

MARINE COATING SYSTEMS

Whatever the material used in the construction of a yacht, the first impression is always based on the quality of her finish and external appearance. This impression is what will remain in the minds of the people who walk the docks, whether they are week-end browsers or potential buyers. The reflecting beams of the setting sun on a smooth and glossy hull are part of the magical attraction which a yacht exerts on the human eye. The choice, the application and the finish of the coatings call for a good understanding and respect of several basic principles, although paints have complex chemical formulations.



First and foremost, it is important to note that the painting of a hull, whether new or used, is done with successive applications of coats of various primers, fillers, enamel, top-coat or antifouling. Nowadays, this is called a marine coating system. Gone are the days when a couple of cans of paint and brushes were good enough to coat or recoat a hull before the onset of the season. Moreover, the coating suppliers have developed a range of products whose chemical component formulations are carefully protected. It would be a mistake to mix the products of various suppliers, mixing the primer or filler of one brand and the topcoat of another. Though the application systems of the various brands appear to be quite similar, the various products can be chemically incompatible.

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Coating Systems

There are paint systems for all the boatbuilding materials and the application sequences are similar with variations associated to the material specificity. As an example, the painting schemes most currently used for FRP (Fiber Reinforced Plastics) and aluminum alloy hulls are generally as follows:

FRP Hulls

- 1 Surface preparation (careful cleaning and degreasing).
- 2 Application of one or more coat of epoxy primer.
- 3 Application of lightweight profiling filler where needed and sanding.
- 4 Application of a coat of epoxy primer
- 5 Application of one or two coats of topcoat on topsides.
- 6 Application of 2 coats of antifouling on bottom.

Aluminum Alloy Hulls

- 1 Surface preparation (careful cleaning and degreasing).
- 2 Sanding or grit blasting to eliminate any aluminum oxide
- 3 Application of one or more coats of anticorrosive epoxy primer.
- 4 Application of lightweight profiling filler where needed and sanding.
- 5 Application of one or 2 coats of epoxy primer.
- 6 Application of one or two coats of topcoat on topsides.
- 7 Application of 2 coats of antifouling on bottom.

Preparation and Primers

The preparation of the surface and the quality of the primers play an important role in the perfect adhesion of the subsequent coats and the quality of the finish. The first operation is a careful cleaning and degreasing of the surface. For metal hulls, a mechanical and/or chemical surface preparation is done to create a surface profile to provide a good adhesion. Mechanical surface preparation can be achieved through abrasive grit blasting or sanding. The chemical solvents used to degrease and etch the surface are developed and formulated to be fully compatible with the other components of the coating system. The primers are made to ensure a better protection of the base material against corrosion in marine environment.



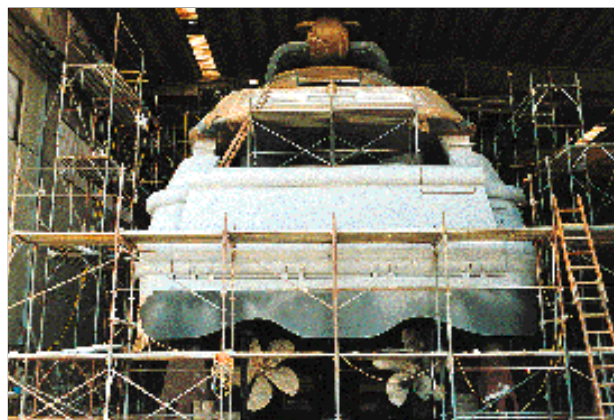
Hull bottom cleaning.



Application of the filler.



Final fairing.



Ready for the finishing touch.

Profiling Fillers

The profiling fillers are generally made of resins filled with various products according to brands (microballoons, fibers etc.) to increase their mechanical properties and their filling power without excessively increasing their specific weight. The leading suppliers offer a range of fillers suited to each use and compatible with the other components of the system. Car body filler should never be used for marine applications. This product shrinks and open cracks into which sea water can permeate with disastrous consequences.

Primers

Primers are made to improve the adhesion, the gloss, and the color of the finish. Several suppliers have had problems with the yellowing of white or light color topcoats after several months of exposure to sunlight. This discoloration is attributed to a reaction of certain pigments and components with the ultra violet (UV) rays of sunlight.

Paint Finish

The selection criteria of an enamel or topcoat are its gloss, durability, resistance to abrasion and UV and its ease of application. Moreover, it must have a fair range of colors, the choice often being a very complicated operation. The enamels and topcoats are generally based on a resin, a plasticizer, a solvent and color pigments. The base resin and the plasticizer link the main components together and form the film of the coating. The two-part polyurethane coatings of the high performance systems are generally manufactured from polyester or linear polyurethane resins. The one-part enamels are generally of the acrylic or alkyd-urethane type. The solvent determines the characteristics of the application, the film tension and the drying time of the coating. The pigments give the enamel its color and thickness. The color indeed plays an important role in the general aspect of the yacht but some of its secondary effects on the structure and habitability must be known. A dark hull is usually very nice but its color will generate a considerable increase in the topsides surface temperature when exposed to sunlight, hence increasing the heat inside



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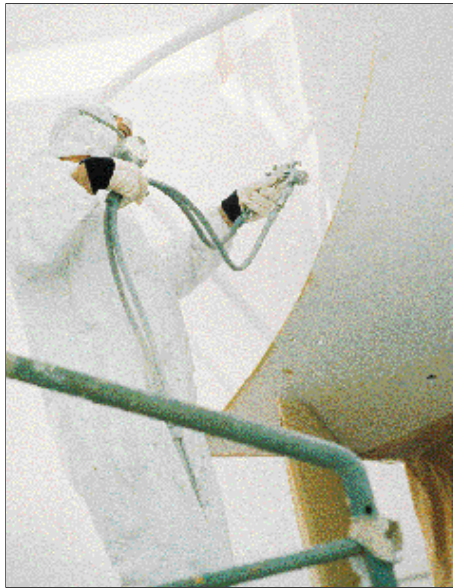
the boat, mainly if thermal insulation is deficient. On FRP hulls, overheating of the laminate can create deformations or print-through of some of laminate reinforcements and with some PVC foams, a softening of the core material.

Varnish

There are two categories of varnish. The traditional ones are mainly phenolic, one or two-part polyurethane. The latter are more resistant but the traditional varnishes are still preferred by some yachtsmen for their better finish. The main criteria of selection of a varnish are its gloss, its UV protection, its durability, and its color (clear, amber or other).

Antifouling

There are two main types of antifouling systems. The first are called self-polishing or eroding antifoulings and the other are hard antifoulings. Their components are fairly similar to that of the enamels with an additional component: a biocide which leaches out when in contact with the water. It is an active compound which repels any marine growth or fouling. The self-polishing antifoulings are



Topcoat application requires skill.

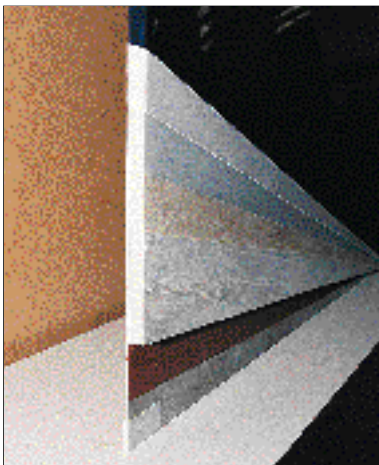
recommended to the active sailboats. Their efficiency is based on the leaching of biocide agents through the eroding surface. However, this type of antifouling should not be used on powerboats with speeds over 25 knots. Hard antifoulings are the option for fast motoryachts. This type of coating forms a hard surface which releases, after drying, its biocides. The technical term for this type of antifouling is "contact leaching". Two main points must be considered during

the selection of an antifouling. First, tin based paints are banned for yachts under 25 m (82ft). Second, copper based paints must not be used on aluminum alloy hulls because they generate serious galvanic corrosion which can have dramatic consequences on the hull structure.

Application and workmanship

The cost of materials only represents about 10 to 15% of the total cost of a paint job. It requires much time and care for the preparation and application. Labor takes the bulk of the cost. Brush or spray can be used even with high performance products. A paint job

Below, one can see the metal and the successive coats applied to obtain the deep blue visible above.



Fine sanding ensures the final gloss and makes even irregularities of fabrication.



Application of filler on large surfaces requires for skilled labor.





The preparation of the surface to paint is essential to achieve good results.

can be undertaken by amateurs under the condition that they carefully follow the suppliers instructions. However nothing supersedes the quality of the work done by a professional team with the know-how, experience and proper tools, in particular when the application is done in a paint booth with controlled environment (moisture, temperature, dust, etc). The greatest foes of the applicator are temperature variations, air moisture, and the dust present in the nearby environment. Extreme care must be taken during the preparation and the application. Brushes or other tools must not be cleaned with generic industrial solvents like acetone or methyl ethyl ketone. They can contaminate the components, producing a visible effect only when the work is finished. So the aesthetic value of a yacht can be largely influenced by the quality of her topcoats and varnishes. Their application is to be carried out by skilled and experienced professional applicators who have a perfect knowledge and understanding of the various products. This will prevent many mistakes.

Several coats of epoxy profiling primers are needed for a good finish.



Only a paint can offer such a gloss and glint.

Determination of Surfaces and Quantity of Paint

A few simple formulae used by all professionals to evaluate the quantity of products necessary for the coating of a yacht are based on the main dimensions of the yacht to be coated. These formulae are as follows :

Bottom ~~face~~ :

$$S = L \times (B+T)$$

Topsides ~~face~~ :

$$S = (2 \times FM) \times (LOA \times B)$$

Deck ~~face~~ :

$$S = 0,75 \times LOA \times B$$

Quantity of paint :

$$Q = S / (0,8 \times PC)$$

KEYS :

LOA: length overall, in ft

LWL: length waterline, in ft

B: maximum beam or width, in ft

T: draft, in ft

FM: average ~~face~~ beam, in ft

S: ~~face~~ area, in sq ft

Q: quantity gallons

PC: rate of paint coverage in sq ft per gallon. It is usually

found in the data sheets or technical manual of the

suppliers.

By Eric Ogden

Photos : Renaud Jourdon and courtesy of US Paint, Sikkens Yachtpaints, Hempel, Boéro and International.