LEROTEC

DOCK-YARD SETTLEMENT AND PRODUCTION MANAGEMENT EXPERIMENTS AND THOUGHTS

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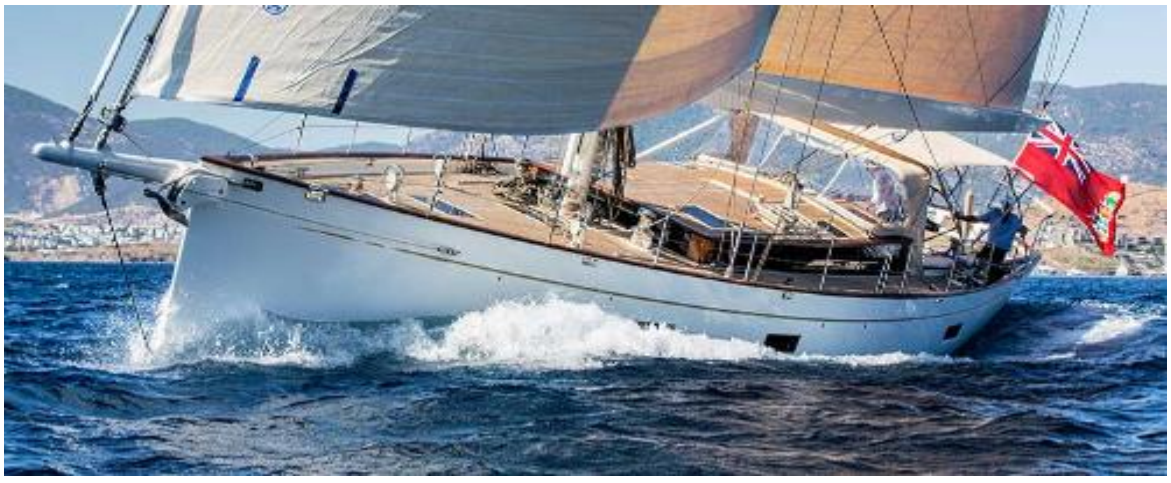
PREFACE

With the effects of the ongoing pandemic illnesses, enthusiasm for sailing on the sea and lakes are getting more ascending interest amongst increasing amount of capable and newly trained for sailing yacht enthusiastic people.

This increasing interest of the market by the new clients for pleasure sea vessels and yachts, it would be a reason for the investors to make investment for this field of marine sector. As all investors would like to achieve predicted profit for their investments in a certain timing and profit rate which would be aimed and secured with a certain path of dock-yard installment and organization plan. Later on depending on the capabilities of the predicted and / or upgraded dock-yard facilities, a certain product, production details and methods would be determined.



PRODUCTION DEPARTMENTS OF DOCK-YARD

Rather than administrational side, the technical formation of the dock-yard should be as follows:

1. Storage:
2. Plug, model and mold production:
3. Product lamination:
4. Surface fairing and painting:
5. Installation of laminated parts:
6. Installation of systems:
7. Registries:
8. Delivery:

1. STORAGE:

The storage of a dock-yard has a great importance as a heart of a body which absorbs material and pumps to be consumed or used in necessary sections of projects.

The ambient of storage should be always kept under control. Separating resin and hardeners, air-conditioning to maintain humidity free environment is essential for safety of production as raw chemical materials and fibers are vulnerable for humid and hot ambient.

The other important function of the storage is keeping the track of raw and consumable materials. As soon as critical lower level of each material is reached, prompt orders should be placed for not running out of the intended material.

Also, as another function of storage management is monitoring and registering the material flow and labor for each project, would be necessary for determining the cost of product, efficiency of material and labor usage.

It is certain that for setting up a new dock-yard or upgrading an existing dock-yard for producing a new sea vessel with most recent modern materials and methods, a satisfied experience should be presented. For a total satisfaction of the final result of the dock-yard investment, a total consultancy for management of entire dock-yard would be essential.

2. PLUG, MODEL AND MOLD PRODUCTION:

Depending on the resin type and the quantity of the contracted products, the mold material and building method will be determined. As the GRP boats will have a gel-coated surface and this surface has to be formed on the mold surface. So that, mold should be formed on a perfectly faired plug and model. For this process, a GRP mold should be formed on model and plugs. Mold resin should be appropriate for its purpose with lower shrinkage and having heat resistance for post-curing session in case required by the product material.

For epoxy – fiber products, fem mold can be formed and directly product can be laminated over. By the help of CNC technology, nowadays, these molds can be cut out of MDF materials. Those MDF pieces can be mounted easily with exact form. Then, surfaces can be formed and mold release films can be sticked over.

During production of plug, model and mold production, all recesses, bases, water channels, scuppers, hatch and porthole inserts, hose barbs and all other details should be formed. During product laminating all those details will be produced, as resin and fiber can be formed in the mold without consuming any labor and materials which is evident for high productivity.

In some cases, when post curing will be required, products should be post-cured before extraction.

As per above instructions, during mold designing, necessary time must be spend as all missing recess details would end up losing more hours for every extracted product.

That statement stands for each hour dedicated for mold project detailing would save days on production site.

3. PRODUCT LAMINATION:

For a resin fiber yacht laminating dock yard, the most convenient production aim is supposed to produce all parts in resin fiber laminate as much as possible.

That way, dock-yard should not pay extra for different materials which cannot be integral with the boat shell such as plastic and metal pieces. For example, by consulting with the structural engineering sources, all deck water drainage system, hull and deck water inlet and outlet seacocks, common single outlet multiple exhaust connections, anchor housing and so would be laminated inside the mold or on formers by using left over fibers.

Structural engineers need to be lead on for the aim of producing all reinforcing elements to be extracted out of molds. Thus, easily produced, dimensionally secure and perfect surfaces can be obtained for all reinforcement elements. All bulkheads should be produced with inserts, cable and pipe penetrations on the work bench with margins all around to be shaped in the hull.

After flange shaping of reinforcing elements to be fit in the hull, bulkheads can be installed in the hull over longitudinal reinforcements and final bonding laminations would be done.

In order to achieve perfectly made placement for installation of the bulkheads and reinforcements, proper marking for indicating the measures should be provided for finding the water level, datum point and eventually all locations in 500 mm partially marked signs on both mold and hull products.

Distribution of the PVC core material over outer laminate layer should be carefully done and adequate intervals should be given to form single skin locations. In general, PVC core is for supplying extra rigidity with lesser laminate for the panels which are not supported. The thickness of the PVC core creates a momentum to achieve rigidity to resist bending which is formed by vertical forces on the shell surfaces. Thus, by consulting with the structural engineer, the locations under reinforcements, locations to be drilled and cut and corners should be kept single skin. That way, encapsulation of PVC core should be secured. After extraction of shell, none of the drilling and cutting action for any installation should make the PVC core exposed to atmosphere.

4. SURFACE FAIRING AND PAINTING:

After extraction of the shell laminate the cut outs of the shell penetrations and necessary laminations can be finalized. Then, filling and fairing session should be started.

For building epoxy fiber laminated yacht shells, an insulated spray booth with heating facility would be essential. This spray booth can be used for post-curing and spray painting as for two different purposes. Before spray application heating the yacht shell to a certain degree would be necessary to eliminate the danger of dew forming.

Both air intake and outlet of the spray booth should be filtered with euro filters.

Screw type air compressor, min 1000 ltrs air tank, automatic water drainage system, air dryer and air filters would be essential.

Air intake should be powered to maintain + (plus) pressure in spray booth for the secure and best result.

5. INSTALLATION OF LAMINATED PARTS:

In the serial production conditions, best way to keep productivity at higher level would be stamping all moving parts out of molds. For example, lids can be produced in two pieces in upper and lower parts coming together. That way, the lids would be produced as designed with maximum functioning condition. List of materials for any systems should be done in details and molds to be built accordingly. If we go on deck lids example; gas pistons and its connections, rubber seals and grooves, locks, hinges and recesses can be determined and so. After designing every component on design, visuals and functional controls can be done. After approval, this component can be cost analyzed on labor and material base.

Other components which may require advanced lamination methods can be discussed and quoted by other specialist producers for carbon fiber rudders, bowsprits, anchor houses and laminated chain plates. Those pieces can be laminated on shell to obtain safer and stronger fit out and saving material costs and labor hours.

The round and oval pipes can be laminated with left over fiber and resins for the future usage to be installed to bulkheads before installment in the hull as pipe and cable penetrations.

Instead of vulnerable plastic hull penetrations for sea-cocks, again composite records to be installed for safety of hull, ease of mounting and saving costs of production. The seacocks would be used in plastic materials to avoid any electrolysis erosion.

6. INSTALLATION OF SYSTEMS:

RIGGING SYSTEM:

Due to developments of the rig components of high performance materials such as carbon mast and Dacron sails, hydraulic systems need to be set up.

The excessive forces applied on the system, no mechanic trimming system would be applicable. For that reason, a solid and user friendly proven hydraulic system should be installed on high performance sailing yachts. During performance sailing, especially on vang trimming operations, the sheet tightening would cause vacuum in the vang cylinder which cause numerous movements by the wind mercurial forces and sea wave impacts. If this situation cannot be notified for a while than these movements of the gasket on dry cylinder surface would cause warn out and oil leakage to pressured gas chamber. Eventually, by next main sheet tightening operation, vang cylinder ram may end up bending.

There is a solution offered by the hydraulic cylinder producers and further solutions can be thought eventually.

After finding out hydraulic hose passage arrangement, to determine lengths of hoses, all records would be fixed to hoses. After fitting records on the hoses, a certified pressure test procedures should be applied.

SANITARY SYSTEM:

Fresh water system is comprised of fresh water fillers, tanks, autoclave, pressure tank, boiler, water maker, shore conn., and taps.

Grey water system would require transfer tanks which are activated with water sensor with a pump to main grey water tank. As transfer tanks would be rinsed and totally emptied, no siphon would be required under sink. However, after transfer tanks, odor safe hoses and odor filters on air vent line would be required.

Black water system would have hanged style tanks which may drain out by gravity.

Again all hoses should be odor-safe and odor filter required on air vent line. As per CE regulations black water tanks should be emptied from deck.

All sanitary tanks should be made of HDPE layers and FW tank should be made with food compatible HDPE sheets. So that, those tanks will not corrode and leak.

FUEL SYSTEM:

Fuel system is comprised of fuel tanks, day tank, distribution manifold, separator and particular filters. Filler taps fill the main tanks, through suction manifold feeding tank may be selected. Transfer pump sucks fuel from the selected main tank to day tank. Before tank a separator filters to be installed. At by-pass line of transfer tank a manual pump should be installed. Return lines to be connected to return manifold so that return line can be directed to desired tank. The data readings from the sounding of day-tank may start and stop the transfer tank. The odor – filter should be installed on air-vent line.

DRIVE TRAIN SYSTEM:

The elements of the drive train are propeller, shaft, bracket, stern tube, gland, aqua-drive, thrust plate and engine.

It is important to laminate single skin the locations where bracket and stern tube to be installed. Thrust plate should be fitted with alignment line. After aligning the thrust plate and bracket, stern-tube should be fitted and laminated thoroughly. Existence of aqua-drive and thrust plate will protect engine beds and gearbox bearings. Also, the vibrations caused by misalignment of the engine would be prevented as well.

Also, earth conductivity of shaft would be requested.

RUDDER SYSTEM:

On the mold, the recesses to form housing for upper and lower bearing for the rudder shaft should be considered on the hull and deck mold.

The easy access and usage to emergency rudder should be maintained.

Because of the heavy forces and impact effects, bearing housing area should be kept single skin and rudder stoppers are to be adequately supported. All Dacron rope or steel line directing pulley bases should be mounted on single skin surfaces. Those locations should be considered before production. Pedestal base and steering wheel recess on the deck should be plugged on the deck mold.

DECK AND RIG EQUIPMENTS:

All rig and deck equipment bases can be recessed, extracted and reinforced on the production lamination phase. So that, easier installation can be achieved after extraction and top coat painting. Depending on the design requirements, all list, designs and quotations of the equipment can be prepared. After final dimensional controls and design corrections. Equipment list can be put on production session.

Depending on the rigger specialist, mast manufacturer and structural engineer, all chain plates can be designed to be produced in 316 inox and / or carbon fiber laminated.

Composite stanchion base housings can be glued on bulwark and all stanchion inox bases to be glued in their houses after top coat painting. All pulpit, gates and stanchions are to be prepared and produced beforehand.

All other equipment list, their production, backing plates and so to be CNC cut and quoted to be purchased at installation session.

KEEL AND BULB:

After extraction the hull should be located on a proper integrally built cradle which does let installation of all systems and topside paintings.
After coming to a certain level of installation, weight study would be necessary for securely shape the bulb of the keel.

Regarding to weight distribution a final shape of the bulb would determinate. Later, a foam model can be CNC shaped to form casting mold of lead. The steel part also CNC nesting cut to form and weld with certificated welders. 10.9 standard conn bolts to be dipped hot painted to prevent corrosion.

7. REGISTRIES:

LAMINATION CONTROL FORM:

All lamination session should be recorded and signed by the lamination team chief. On this form, it can be seen the date, project number, humidity and temperature readings from certified and calibrated hygrometer and thermometer, laminated part, lamination method, fiber types and amounts, resin types and amounts. Starting and finishing time. Those forms need to be kept as certification bodies would request them. Some certification bodies may require small labs to control product at every sequence of production. Hardness and glass resin ratio would be registered from sample pieces may be required. Other tests are to be done with collaboration with agreed test labs in case requested by certification organizations.

STORAGE REGISTRIES:

All used raw and consumable materials and labor hours should be registered by the storage responsible persons. So that, real costs will be clear. Also, material consumption rates may indicate better production methods for saving material and labor.

Inventory lists to be updated will indicate the critical level for ordering material in order not to have any material shortage which may seize production.

PLANNING:

With a chart production plan, material and labor flow should be planned. Plan and actual dates should be confronted.

If the program can be determined in details, during production there won't be any unpleasant obstacles.

All other problematic developments which is not caused by the collaborating parties also should be recorded to be added to production plan time vise.

8. DELIVERY:

After finalizing all installation, all moving pieces should be controlled. All hull and deck penetrations should be controlled to be sure if there is no obstacle to clog the lines.

All sanitary, water cooling and drainage systems must be tested with water to see if there is any leakage.

Other lines can be testes with pressured air and leak indicating foam

After launching the yacht, an experienced sailor should set the sails and make a test to see the performance in extreme condition. Presence of the engine and electric specialist would be beneficial for securing the test results.

Final test report would finalize the production.

SUMMARY

The yacht building is very complex activity. Parts of this activity are the design office, structural engineering office and the dock-yard. At this point, an operational engineer who will collaborate with each party as a “solution partner” will be essential for smoothly running production sequence.

At that point, my suggested role will be the solution partner engineer.

I bring information to dockyard and bring feedback to design office.

I suggest on setting the dock yard to function as above indications.

I suggest and control all production as designed key in hand.

As above detailed information, a plan that is good with dock yard production capability and/or setting up a capable production site would help to avoid any obstacle on the progress of production.

All above items have been experienced. During taking part of this journey of yacht production, acquaintances with many experienced specialize people have been accomplished. Some of them are listed below:

1. Umberto Tagliavini:……. www.marinedesign.it
2. Mark Speirs:…….. www.performanceclassicyachts.com
3. Ruurt Meulemans:…… www.hoekdesign.com
4. Fernando Borges De Sena:….. www.trimarine.com
5. Mark Bishop:…….. www.wfcomp.com
6. Doug Schickler:…….. www.styacht.com
7. Luca Coretti:…….. www.questayachting.com
8. Vittorio Papa:…….. www.spintastudio.com

I would like to thank above special people listed above for having chance to work together to a direction of achieving best solution of high performing, simplest and most beautiful production methods.

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