurethane paints are two component, chemically curing products. In terms of surface preparation, mechanical strength, adhesion, hardness and resistance properties, polyurethanes are comparable to epoxy paints. However, polyurethanes are superior to epoxy paints in colour and gloss retention and chalking resistance.

Therefore, polyurethane paints are often used on f.i. superstructures and accommodation areas.

Alkyd paints

Alkyd paints are one component, air drying paints. They are saponifiable, soften in water and therefore are not suitable for constant immersion. Alkyds are easy to apply and have good levelling properties. Substrate wetting is outstanding and wire-brushing as surface preparation is in most cases sufficient, which explains their popularity as maintenance paints. Although they show a good outdoor durability, alkyds are not particularly resistant to chemicals and strong solvents. Alkyd paints find their use on most areas above the waterline.

Vinyl paints

Vinyl paints are one component, physically drying paints and are similar in properties and use to chlorinated polymer paints. However, vinyl paints show better durability and toughness and less tendency of yellowing and chalking. Blends of vinyl polymers and coaltar (vinyltar) provide very good water resistance. Vinyl tars are used on underwater areas and in ballast tanks. Vinyl paints without tar find their use on boottop, topsides and superstructures. ■

Properties Comparison Table

	Alkyd	Bitu-minous	Chlo-rinated Polymer	Vinyl	Epoxy	Ure-thane	Zinc silicate
Tolerance to lower degree of surface preparation	++	++	+	–	+	+	–
Corrosion protection	++	++	++	++	+++	++	+++
Gloss/colour retention	++	–	+	++	+	+++	–
Abrasion resistance	+	+	+	+	+++	++	+++
Water immersion	–	++	++	++	+++	++	+++
Resistance to acids	–	–	+	+	++	++	–
Resistance to Alkalis	–	++	++	++	+++	++	–
Resistance to Solvents	–	–	–	–	++	++	+++

– = Poor   + = Fair   ++ = Good   +++ = Excellent

The "Properties Comparison Table" shows a review of the properties of each paint type. One should bear in mind that the mentioned qualifications shown are general indications. Total paint system and surface preparation are for instance two major influences that can affect the properties and performance of paint in a positive but also in a negative way. Of course, your local Transocean Company will be more than happy to advise and assist you in selecting an appropriate paint system. However, when looking for a specific paint system, this table might help in selecting the most suitable one. ■

ces speed, increases cost

algae and barnacles - he enemy!

If corrosion protection is the first priority for users of marine paints, fouling protection will follow shortly after. Fouling is the growth of marine organisms on the underwater area of vessels outside hull. Any organism capable of attaching itself to a vessel can cause fouling. Fortunately, only relatively few species are found on ships hulls. These species can be roughly divided in three categories.

Slime fouling

As soon as any object is immersed in the sea, a film of organic molecules will settle on the object within minutes. This so-called conditioning film is believed to enhance settlement of bacteria, diatoms (such as *Achnantes*) and filamentous algae.

Achnantes

Algae fouling

Initially algae settle in the form of individual cells but in time they multiply to form a chain of cells and

Enteromorpha

finally, may develop to strings of several meters in length. Examples are the well-known *Enteromorpha* ('green algae') and *Ectocarpus* ('brown algae').

Animal fouling

Barnacles, tubeworms and mussels are three more notorious examples although tubeworms and mussels

Acorn barnacles

tend to be more proliferated in sub-tropical waters. Barnacles is a generic name for a class of organism

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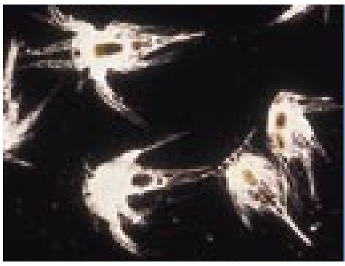
for all

which have in common that after settlement of the larvae (cyprids) on a surface a hard, calcareous shell is



Cybrids

build. Once a barnacle has adhered to a substrate it is not easy to remove. From a tiny shell of 5 millimeters in diameter a barnacle shell might grow to a diameter of 5 centimeters. During the shell-growing process enormous powers are developed to such an ex-tent that it can undercut hard epoxy coatings. Examples are the common Acorn barnacle and the typical Goose- neck barnacles.

Effects of fouling

The most quoted effect of fouling on a ship hull is the increase in drag and hull roughness resulting in speed reduction. Other effects are blockage of cooling water inlets and the al-ready mentioned corrosion initiated by bacteria and coating damage by barnacles. However, shipowners will be more concerned about loss of speed as it influences sailing sche-dules and increases fuel bills. Using antifoulings is therefore an effective solution and worthwhile investment too. The basic principle of any anti-fouling is the release of active com-pounds called biocides at the coa-ting-seawater interface where it crea-tes a hostile environment for fouling organ- isms. Fouling will therefore be prevented and any growth of fouling will be inhibited. The mechanism

Gooseneck barnacles

how biocides are released can vary from antifouling to antifouling and depends on lifetime, coating system and budget. Transocean delivers four ranges of Antifouling paints and their working mechanism is explained in a separate brochure “Transocean Anti-foulings protect the world around”. A brief outline of the Transocean range is given on the adjacent page. ■

f Transocean Antifoulings

ble travel companion ships

Transocean Optima

Lists four conventional Antifoulings offering adequate protection at economic cost.

Transocean Longlife

Represents a range of well-known Antifoulings combining lasting fouling protection and toughness.

Transocean Cleanship

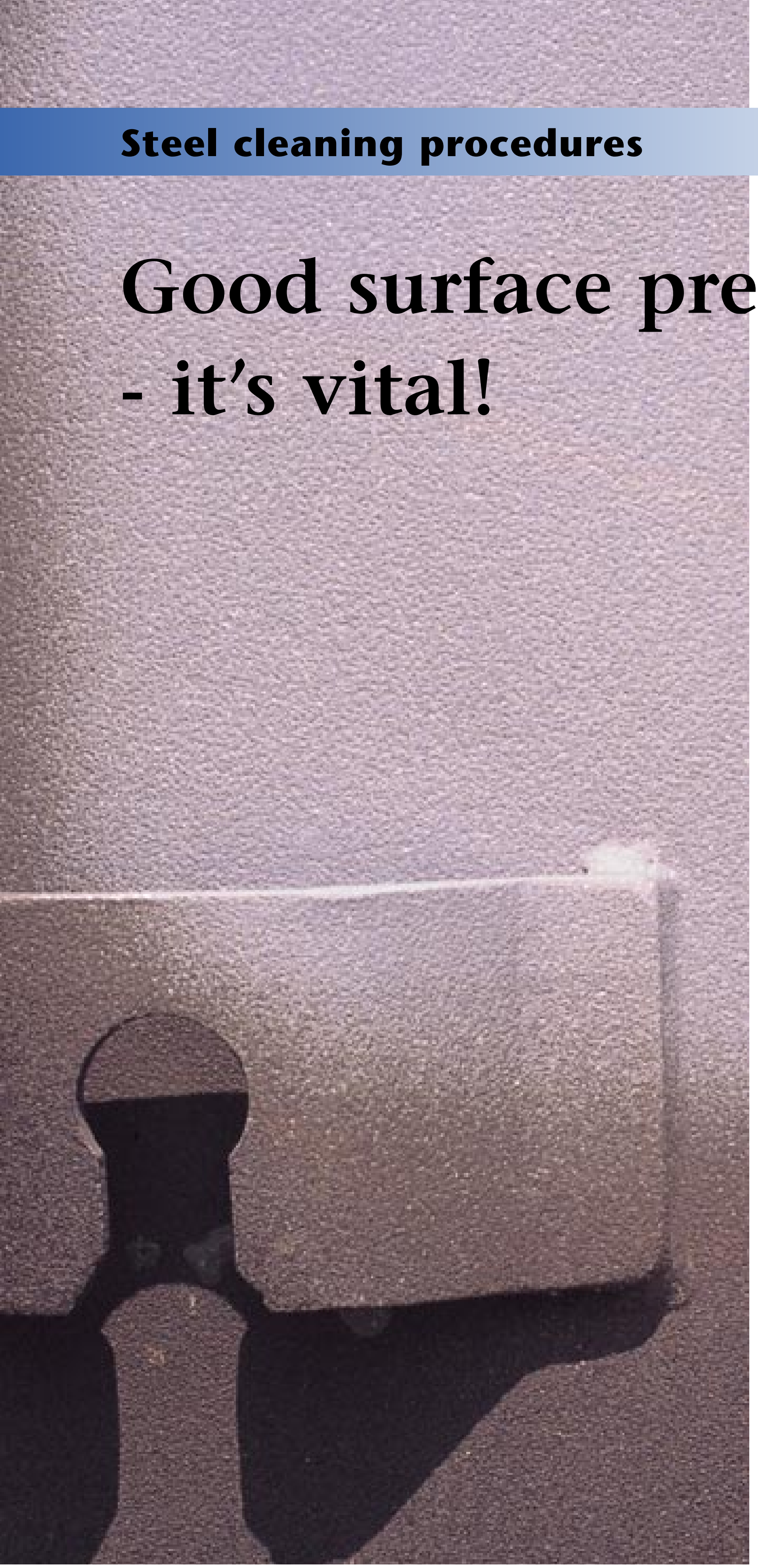
A range of tinfree self-polishing Antifoulings that overcome the drawbacks of tin-containing products whilst maintaining the same high level of protection.

Transocean Ultima

Transocean Ultima is a biocide free, so-called fouling release system based on silicone technology. The system consists of two layers. The first, Transocean Ultima Tiecoat provides toughness and adhesion to the anticorrosive system. The second, Transocean Ultima Topcoat provides fouling release capacities. ■

Typical Transocean Antifouling Systems (*)				
	Usage guide	**Typical system**		
		Number of coats	**Dry film thickness (µ)**	**Drydock Interval**
Optima 2.32	Economical grade.	2	50	up to 12 months
Optima 2.34	Standard grade.	2	75	up to 18 months
Optima 2.36	Premium grade.	2	75	up to 18 months
Longlife 2.75	Tinfree, standard grade.	2	75	up to 24 months
Longlife 2.77	Tinfree, premium grade.	2	75	up to 24 months
Cleanship 2.90	Cost efficient, general purpose antifouling.	2	125	36 months
Cleanship 2.91	For medium to fast sailing vessels.	2	100	36 months
Cleanship 2.92	Special quality for aluminium vessels.	2	125	36 months
Cleanship 2.93	High biocide strength, general purpose antifouling.	2	110	36 months
Cleanship 2.95	Medium biocide strength, general purpose antifouling.	2	125	36 months
Cleanship 2.97	Medium biocide strength, fast polishing antifouling.	2	125	36 months
Ultima Tiecoat 95.50	Biocide free, fouling release system. Especially suitable	1	125	Condition
Ultima Topcoat 95.55	for fast sailing ships.	2	75	dependent

(*) Due to local regulations, in some countries not all products may be available or be available under a different product code.



Good surface preparation - it's vital!

The single most important function that can influence paint performance is the quality of surface preparation. For optimum service life, the surface must be completely free of all contaminants that might impair performance and should be treated as such to assure good and permanent adhesion of the paint system. The quality of surface preparation has a direct relation with the lifetime of a system. Even when using surface tolerant paints it cannot be emphasized enough that better surface preparation always results in longer lifetimes. The most important methods employed to prepare surfaces for paint application in modern shipyards are hand/ powertool cleaning, blast cleaning and hydrojetting.

Hand/ Power tool

Common handtools are wire brushes, scrapers, chipping hammers etc. Examples of mechanical tools are rotary wire brushes, sanding disc and needle guns. Preparation grades with hand- or powertool cleaning are specified according to International Standards method ISO 8501/1: 1988 ▶

Hand / Power tool

and relevant preparation grades are St2 and St3. Preparation grade St2 is in general not recommended for underwater areas.

Blast cleaning

Cleaning is based on the principle of an abrasive jet of particles in a compressed air stream impinging on the surface, removing impurities, millscale, rust and old paint. Abrasive blast cleaning is the most thorough and widely used method of surface preparation in the shipbuilding and repair industry. Different degrees of surface cleanliness are possible and depend in part on the surface condition prior to treatment and also to the length of time for which the surface is exposed to the abrasive jet. In addition to cleaning the surface, the abrasive particles will impart a surface roughness to the steel. This so-called “profile” roughness can be a very important “key” for anchoring of paint systems. Mineral slag blasting grit generally gives faster rates of cleaning and lower health risk (from shattered grit) than does sand. Grit also gives more effective cleaning, especially for pitted substrates, and some grades can be recycled. Particle size for the most widely used (for general cleaning) grit is 0.5 to 1.5mm diameter. Spot blasting is localised abrasive cleaning often carried out in ship repair, especially on the outside hull, where patchy corrosion or damage has occurred. It can be used to yield surfaces that are cleaned to Sa2 or better but often surrounding intact areas are peppered with stray grit. Always mark areas to be spot blasted and mechanically “feather” the damage round the area using rotary disc or sander. The surface appearance resulting from blast cleaning has been defined by several bodies - American (ASTM D 2200 and SSPC VIS. 1 & 2), British (Standard BS 4232), German (Standard DIN 18364) and Japanese (JSRA SPSS, 1975). The most widely used was the Swedish Standard (SIS 05 59 00 “Pictorial surface preparation standard for paint steel surfaces”) which also sought to define the initial condition of the steel.
This standard was taken over by International Standard ISO 8501/1: “Rust grades and preparation grades of uncoated steel substrates after overall removal of previous coatings”.

Blast cleaning

Waterjetting

Waterjetting or hydroblasting as a surface preparation technique is being used more and more in shipyards. Commonly used and suitable water pressures range from High pressure (700-1700 bar) to Ultra High pressure (greater than 1700 bar).
A major advantage of using water pressure as an abrasive is the lower impact on environment and health because less dust is generated than is the case with grit blasting. It also constitutes less of a safety risk caused

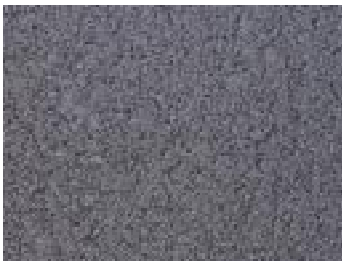
Waterjetting

by sparks and reduces the amount of salt remaining on the surface. Prior to Waterjetting, water insoluble foreign matter such as oil and grease must be removed. The surface quality then resulting from Waterjetting is divided into three DW grades by the German STG-norm 2222-1992. The table on the next page describes surface preparation grades used in this manual and Transocean datasheets.
Recommendations may be modified by your Transocean Company in the light of locally prevailing conditions - in the absence of Transocean technical supervision these recommendations should be treated as the minimum conditions that should persist prior to product application. ■

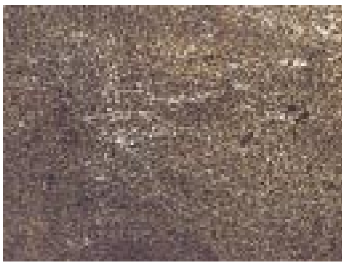
A lower standard of surface preparation - an appraisal

Standard steel surface preparation for most coating systems is ISO-Sa2,5. However, for maintenance of existing coating systems nowadays so-called surface tolerant coating systems are available, compatible with a lower degree of surface preparation. Often blast cleaning to ISO-Sa2 or power-tool cleaning to ISO-St3 are specified, suggesting a certain equivalency in those two qualifications. The picture series below indicate that in reality there is a huge difference. The first picture represents a typical example of steel with rust grade C. The other two pictures represent rust grade C-steel prepared to respectively ISO-Sa2 and ISO-St3. It will be clear that blast cleaning to ISO-Sa2 is preferred over powertool cleaning. In addition, improper use of popular powertool methods such as wirebrushing and rotary disc sanding may damage the existing roughness profile and lead to a polished steel surface. This might have a detrimental impact on the paint's adhesion. The lesson learnt from the above is that even when using surface tolerant systems the best possible surface preparation should be chosen. In return the effort for doing so will be rewarded with better lifetime expectations. ■

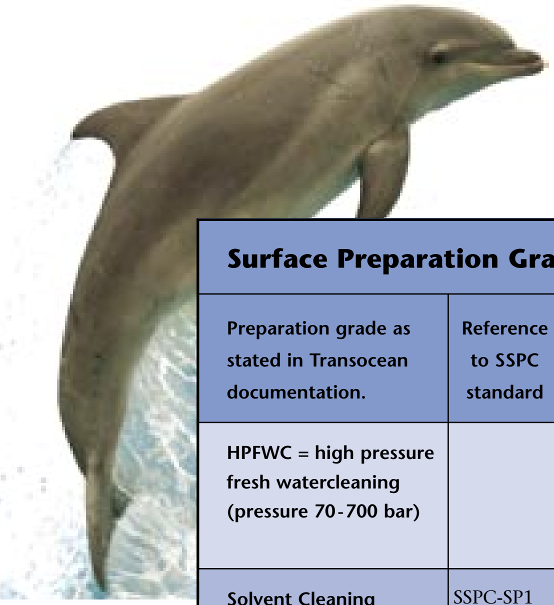
Grade C



Grade C-ISO SA 2

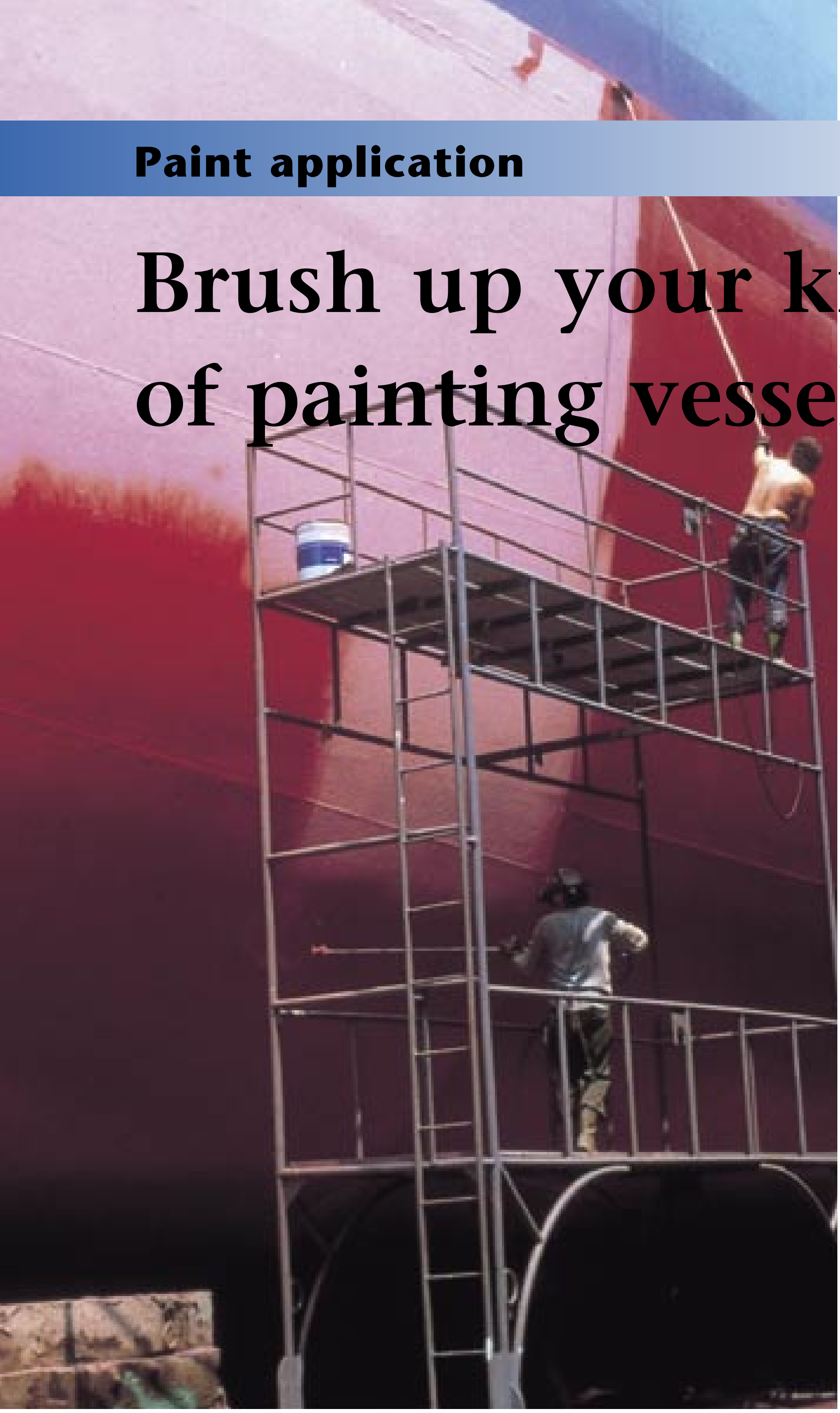


Grade C-ISO ST 3



Surface Preparation Grades

Preparation grade as stated in Transocean documentation.	Reference to SSPC standard	Description
HPFWC = high pressure fresh watercleaning (pressure 70-700 bar)		This method is routineously used on ships in drydock to clean the underwater area of fouling, salts, loose adhering paint and other foreign matter.
Solvent Cleaning	SSPC-SP1	Foreign matter other than oil and grease should be removed by scraping or brushing followed by HPFWC. Removal of oil, grease, dirt, soil, salts and contaminants by cleaning with solvent, alkali, emulsion or steam. After cleaning remove dirt, dust and other contaminants by vacuuming or blowing with clean, dry air.
Thorough Hand- and Powertool cleaning ISO-St2	SSPC-SP2	When viewed without magnification, the surface must be free from visible oil, grease and dirt and from poorly adhering millscale, rust, varnish coating and foreign matter.
Very Thorough Hand- and Powertool cleaning ISO-St3	SSPC-SP3	Similar to St2 but the surface must appear very thoroughly treated to give a metallic sheen arising from the steel surface.
Brush off Blast-cleaning ISO-Sa1	SSPC-SP7	When viewed without magnification, the surface must be free from visible oil, grease and dirt and from poorly adhering millscale, rust, varnish coating and foreign matter.
Thorough Blast-cleaning ISO-Sa2	SSPC-SP6	When viewed without magnification, the surface must be free from visible oil, grease and dirt and from most of the millscale, rust, varnish coating and foreign matter. Any residual contamination must appear firmly adhering.
Very Thorough Blastcleaning ISO-Sa2,5	SSPC-SP10	When viewed without magnification, the surface must be free from visible oil, grease and dirt and from most of the millscale, rust, varnish coating and foreign matter. Any remaining traces of contamination shall show only as light stains in the form of spots or stripes.
"White metal" Blastcleaning ISO-Sa3	SSPC-SP5	When viewed without magnification, the surface must be free from visible oil, grease and dirt and from millscale, rust, varnish coating and foreign matter. It shall have an uniform metallic colour.
Hydrojetting DW1 (STG-2222)		Remove water-insoluble matter such as oil and grease acc. to SSPC-SP1. Only loosely adhering millscale, rust and poorly adhering coatings are removed. After cleaning, previously coated surfaces are generally still predominantly covered with remaining coatings or parts of old coating systems
Hydrojetting DW2 (STG-2222)		As DW1. Various spots of old coating systems and firmly adhering millscale is still present. Thin coatings on previously blastcleaned surfaces are predominantly removed. Before drying a weak sheen arises from the metal surface which disappears during drying due to flash rust formation.
Hydrojetting DW3 (STG-2222)		As DW2. Firmly adhering millscale is still present. From firmly adhering rust at most thin dark oxide layers and/or slight residues in the roughness valleys are present. From firmly adhering old coatings residual areas having spots with damages, various scattered small spots and residues in the roughness valleys may be present. Thin coatings on previously blastcleaned surfaces are predominantly removed. Before drying a distinct sheen arises from the metal surface which disappears during drying due to flash rust formation.

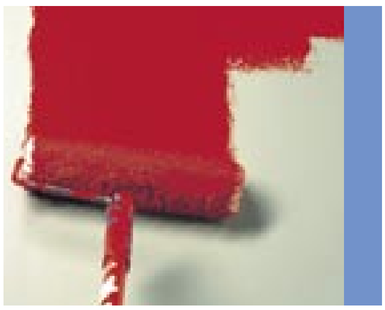


Brush up your knowledge of painting vessels!

Paint is not a finished product until it has been applied and dried on an appropriate substrate at the designed performance film thickness. Proper application therefore is critical to the performance of the paint system. High performance paint systems are especially sensitive to misapplication and knowledge of the application characteristics and recommended film thickness is vital to obtain optimum results. Three main methods are used in painting modern vessels. The choice of method depends on the type of coating to be applied, the effect on adjacent areas and the degree of skill of the personnel.

1. Brush and Roller

Low viscosity paints are easily applied by these techniques to yield low applied film thickness. Modern, thixotropic paints are often specified at high film thickness especially where they perform a protective function. Therefore, where brush and roller methods are called upon (especially for "touching up" or "stripe coating") a number of coats may need to be applied in order to achieve the minimum specified dry film thickness. It is in general better to apply high solids paints by brush instead of roller. Although these techniques have largely been replaced by spray application, they may find use in maintenance sche-dules operated by ship crews. Both methods have the advantage that paint losses are low but on the down-side is the slow working speed.



2. Conventional Spray

This technique mixes a jet of air with a stream of paint to propel a fan of paint droplets towards a surface. The mix of air with the paint particles gives high turbulence however and considerable "bounce back". Air atomisation of paint can thus result in considerable overspray. Therefore, not only must adjacent areas be protected but also paint applicators must wear protection to avoid paint mist inhalation. The technique particularly suits low viscosity paints and in the marine paint field is most commonly used for the application of conventional decorative paints and zinc silicate coatings.

3. Airless Spray

This technique relies on hydraulic pressure rather than air atomisation to produce the spray. Paint under very high pressures (1.000 to 6.000 p.s.i., approximately 100 to 400 kg/cm^2) is delivered to the spray gun and then forced through a very small orifice to atomise it. Thus more rapid coverage can be achieved with much less overspray and considerably higher film thickness can be obtained. Most of the products manufactured by Transocean Coatings for application on ships can be applied by airless spray. It has many advantages over conventional application methods such as a high output, reduced spray mist and less need for thinning. Finally, it must be remembered that airless spray ejects under very high pressure. The spray gun should not be directed at people as injury can be easily caused and due precautions should be taken when the equipment is being cleaned. The quality of paint application can be seriously affected by weather conditions. Bad weather conditions are a perennial hazard in ship painting operations especially during winter in moderate climates. At low temperatures (below 5°C), the curing of paints such as ordinary epoxies may slow down dramatically and for some paints stop altogether. Others are not seriously affected and chlorinated rubber and vinyl paints may be used at or below 0°C as long as the surface is free from ice. Most paints will become thicker when temperature decreases and this effect may result in poor atomisation, dry spray and poor flow. The problem may be rectified by the addition of thinners but never more than the amount stated in the product datasheet. Excessively high temperatures too may present problems. Reaction times for two-component paints in- crease resulting in shortened potlifes and increased curing speed. It

Airless spray

is advised not to mix more material than can be used in the time stated as the potlife at the relevant temperature. Generally, painting should be avoid-ed during extremely hot hours - where paint operations are carried out in hot climates, the paint should be applied in the morning and early evening. Paint should never be applied on wet surfaces and therefore painting is to be avoided not only in rain, sleet and fog but also when high humidities and low steel temperatures lead to condensation. Condensation is very difficult to detect on surfaces and will occur if the steel temperature is below atmospheric dew point. As a general guide, application should not take place when the steel surface temperature is less than 3°C above the dew point. Condensation problems can also be exacerbated when ballast tanks are full and therefore, when condensation is likely to pose a problem, the vessel should be deballasted on entering drydock. Finally, good visibility for the applicator is important to achieve a good control of the paint thickness and the quality of application. Therefore, painting should be preferably carried out during daylight and if necessary, under additional lighting. Application problems can originate from several causes or even from a combination of causes. A review of typical problems experienced with paint application along with its causes and possible solutions is given on the next page. ■

Complicated steel structures need special attention

Application of a coating system on flat-shaped surface is rather straight forward, as it only requires a good spaying technique at the right wet film thickness. When coating com-

Ballast tank

plex structures such as can be found in ballast tanks, one has to realize that any paint tends to flow away from edges and weld seams. As a result these places will have a lower

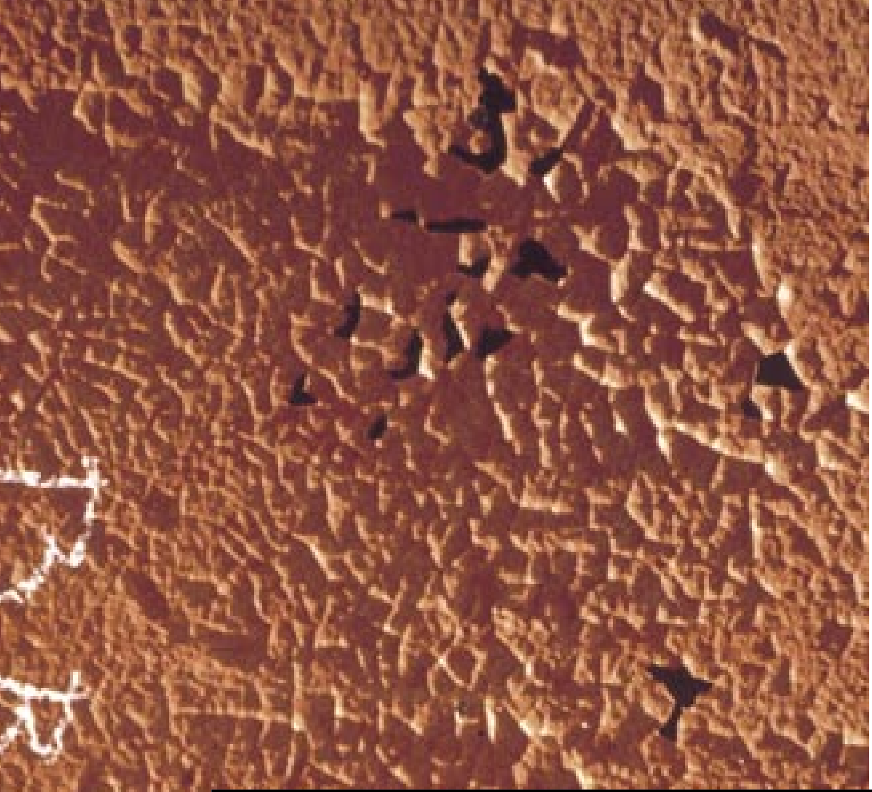
Weld seam

dry film thickness than mentioned in the system specification. When this phenomena is not recognized it leaves a steel structure where the required dry film thickness is applied on the flat areas but it will be too low on edges. The effects on a paint's anticorrosive properties are clearly shown in the picture below. The

Corner section

coatings performance on flat areas is good but edges, weld seams and difficult to reach places are already rusted. Such a disappointing appearance can be prevented by a good secondary surface preparation of weld seams and by stripe-coating edges, weld seams and difficult to reach places before applying a full coat. Again, a better lifetime expectation of the coating system will pay back the required extra efforts. ■

TRANSOCEAN COATINGS



Paint Application: Problems & Solutions

Problem	Probable cause	Solution
Excessive spray fog	Excessive atomisation. Too much thinner used. Distance spray gun to surface.	Decrease pump pressure. Do not add more thinner than necessary. The spray gun should be held at approx. 40 cm distance.
Blistering	Contamination such as oil, grease and rust. Moisture.	Degrease surface properly before painting. Ensure that substrate temperature is at least 3°C above dew point.
"Orange peel"	Paint too thick. Paint too cold.	Add the correct amount of thinner. Warm up the paint.
Pinholes/Cratering	Poor atomisation. Oil or grease on the surface. Too high wet film thickness.	Increase pump pressure. Degrease surface properly before painting. Apply less paint by moving spray gun faster.
Sagging	Spray gun distance to close. Spray gun is held at a wrong angle to the surface. Excessive wet film thickness. Excessive dilution.	The spray gun should be held at approx. 40 cm distance. Spray gun should be held at a 90° angle to the surface and moved in a straight line. This can be caused by a less skilled painter or selection of a wrong nozzle. Too much thinning always result in less efficient thixotropic properties. A paint should not be thinned more than necessary.
Streaks or rattails	Nozzle can be worn out or too big. Paint too cold. High viscosity of the paint.	Select a new or smaller nozzle. Warm up the paint or increase pump pressure. Thin the paint with the right thinner or increase pump pressure.
Dry overspray	Excessive atomisation. Wrong nozzle (too small). Spray technique.	Decrease pump pressure. Use a larger nozzle. Hold the spray gun closer to the surface and at the right angle.

Transocean Coatings solutions at any shore

On the next pages systems are outlined divided into several vessel areas. The systems are listed as generic types trying to catch the main characteristic of the system in one keyword. In general this keyword will refer to binders used in paints forming a particular system. In some cases an additional keyword is added in order to emphasize a special feature of the system. For example 'abrasion resistant epoxy ' contains the keyword epoxy referring to the binder type while abrasion resistant points out an important feature of the system. The actual choice of system is dependent on several factors such as vessel condition, lifetime requirements and budget. In general three conditions can be described, each bringing its own requirements, difficulties and opportunities.

Newbuildings

A Newbuilding vessel requires a paint system that usually should comply with shipyard standard painting procedures. A newbuilding offers the advantage of a good standard of surface preparation providing a solid base for a long lasting paint system.

Refurbishment

Refurbishment describes a situation where the existing paint system on a vessel for whatever reason is totally removed by blastcleaning or waterjetting. As is the case with newbuildings here too the possibility exists to prepare the surface to a good standard. Contrary to newbuilding for refurbishment projects normally no yard paint specifications are written allowing a wider range in paint systems to choose from. The use of holding primers is not mentioned in the systems but when circumstances dictate so, use Transozinc Epoxy Primer 1.50 or 1.55 when a zinc epoxy primer is desired and Transpoxy Primer 1.16 or Transpoxy Extend-o-Kote 2.20 when a pure epoxy primer is required.

Maintenance

Finally, Maintenance describes a situation where usually the anticorrosive system is touched up with primer followed by a touch-up or a full coat of finish. This work can be carried out in drydock but may also be carried out by the crew on the vessel's journey. The quality of surface preparation is in general lower than the quality achieved in newbuilding/ refurbishment situations. Reasons for this are various but cost, time and opportunity are three main factors why maintenance requires paint systems that tolerate a lower degree of surface preparation.

Not all Transocean products and systems are represented in this manual. To avoid confusion and for sake of clarity, the number of systems is limited to the ones that are believed to be commonly used. System recommendations give the reader a quick review of the possibilities and may provide a starting point for fruitful discussions with your local Transocean representative. ■

WORLDWIDE NETWORK WITH LOCAL SERVICE

Underwater Hull Systems to be overcoated with Transocean Antifoulings

System Keyword	Product	Product code	No. of coats	DFT (µ)
Abrasion Resistant Epoxy	Transpoxy ARC	2.24	2	125
	Transvinypox HS	2.06	1	75
Surface Tolerant Epoxy	Transpoxy Masterbond Aluminium	4.66	1	125
	Transvinypox HS	2.06	1	125
Modified Epoxy	Transpoxy Barrier	2.16	1	150
	Transvinypox HS	2.06	1	125
Moisture Tolerant Zinc-Epoxy	Transozinc Epoxy Primer ST	1.50	1	50
	Transpoxy Barrier or	2.16 or	1	125
	Transpoxy ARC	2.24		
	Transvinypox HS	2.06	1	100
Coaltar Epoxy	Transpoxy Tar PA or	2.11 or	2	110
	Transpoxy Tar AA	2.12		
	Transbarrier Vinyl	2.04	1	50
Vinyl	Transvinyl Primer	1.48	3	75
Chlorinated Polymer	Transoprene Primer	1.25	3	75
Bituminous	Transbarrier Anticorrosive	2.02	2-3	75

Boottop / Topsides

System Keyword	Product	Product code	No. of coats	DFT (µ)
Abrasion Resistant Epoxy	Transpoxy ARC	2.24	2	125
	Transurethane Finish (1)	3.43	1	50
Surface Tolerant Epoxy	Transpoxy Masterbond Aluminium	4.66	1	125
	Transvinypox HS (2)	2.06	1	125
Modified Epoxy	Transpoxy Barrier	2.16	2	125
	Transurethane Finish (1)	3.43	1	50
Moisture Tolerant Zinc-Epoxy	Transozinc Epoxy Primer ST	1.50	1	50
	Transpoxy Masterbond	4.69	1	125
	Transurethane Finish (1)	3.43	1	50
Chlorinated Polymer	Transoprene Primer	1.25	2-3	75
	Transuniprene Finish	2.53	1-2	40
Alkyd	Transogard Primer	1.22	2	75
	Transunilac Finish	3.31	2	35

(1) – If desired, Transurethane Finish can be replaced by other Transocean Finishing Systems.
(2) – Transvinypox HS can be recoated with all Transocean Finishing Systems.

Decks

System Keyword	Product	Product code	No. of coats	DFT (μ)
Abrasion Resistant Epoxy	Transpoxy ARC	2.24	2	125
	Transurethane Finish (1)	3.43	1	50
Surface Tolerant Epoxy	Transpoxy Masterbond Aluminium	4.66	1	125
	Transpoxy Masterbond	4.69	1	125
Modified Epoxy	Transpoxy Barrier	2.16	2	125
	Transpoxy Finish	4.60	1	50
Moisture Tolerant Zinc-Epoxy	Transozinc Epoxy Primer ST	1.50	1	75
	Transpoxy Intermediate	2.19	1	125
	Transurethane Finish (1)	3.43	1	50
Chlorinated Polymer	Transoprene Primer	1.25	2	75
	Transuniprene Finish	2.53	1-2	40
Alkyd	Transogard Primer	1.22	2	75
	Transunilac Finish	3.31	1	35

(1) – If desired, Transurethane Finish can be replaced by other Transocean Finishing Systems.

Superstructures and Deck Fittings

System Keyword	Product	Product code	No. of coats	DFT (μ)
Surface Tolerant Epoxy	Transpoxy Masterbond	4.69	1	150
	Transurethane Finish (1)	3.43	1	50
Modified Epoxy	Transpoxy Barrier	2.16	1	150
	Transurethane Finish	3.43	1	50
Moisture Tolerant Zinc-Epoxy	Transozinc Epoxy Primer ST	1.50	1	50
	Transpoxy Intermediate	2.19	1	100
	Transurethane Finish (1)	3.43	1	50
Chlorinated Polymer	Transoprene Primer	1.25	2	75
	Transuniprene Finish	2.53	1	40
Alkyd	Transogard Primer	1.22	2	75
	Transunilac Finish	3.31	1-2	35

(1) – If desired, Transurethane Finish can be replaced by other Transocean Finishing Systems.

Holds

System Keyword	Product	Product code	No. of coats	DFT (μ)
Abrasion Resistant Epoxy	Transpoxy ARC	2.24	2	125
Surface Tolerant Epoxy	Transpoxy Masterbond Aluminium	4.66	1	125
	Transpoxy Masterbond	4.69	1	125
Modified Epoxy	Transpoxy Barrier	2.16	2	125
Solventfree Epoxy	Transpoxy Guard	4.64	1	300
Polyurethane	Transurethane Elastic	3.42	1	300
Alkyd	Transogard Primer	1.22	1	75
	Transolac Hold or	4.10 or	2	35
	Transogard Rustarrestor	4.16		

Ballast water-, Potable Water- and Liquid Cargo Tanks

System Keyword	Service indication	Product	Product code	No. of coats	DFT (μ)
Phenolic Epoxy	Chemicals	Transpoxy Tankguard	4.61	3	100
Epoxy	Chemicals	Transpoxy Deep Tanks	4.62	2	150
Solvent free Epoxy	Chemicals	Transpoxy Tankguard	4.71	2	150
Solvent free Epoxy	Potable water	Transpoxy Guard	4.64	2	150
Surface Tolerant Epoxy	Ballast water	Transpoxy Masterbond Aluminium	4.66	1	150
		Transpoxy Masterbond	4.67	1	125
Coaltar Epoxy	Ballast water, crude oils	Transpoxy Tar	2.12	2	125
Modified Epoxy	Ballast water	Transpoxy BWT	4.75	2	150
Butiminous	Ballast water	Transbarrier HB	4.98	3	100

Void Spaces, Behind Linings, Cofferdams and Chain Lockers

System Keyword	Product	Product code	No. of coats	DFT (μ)
Surface Tolerant Epoxy	Transpoxy Masterbond	4.69	1	200
Solventfree Epoxy	Transpoxy Guard	4.64	1	200
Coaltar Epoxy	Transpoxy Tar AA	2.12	1	150
Bituminous	Transbarrier HB	4.98	1-2	100

Interiors, Accommodation and Engine Rooms

System Keyword	Product	Product code	No. of coats	DFT (μ)
Surface Tolerant Epoxy	Transpoxy Masterbond	4.69	1	150
Solventfree Epoxy	Transpoxy Guard	4.64	1	150
Epoxy/Polyurethane	Transvinypox HS	2.06	1	125
	Transurethane Finish (1)	3.43	1	50
Alkyd	Transogard Primer	1.22	1	75
	Transunilac Finish	3.31	1	35

(1) – If desired, Transurethane Finish can be replaced by other Transocean Finishing Systems.

Your guide to the world of Transocean Coatings

Generic type	Place in system	TO product name	TO code
Bituminous	Primer	Transbarrier Anticorrosive	2.02
		Transbarrier HB	4.98
Alkyd	Primers	Transogard Primer	1.22
		Transogard Zincphosphate	1.24
	Primer/Topcoat	Transogard Rustarrestor	4.16
	Topcoats	Transunilac Finish	3.31
		Transolac Hold	4.10
Chlorinated Polymer	Primers	Transoprene Primer	1.25
		Transoprene Silverprimer	1.26
	Topcoats	Transuniprene Finish	2.53
Acrylic	Primer	Transaqua Primer	1.36
	Topcoats	Transocean Fluorescent	3.08
		Transacryl Finish	3.53
Vinyl	Primer	Transbarrier Vinyl	2.04
	Primer/Sealer	Transvinyl Primer	1.48
Epoxy	Primers	Transpoxy Primer	1.16
		Transpoxy Uniprimer	1.71
		Transozinc Epoxy Primer ST	1.50
		Transozinc Epoxy Primer	1.55
	Primer/Buildcoats	Transpoxy Tar AA	2.12
		Transpoxy Barrier	2.16
		Transpoxy ARC	2.24
		Transpoxy Masterbond Aluminium	4.66
		Transpoxy Masterbond	4.69
		Transvinypox HS	2.06
	Tanklinings	Transpoxy Tankguard	4.61
		Transpoxy Deep Tanks	4.62
		Transpoxy Tankguard	4.71
		Transpoxy Guard	4.64
		Transpoxy BWT	4.75
	Undercoats	Transpoxy Intermediate	2.19
	Topcoat	Transpoxy Finish	4.60
Polyurethanes	Primer	Transurethane Primer	1.13
	Primer/Topcoat	Transurethane Elastic	3.42
	Topcoats	Transurethane Finish	3.43
		Transurethane Finish HB	3.44
Inorganic Zinc Silicates	Shopprimer	Transozinc Silicate Shopprimer	1.53
	Anticorrosive	Transozinc Silicate	1.52
Antifouling	Conventional Antifouling	Transocean Optima	2.32
		Transocean Optima	2.34
		Transocean Optima	2.36
	Hard Matrix Antifouling	Transocean Longlife	2.75
		Transocean Longlife	2.77
	Selfpolishing Antifouling	Transocean Cleanship	2.90
		Transocean Cleanship	2.91
		Transocean Cleanship	2.92
		Transocean Cleanship	2.93
		Transocean Cleanship	2.95
		Transocean Cleanship	2.97
	Silicone Fouling Release	Transocean Ultima Tiecoat	95.50
		Transocean Ultima Tiecoat	95.55

End use	Volume solids (%)	Typical DFT (µ)	Dry to recoat (20°C)
Anticorrosive for the outside hull.	41	75	8 hours
Anticorrosive for void spaces, behind linings, chain lockers etc.	48	100	12 hours
High build primer for all above waterline areas, contains no lead or chromates.	45	80	16 hours
Excellent protection with non-toxic pigments.	52	45	12 hours
Surface tolerant primer/finish for cargo holds.	45	30	16 hours
Topcoat for all above waterline areas. Available in many colours.	43	35	16 hours
Topcoat for cargo holds.	50	35	16 hours
General purpose primer for all areas.	49	75	8 hours
General purpose primer pigmented with aluminium for all areas.	45	75	16 hours
Topcoat for all areas. Available in various colour shades.	34	40	12 hours
Waterborne primer for interior and exterior.	43	50	4 hours
Special finish available in five fluorescent colour shades.	44	35	6 hours
Modified Acrylic Finish.	44	40	12 hours
Standard Vinyl tar anticorrosive.	45	75	8 hours
Tar-free anticorrosive. Sealer on old antifoulings.	40	75	8 hours
Standard primer for all areas.	43	40	8 hours
Primer for ferrous- and non ferrous substrates.	51	50	8 hours
Versatile zinc epoxy primer for hydroblasted steel or steel blastcleaned to ISO-Sa2. Tolerates damp surfaces.	48	50	8 hours
Standard primer with a high zinc content.	45	40	6 hours
Polyamine cured coaltar epoxy with increased chemical resistance.	65	125	8 hours
Tar-free anticorrosive for all vessel areas.	67	125	12 hours
Abrasion resistant coating for hulls, decks and holds.	80	150	8 hours
Aluminium pigmented surface tolerant coating for areas where optimal surface preparation is not possible.	82	125	12 hours
Surface tolerant coating for hulls, deck and holds. Compatible with most old coating systems.	84	150	15 hours
Versatile tiecoat on epoxies to enhance adhesion of antifoulings.	76	125	16 hours
Phenolic epoxy coating with an outstanding chemical resistance.	61	125	12 hours
Polyamine cured coating with an all-round chemical resistance.	51	125	12 hours
Solventfree coating with excellent resistance against wine and alcoholic spirits.	100	200	24 hours
Solventfree epoxy anticorrosive. Potable water approval.	100	150	24 hours
Solventless coating for waterballast tanks.	90	150	16 hours
An undercoat with a well-chosen blend of pigments enhancing water resistance and hiding power.	47	100	8 hours
Easy to use. Good chemical resistance.	57	40	16 hours
Epoxy modified primer specially developed for aluminium substrates.	57	50	16 hours
Solventless coating for dry cargo holds.	92	250	16 hours
Standard high gloss finish available in many colour shades.	51	40	12 hours
High build, high gloss finish with increased chemical resistance.	50	75	18 hours
Reduced zinc content for optimal balance between welding speed and corrosion protection.	20	15	24 hours
Self curing ethylsilicate with a high zic content. Can be left uncoated.	55	70	10 hours
Economical grade for moderate waters.	57	75	6 hours
Standard grade with lifetime up to 1 year.	57	75	6 hours
Increased biocide strength.	57	75	6 hours
Standard non polishing antifouling.	51	100	6 hours
Hard antifouling with increased biocide strength.	51	100	6 hours
Cost efficient general purpose antifouling.	50	125	6 hours
For medium to fast sailing vessels.	55	125	6 hours
Special quality for aluminium vessels.	50	125	6 hours
High biocide strength, general purpose antifouling.	51	125	6 hours
Medium biocide strength, general purpose antifouling.	51	125	6 hours
Medium biocide strength, fast polishing antifouling.	44	125	6 hours
First coat in Ultima system and tiecoat to anticorrosive system.	50	125	6 hours
Finishing layer in Ultima system.	56	75	6 hours

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