

# **Materials used for boat construction- wooden boat**

## **Materials used for boat construction**

### **General**

Several construction materials are available for fishing vessels up to 100ft. For vessels over 100 ft steel is the dominant material. Each material has its own construction method. In general, a fishing vessel of any material is built up of some kind of frame and a skin.

Following are the materials available for construction of fishing vessels.

- Wood
- Steel
- Aluminum
- GRP (Glass Fibre Reinforced plastic)
  - Ferro-cement
  - Composite

Following factors to be considered while selecting a material

- Type of vessel
- Size of vessel
- Speed of vessel
- Shape of the vessel
- Availability of material
  - Suitability
  - Economic viability
- Environment in which the vessel is going to operate

## **Wood**

The timber is being used as a boat building material since time immemorial. Nearly 5000 species of Indian tropical trees are known to yield timber though only about 400 species are actually suitable as boat–building material. About 200 of them can be put to commercial use of which a few have been found ideally suited for the construction of modern mechanized boats. Hence selection of the timber is very essential.

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### **General consideration in selection of timber**

- Select Seasoned stock: Seasoned timber in which moisture content is within prescribed limits is preferred except in the case of steam bent frames where green stock is better as it can be bent easily.
  - Prefer air dried wood compare to kiln dried wood: In kiln drying, oils of wood having resistance to fungi and borers leak out or evaporate. Hence they are susceptible to dry rot. As such air-dried wood is preferred.

- Avoid sapwood: Sapwood is softer and less durable than heart wood. It is recognized by its light colours as compared to heart wood. Hard heart wood is free from natural defects and blemishes and with straight grain is good for boat construction.
  - Prefer radial cut timber than tangential cut
- Select timbers having high rot resistance: Rotting is severe problem in tropical areas. High resistance to rot can also be achieved pressure impregnation of timbers.
- Choose timbers which have high dimensional stability: A timber that is not stable will shrink and swell excessively resulting in opening of seams with resulting leaks causing great strain in the fastenings and making planks buckle. Stability is measured by tangential shrinkage which should be less than 4%.
- Timber must have good strength: The weight of the timber gives an indication of its strength. Moderately heavy timber with a weight of 562-722 Kg/m<sup>3</sup> at about 12% moisture content is good enough.
- Timbers should be able to take nails and screws without splitting: The problem of splitting, when nailing the planks can be solved by pre boring the holes for nails and screws.
  - Workability of the timber: Cutting, planking and working with wood should not be cumbersome
    - Ability to take finish
  - Select those timbers which can take preservatives
  - Cost and availability

## **Specific requirements of wood for various components of boat**

For hull planking, the wood used is subject to severe conditions of biological deterioration and electro–chemical degradation. It should be especially durable against marine bore’s attack, stable in shape and size, good nails screw holding power, easy to work and shape as the planks are butt joined and it should have low swelling, shrinking and warping.

Decking is subject to alternate wetting and drying. Therefore, timbers should have high dimensional stability, resist decay and insect attack, should not wear out easily, take polish satisfactorily, easy to shape and work as decking is butt jointed, should not crack under alternative wetting and drying and good resistance to impact and abrasion . For both hull and deck planking light weight combined with moderate strength is preferred.

For keel, keelson and Hog keel, heavy timbers with high strength are used. Single piece wood is preferred to avoid joint. The timber used should have resistance to decay and insect attack. It should not develop severe cracking and splitting as the timber used in this area is subject to stagnant and humid air conditions.

The wood used for ribs must be very tough stock resistance. Possess good bending qualities, durable as that in keel, it is subject to stagnant humid air conditions and it should be free from, knots, cross grains etc., which impair the bending and strength properties. For stringers, transom, beam and floor timbers, the timbers with considerable length should be available and those must possess resistance to decay and insect attack under humid air conditions prevailing inside the boat.

Light weight with moderate strength is required. Knees require very strong and hard timber having resistance to decay and insect attacks. Oars, paddles and masts require long length elastic and tough but not heavy timber and it should be durable against decay and insect infestation.

### **Wooden fishing vessel**

No single material is ideally suited for all types, sizes and areas of operation. Each material has its own merits and demerits. There are vast resources of wood available in India. In spite of this factor, good quality timber suitable for boat construction is becoming scarce and dearer with proper selection, seasoning and treatment by preservatives many secondary timbers like van teak, mango etc., can be brought to extensive use in boat building.

### **Properties of wood**

Wood consists of hollow fibres, the walls of which are composed of cellulose and lignin. The strength of wood depends on the direction, size arrangement and appearance of the fibres and also its moisture content. Timber with straight and close grain with 10 to 15% moisture is the strongest. It is 16 times stronger in direction of grain than across. The specific gravity of wood is about 1.56 regardless of species. In spite of this, dry wood of most species float because a large part of it is occupied by all cavities and pores. Since wood decays in normal working condition due to attack of fungi, marine borers and insects it has to be used in boat building after proper treatment and preservation.

The strength of any wood is closely related to the amount of moisture it contains. Wood in very wet condition and absolutely dry condition will have poor strength. Usual permissible range of moisture is 12-18% with maximum strength found at 15%.

### **Merits and demerits of wood**

#### **Merits**

Wood has been used in boat building exclusively from time immemorial. Wood presents certain inbuilt and Inherent advantages like positive buoyancy, easy workability, treatability and good strength. Inherent elastic properties of wood help in bending and shaping when heated and steamed. It can shrink and swells without rupture. Wood can also stand sudden applied shock. It also has clean and smooth finish apart from being highly durable with proper treatment. Care and maintenance the life of the wooden boat can be increased. It is good heat insulation. Easy to fit and drill holes.

#### **Demerits**

Wood being a hygroscopic material is subject to rapid changes in physical conditions resulting in dimensional instability. It absorbs nearly 30% of its weight. Being an organic material it is subject to several types of deterioration. Though strong, its strength is not uniform as it depends on the orientation of its grains. It is unhygienic as wooden decks and fish holds harbor millions of micro-



organisms. It deteriorates easily due to mechanical wear and tear and is easily destroyed by fire. Constant protection against fungi, bacteria, insects, borers and foulers is needed. It also requires careful selection, seasoning and storage sharp curves are not possible and wastage is also considerable.

### **Seasoning of wood**

Freshly felled timber contains 100% moisture in many cases though in some light timbers, it may even go up to 200%. Excessive moisture in wood renders it weaker. It is susceptible to fungal attack and it is prone to dimensional instability. The water is in the form of sap or moisture. Seasoning of timber is the means adopted to reduce the moisture content to an amount suitable for the purpose for which the timber is to be used.

The objects of seasoning are

- To increase its strength, durability, workability and resistance.
  - To reduce the tendency of split, shrink and warp
- To reduce its weight and thus minimize the cost of transport and handling.
  - To make it immune from the attack of insects and fungi
- To make it receptive to finish (Preservatives, paints, varnish and polish)
  - To make it burn readily, if used as fuel
- To maintain the shape and size of the components of the timber articles which are expected to remain unchanged in form

- To reduce the tendency of timber to crack, shrink and warp.

Seasoning helps in increasing its strength and service ability and also improves timbers dimensional stability and protect from attack by insects and fungi.

**i) Methods of seasoning:**

- Natural seasoning
- Artificial seasoning

### 1) Natural seasoning:

In this method, seasoning of timber is carried out by natural air and hence, it is also sometimes referred to as air seasoning. Following procedure is adopted in air seasoning.

- Timber in log form is not usually fit for the process of seasoning. Hence, it is cut and sawn into suitable sections of planks or scantlings.
- Timber pieces can either be stacked horizontally or vertically, the former arrangement being very common.
- The ground, where stack is to be constructed is cleared and it is leveled for good drainage.
  - The platform of stack is made slightly higher about 30cm, than the ground level. For this purpose, rows of brick or concrete pillars are constructed. The pillars may also be made of creosoted wood or wood coated with coal tar. The tops of pillars should be in the same horizontal plane. The pillars should be durable.
- The timber pieces are sorted out according to lengths and thickness. They are then arranged in layers, one above the other. Care should be taken to see that all members in a particular layer are of the same thickness. If this precaution is not taken, there are chances of timber to become warped or cracked.
- Each layer is separated by spacer of sound dry wood. The usual dimension of spacers varies from 35 mm x 25 mm to 50 mm x 35 mm. The larger dimension of the timber is the width. The spacers are to be carefully placed in correct vertical alignment.
- The distance between spacers depends on the sizes of the timber members to be seasoned. It is less for thin sections and more for thick sections. It usually varies from 45 to 60 cm.

- Length of stack is equal to length of timber pieces. Width and height of stack are restricted to about 150 cm and 300 cm respectively. A distance of about 25 mm is kept between adjacent layers.
- The stack is to be protected from fast blowing wind, rain and extreme heat of sun. Hence the stack should preferably be covered by a roof of suitable material.

### **Advantages:**

- Depending upon the climatic conditions, the moisture content of wood can be brought down to about 10-20%.
  - It does not require skilled supervision.
- It is uneconomical to provide artificial seasoning to timber sections thicker than 100 mm. As such sections dry very slowly. Hence such thicker timber sections are usually seasoned by the process of air seasoning.
  - This method of seasoning timber is cheap and simple.

### **Disadvantages:**

- As the process depends on natural air, it sometimes becomes difficult to control it.
    - Drying of different surface may not be even and uniform.
- If ends of thick sections of timber are not protected by suitable moisture proof coating there are chances for end splitting because the ends of such timbers dry rapidly in comparison to the central portion.

- If not properly attended, fungi and insects may attack timber during the process of seasoning and may there by damage it.
  - Moisture content of wood may not be brought down to the desired level.
- Space required for this purpose will be more as timber will have to be stacked or stored for a sufficiently long time.
- The process of seasoning is very slow and it usually takes about 2 to 4 years to make timber fit for the work of carpenter.

## 2) Artificial seasoning:

Following are the reasons for adopting artificial seasoning to natural seasoning.

- Defects such as shrinkage, cracking and warping are minimized.
- Drying is controlled and there are practically no chances for the attack of fungi and insects.
  - Drying of different surfaces is even and uniform.
  - It considerably reduces the period of seasoning.
- There is better control of circulation of air, humidity and temperature
  - Wood becomes more suitable for painting, gluing etc.,
- Wood with desired moisture content may be obtained by artificial seasoning

### **Various methods of artificial seasonings are as follows**

- Boiling
- Chemical seasoning
- Electrical seasoning
  - Kiln seasoning
- Water seasoning

#### **Boiling:**

In this method timber is immersed in water and water is then boiled. This is very quick method. Timber is thus boiled with water for about three to four hours. It is then dried very slowly. The period of seasoning and shrinkage are reduced by this method, but it affects the elasticity and

strength of wood. In place of boiling water, timber may be exposed to the action of hot steam. This method of seasoning proves to be costly.

### **Chemical seasoning:**

This is also known as salt seasoning. In this method, timber is immersed in a solution of suitable salt. It is then taken out and seasoned in the ordinary way. The interior surface of timber dries in advance of exterior one and chances of formation of external cracks are reduced.

### **Electrical seasoning:**

In this method, use is made of high frequency alternating currents. Timber, when it is green, offers less resistance for the flow of electric current. The resistance increases as the wood dries alternately which also results in the production of heat. This is the most rapid method of seasoning. But initial and maintenance costs are so high that it becomes uneconomical to season timber on commercial base by this method.

### **Kiln seasoning:**

In this method, drying of timber is carried out inside an air tight chamber or oven. The process of seasoning is as follows.

- Timber is arranged inside the chamber such that spaces are left for free circulation of air.
- Air which is fully saturated with moisture and which is heated to a temperature of about 35 °C to 38 °C is then forced inside the chamber by suitable arrangement.

- This forced air is allowed to circulate round the timber pieces. As air is fully saturated with moisture, evaporation from the surface of timber pieces is prevented. The heat gradually reaches inside the timber pieces.
  - The relative humidity is now gradually reduced.
- The temperature is then raised and maintained till the desired degree of moisture content is attained.

Depending upon the mode of construction and operation kilns are of two types namely stationary kilns and progressive kilns

#### **Stationary kiln:**

A stationary kiln is also known as compartment kiln and in this kiln process of seasoning is carried out in a single compartment only. Drying operations are adjusted as drying proceeds. This kiln is adopted for seasoning timber which requires a close control of humidity and temperature. It gives better results.

#### **Progressive kiln:**

In a progressive kiln, carriage with timber sections travel slowly from one end of the kiln to the other and in doing it gets seasoned. The hot air is supplied from the discharging end so that the temperature is less at the charging end and it increases towards the discharging end.

#### **Water seasoning:**

- The timber is cut into pieces of suitable size



- These pieces are immersed wholly in water, preferably in running water of a stream. Care should be taken to see that timber is not partly immersed.
  - The thicker or larger end of timber is kept pointing on the upstream side
- Timber is taken out after a period of about 2 to 4 weeks. During this period, sap contained in timber is washed away by water.
- Timber is then taken out of water and allowed to dry in free air. Water that has replaced sap from timber dries out and timber is seasoned.

## **Preservation of wood**

In view of the limited availability of naturally durable species of timber like teak and Sal there is need to utilize less durable species of wood. This is commonly known as secondary timbers, which are used for boat construction. These timbers if properly selected, seasoned and treated with preservatives will be more durable and economical for boat construction. Treatment of timbers with preservatives is known as timber treatment.

### **Objectives**

- To increase the life of timber structure
- To make the timber structure durable
- To protect the timber structures from the attack of destroying agencies such as fungi, insects etc.

Many timbers used in boat building yards are susceptible to fungal infection, attack by white ants, beetles and marine fouler and borers unless treated with a suitable preservative. Hence to increase the serviceability, the treatment of timbers is highly essential. While white ants like fungal infection attack interval timber structures, the marine borers attack from outside below the water lines.

## 1) Requirements of a good preservative

The requirements of good chemical preservatives should be

- High toxicity to fungi, termites beetles, marine borers and fouler.
  - Good retention for considerable time.
    - Non corrosive to metals
  - Should not adversely effect the strength of wood
    - Safe and easy to handle
    - Free from fire hazards
      - Good penetration
      - Abundant supply
      - Economical to use
- Should not taint fish and free from health hazards for human beings

## 2) Types of preservatives

There are three types of preservatives

- Oil type
- Organic solvent type
- Water borne type

### **i) Oil type:**

In this group byproducts of oils such as coal tar creosotes, creosote petroleum solutions, creosote coal tar solution and lignite tar oils are included. The coal tar creosote is specially suited for exterior application. Coal tar is seldom used alone for preserving wood as with its use good penetration is usually difficult and it is less poisonous to wood – destroying fungi other than coal tar creosote. Coal tar creosote is normally used with a mixture of petroleum. The petroleum gives stability to creosote against evaporation and also protects the timber from splitting and cracking.

### **Advantages:**

- Highly toxicity to wood – destroying organisms
  - Ease of application
- General availability and relatively low cost
  - Non-corrosive

### **Disadvantages:**

- Satisfactory painting is difficult
  - Unpleasant odour
  - Involves risk of fire
  - Weight increases
    - Taints fish

## **ii) Organic solvent type**

These preservatives are used after dissolving them in suitable organic solvents. The choice of solvent depends on suitability of the preservative and the use to which the treated timber is to be put. The preservatives prepared by dissolving toxic chemicals in low cost solvent oils are also included in this group. The solvents may be heavy petroleum fuel oils, light fuel oils or any other cheap oil. The principal toxic chemicals used are pentachlorophenol, copper naphthenate and tributyltin oxide. Oil solutions of toxic chemicals has an important advantage over byproduct oils in that their effectiveness is due to definite chemical compound, the concentration of which can be controlled as desired and determined accurately by chemical analysis.

### **Advantages:**

- Treated timbers can be painted waxed or polished.

### **Disadvantages:**

- As some of the solvents are highly inflammable, care should be taken while, handling the solution. In such cases the preservatives should preferably be applied cold expensive.

### **iii) Water borne type:**

These preservatives include (a) Acid copper chromate (b) Chromated copper arsenate (c) Chromated zinc chloride. These preservatives are often employed when cleanliness and paintability of the treated wood are required. Water borne type preservatives are inorganic salts soluble in water.

Several formulations involving combinations of copper, chromium, arsenic etc., show a high resistance to leaching and good performance in service. These preservatives consist of a mixture of various salts with the addition of a fixative salt –usually sodium dichromate or potassium dichromate. The effect of chromium is to fix element, arsenic, copper zinc etc., in the wood so that the toxic salts are not leached by the action of water. It is however, necessary to allow timber to dry for 3-6 weeks for the fixation process to be complete.

#### **Advantages:**

- Easy to handle
- Available and cheap
- Treated timber can be painted and sheathed
  - Free from fire and health hazards
  - Treated wood light and dry

#### **Disadvantages:**

- Unstable at high temperature hence application should be at low temperature
  - Treated wood needs re drying
  - No protection against weathering and mechanical wear
    - Dissolves in course of time.

### 3) Selection of preservatives:

The type of preservative used depends on the working conditions. Water borne preservatives are best suited when cleanliness, freedom from odour, low increase in weight and relatively low cost are desired. Tributyl tin derivatives are found more suitable for fungi, insect attack as well as antifouling paints. Penta chloro phenyl is found to be having more penetration into wood than the copper naphthanate though it may not be as effective as the latter. Organic solvent types are needed where painting has to be carryout and where cost is not a limiting factor. By products of oil are recommended where high toxicity is needed, painting is not required and where weight is not a factor.

### 4) Choice of treatment:

The choice of treatment is governed by the timber species, its sap wood content and the use to which it is to be put. The treatment is necessary for sap wood of all species of timber heart wood of non-durable species, heart wood of durable species if the timber members are to be placed on the ground or are required to give long life under severe conditions of service. In the case of marine structures all timbers should be treated certain timbers are resistant to treatment. Based on the degree of penetration timbers are classified as follows for the purpose of treatment.

- Easily treatable (100% penetration).
  - 75-100% penetration (gurjan)
- Partially treatable 50-75% (siris, kindal)
- Difficult to treat – 25-50% (Dhaman)
- Not treatable -0-25% (teak and venteak)



## 5) Types of treatment

The following are the methods used for treatment for timbers.

- Surface application
- Soaking treatment
- Hot and cold process
- Boucheries process
- Pressure process
- Diffusion process

### 1) Surface application:

This is done either by brushing, spraying or dipping in the preservative, for a short period. For this treatment the timber is debarked thoroughly. For oil type preservative the moisture content in timber shall not be more than 14% with aqueous solutions, moisture content of 20-30% is permissible. At least two coats should be applied; the initial coat has to dry up before application of subsequent coats. This type is used mostly for treating material at site and for treatment of cut surface.

### 2) Soaking treatment:

In this treatment, the timber is debarked thoroughly and the treatment is carried out by submerging the timber in the preservative solution for a sufficiently long period until the required absorption of preservatives has been obtained.

### **3) Hot and cold process:**

In this process, the timber is submerged in the preservative oil or solution which is then heated to 90°C and maintained at this temperature for a suitable period depending on the change. It is then allowed to cool until the required absorption of preservative is obtained. During the heating period, the air in the timber expands and is partially expelled during cooling the residual air in the timber contracts creating a partially vacuum which causes the preservative to be sucked into the timber.

### **4) Butcheries process:**

This process is applied for the treatment of sap wood of green timbers soon after felling using any of the inorganic water soluble preservatives. The treatment is carried out by attaching to the butt end of a pole with back on, a rubber hose connected to a reservoir containing preservation solution and placed at a sufficiently high level. The pole is held in an inclined position, generally at an angle of 45°C to the horizontal with the butt end up. Due to hydrostatic pressure the preservatives displaces the sap in the timber which is then forced out at the narrow end. The treatment is stopped when the concentrating of preservative in the drip is nearby the same as that of the solution in the reservoir.

### **5) Pressure process:**

This is a process of treating wood in a closed container of preservative. It is forced into the wood under pressure greater than one atmosphere pressure and is generally preceded or followed by vacuum. The pressure process may be done either with oil type or with water soluble type preservatives. In the former case a temperature of 80-90°C should be maintained during the pressure period.

There are two methods of pressure process. (1) Full cell process (2) Empty cell process

### **The full cell process:**

It is used when maximum absorption of the preservative is desired. The timber is introduced into the cylinder. The door is closed, and then a vacuum at least 56 cm of mercury is created and maintained for half an hour. At the end of the vacuum period, the preservative is introduced into the cylinder, with the vacuum pump working. When the cylinder has been filled with the preservative the vacuum pump is stopped and the cylinder is subjected to 3.5–12.5 kg/cm<sup>2</sup> pressure depending on the species and size of timber. After the desired absorption is obtained the preservative is withdrawn from the cylinder and finally a vacuum of 38-56 cm of mercury for about 15 minutes is once again applied to free the timber from dripping preservative.

### **Empty Cell Process:**

It is a process for impregnating wood with preservatives or chemicals in which air imprisoned in wood under pressure expands when pressure is released to drive out part of the injected preservative or chemical. The distinguishing feature of empty cell process is that no vacuum is drawn before applying the preservative. The cell cavities are only partially filled.

### **Diffusion process:**

This process is used in the case of timbers which are not easy to impregnate under pressure in

dry conditions and also when there is danger of the timber getting deteriorated during seasoning.

The depth of penetration and the amount of preservatives absorption depends on the concentration of preservative, period of diffusion species of timber and its moisture content. The preservatives are applied in different ways. Momentary dipping of timber in concentrated solution or prolonged immersion in dilute solution or application of paste over all the surfaces of timber and then these are close slacked under cover.

## **Fouling and boring organisms**

### **Factors causing deterioration of wood**

#### **(1) Rot:**

Rotting is a natural phenomenon caused by micro-organisms like fungi, which cause decay in wood. Organic material of wood is absorbed by these fungi, which causes disintegration of the cell walls followed by changes in colour, texture and strength properties. Wood becomes soft and spongy, due to rotting, besides other changes in the physical and chemical characteristics. Use of untreated wood together with inadequate ventilation and drainage lead to decay. Most of the decay in boats in salt water occurs above the waterline where water can enter but not evaporate and at joints where grain is exposed. In fresh water, interior members below the water line are also often subject to decay.

Some of the preventive measures to avoid rot are usage of heartwood, seasoned and treated wood, allowing proper ventilation of the wood surfaces possibly at all times and eliminating entry of water into the boat.

#### **(2) Marine borers:**

Certain group of animals like teredo, martesia etc., bore into the under part of the wooden hull and destroy the wood in the long run. They consume cellulose, a constituent of wood. The damage caused by marine borers is not so easily detectable till it has progressed to a dangerous level. Use of antifouling paints or use of under water sheathing made of copper, FRP or aluminum act as preventive measures. Besides, if vessel is moored in fresh water for a few weeks or taken out of

water altogether for about there weeks, they will perish. If the damage caused is not very severe, the holes could be filled with wooden plugs or with any sealing compound. However it is advisable to replace a member in case of extensive damage.

### **(3) Marine foulers:**

Certain organisms settle on the submerged part of the hull there by affecting the propulsions and efficiency of under water acoustic devices. These organisms otherwise called foulers include microscopic ones like bacteria, fungi, diatoms rotifers and macroscopic ones like coelenterates flatworms, tubeworms, branacles and molluscs. As the settlement of foulers affect the propulsion the speed of the boats is reduced and fuel consumption gets increased. This forms a negative aspect in the economical operation of boats. If the affected boat is kept in fresh water for a considerable time, many of the foulers are cleared. However, adherent shells of organisms like branacles and bivalves remain attached. For complete removal of foulers, they have to be scrapped during dry docking. Metallic sheathing like copper or application of antifouling paints on the submerged portions also prevents settlement of foulers.

### **(4) Corrosion:**

Corrosion is the gradual disintegration of metal due to chemical or electro – chemical attack by atmosphere moisture or other agents. This phenomenon is prevalent in steel vessels and also wooden vessels having metallic sheath to the underwater part of the hull. The corrosion results in thinning of plates and reduction of speed of vessels due to roughness caused on the surface of

boat.

**Control of corrosion:**

The corrosion can be controlled by the following means.

**(a) Material selection and design:**

Metals that show potential differences should be positioned in such a way that the anodic area is large as compared to cathodic area. For example, iron screws in a brass plate will be quickly attacked but brass screws in an iron plate would be acceptable.

**(b) Use of alloys which resist attack:**

Alloys immune to all corroding media are preferred. However, no single alloy satisfies this condition. Copper base alloys and stainless steel alloys are resistant to corrosion.

**(c) Galvanic or sacrificial system:**

Sacrificial plates are used to protect the structure. Normally Zn is used to protect steel, cast iron, brass and bronze.

**(d) Efficient paint system:**

Adequate coating of anticorrosive paints affords protection against corrosion. The affected parts are chipped, brushed and cleaned to remove rust and mill scale. Subsequently the surface is painted with anticorrosive paints. In case of severe corrosion, the affected plates are replaced by new ones.

**(5) Mechanical damage:**

The hull of a vessel gets damaged after collision with other boats, structures and jetties. This kind of damage shortens the life of the boat besides posing a threat to the lives of the crew and others on the vessel. Careful handling of the vessel by competent crew would help to avoid collisions.

Mechanical damage should be attended to immediately.