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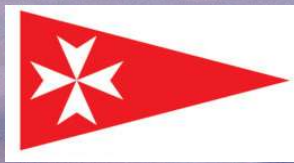
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# Presentation on Pro-Active Ways to Improve Safety of Life at Sea

Inspecting & Maintaining Your Craft

in collaboration with:



Malta Cruising Club

Presented by:

Alan Cassar, M.Sc.

Director of CSR Yachting Ltd. & Malta Gov. Appointed Surveyor of Ships

# Background / Introduction

- Alan Cassar
- 20 years in the Maritime Industry – 8 Years with Malta Flag – Technical Department / 9 Years in the Private Sector / 3 Years Own Business
- Masters of Science in Marine Surveying
- Gov. of Malta Flag Approved Surveyor of Ships
- Specialized in Commercial, Fishing and Recreational vessels
- Consultant to various Gov. entities including Civil Protection Department of Malta and Ministry for Fisheries and Aquaculture



## Personal / Company Vision

- Improving Safety of Life at Sea;
- Increasing Awareness on Pollution Prevention at Sea;
- Improving and safeguarding the work conditions of crew on commercial vessels.



# Services offered as a Surveyor

- **Certification:**

- Commercial Yachts
- Pleasure / Recreational Yachts
- Workboats and Fishing Support Vessels
- Local Chartering / Watersports Crafts
- Fishing Vessels

- **Consultancy:**

- Court Cases
- Dry-Docking & Re-fits Supervision
- Towage / Single Voyages
- Safety Management Systems
- Government Entities

- **Surveying:**

- Condition and Valuation Surveys
- Pre-Purchase Surveys
- Hull & Machinery Surveys
- Loading & Un-loading Survey
- Lashing Surveys
- Cargo Quantity Surveys
- Damage Surveys

# Presentation: Overview

1. Basic Rig Inspection – Inspecting and Maintaining
2. Keel and Keel retention bolts – Inspection and Maintenance
3. On Deck Safety Systems
4. Fire & Safety Systems onboard – enhancing safety
5. Electrical Systems – Basic Safety & Inspection
6. Engine and engine bay – Inspecting and Maintaining
7. Inspection of bilges and bilge cleaning incl. Bilge Pumps
8. Osmosis – Inspection and Prevention

A photograph of a vast blue ocean under a clear blue sky, viewed from a window. The horizon line is visible in the distance, with a thin layer of white clouds just above it. The water in the foreground shows gentle ripples. The window frame is visible on the left and right sides.

# RIGGING – BASIC INSPECTION AND MAINTENANCE

# Rig Inspection

**Rig failures** – caused by poor maintenance and breakage of the fittings and connectors, (not by actual spars or rigging)

**Important to avoid failures** - Reducing fatigue: correctly adjusting and tuning the rigging (Professional rigger).

General Inspections:

1. Visual inspection – in case of wear/failure aided by NDT Testing such ultrasound.
2. Look for items such as cracks in rigging components, misalignment of stays and corrosion.
3. Rig tensions should be checked and adjusted as necessary.
4. **A rigging maintenance booklet is always recommended (esp. for insurance purposes).**

A rigging inspection is recommended every 5 years or as recommended by the manufacturer.

Dye Testing or Liquid Penetration Inspections which reveal surface flaws not visible to the naked eye should be also carried out rig is dismantled, and mast lowered.

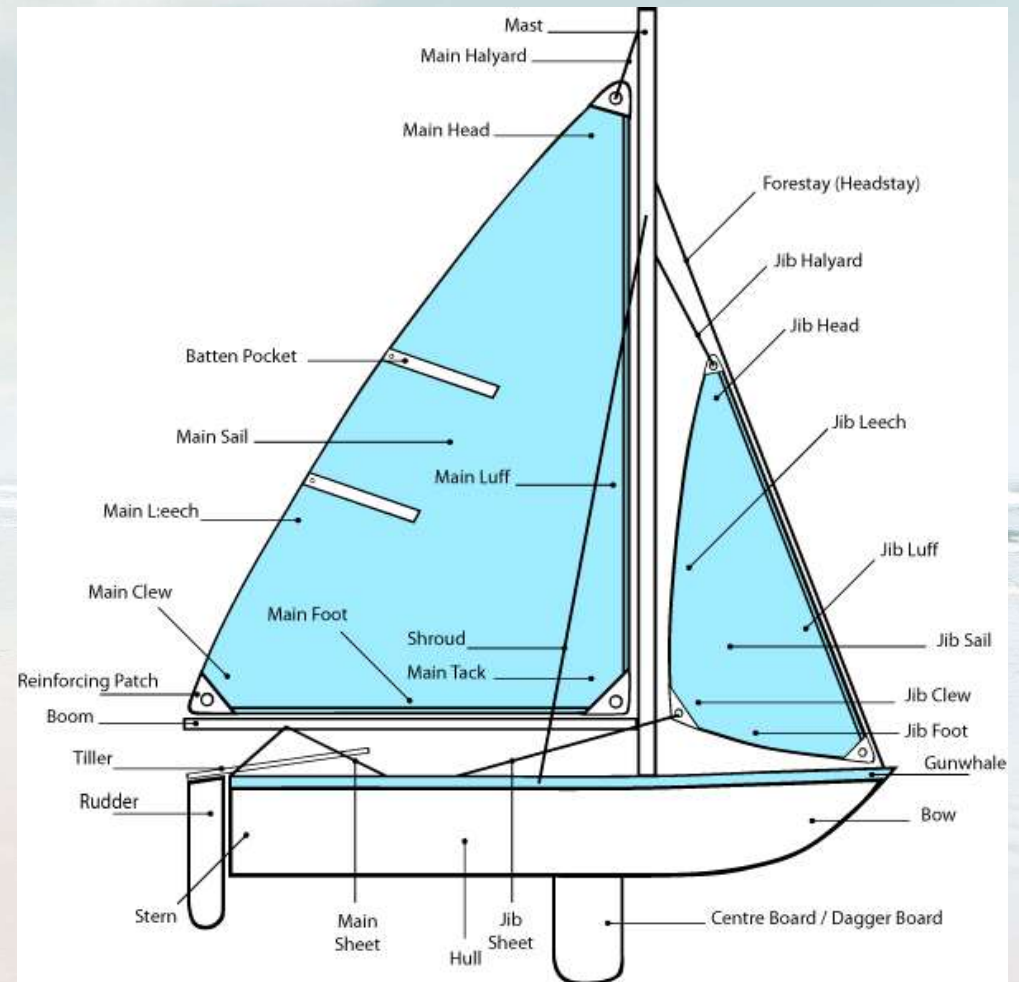
**It is also advisable to do an inspection before a major sea passage.**



## Checklist of things to look out for:

- Deck check:

- Split Pins,
- Adequacy of threaded fittings,
- Chafe or breakage of stranded wires,
- Rig cracking,
- condition of mast collar sheaves,
- forestay condition.



## CHECK

### Masthead:

- Halyards sheaves rotate freely and are sound / halyard shackles are in good condition
- Bushes, split pins intact, electrical wires are clamped correctly and chafe free
- Lights are operating, halyard shackles in good condition.
- Wind gear operating correctly.

### Forestay:

- Inspect halyards for wear
- corrosion around mast
- Condition of threaded fittings
- No broken strands of wire, signs of cracking or rust.

### Mast stay wires and mast fittings:

- No broken strands of wire
- No visible signs of cracking
- No signs of rust streaking
- Fastening secure
- Threaded fittings are sound,
- rigging screws locked

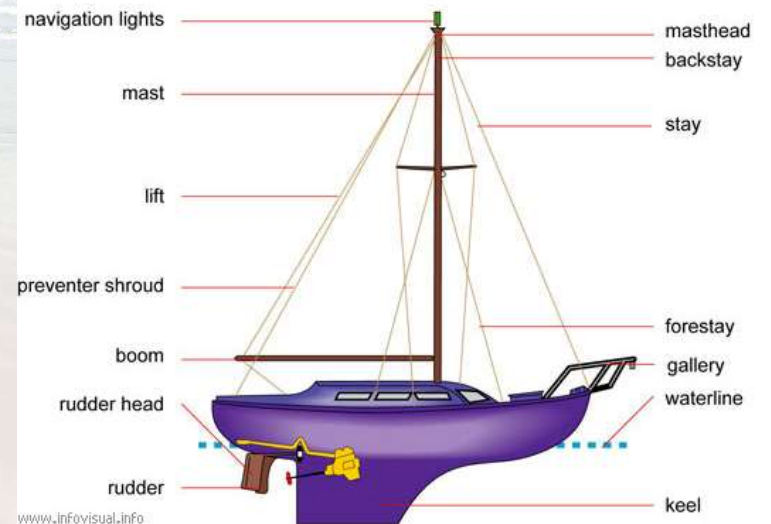
### Spreaders:

- No visible signs of cracking
- Fastenings secure

- No signs of rust streaking,
- No broken wire strands,
- Lights are working,
- Wires clamped correctly, no chafe, no corrosion!

### Chainplates:

- Check for excessive wear
- Signs of elongation in pin holes
- Alignment with stay angles
- Evidence of fracture at deck level,
- Fastening between deck and hull.





## RIG MAINTENANCE TIPS

- Ensure any taping of screws or pins cannot trap water, which will in time cause corrosion;
- If you are taping over sharp edges, use self-amalgamating tape (silicone-rubber tape) will last longer than electrical tape;
- Wash all moving parts with fresh water to remove salt residue;
- Use a silicone-based lubricant regularly to keep moving parts free-running;
- Avoid contact between dissimilar metals due to galvanic corrosion (such as stainless steel and copper) – use an anti-corrosion paste when using screws or rivets, and use plastic tape to create a barrier layer between fittings;
- Rake out and renew sealant around through-hull fittings to prevent water ingress. If you are taking your rig down, remove deck fittings and re-bed on new sealant;
- **Get your rig professionally inspected and let your insurance company know!**

# Sailing Ropes – DO's and DON'Ts

## DO'S

- Check your ropes thoroughly including splices, tapers and joints;
- Check for abrasion points on your boat – a corroded fitting can cause chafing;
- Seal rope ends when cutting;
- Wash your ropes; why not put them into the washing machine;
- Dry your ropes once washed;
- Use the right rope for the right job.

## DON'TS

- Leave your ropes in direct sunlight;
- Use a soap which contains a bleaching agent while washing;
- Drag your ropes on the floor.





# The Mast & Boom

- **Weld and Rivets**

**Aluminum welds on the mast and boom** - inspect at critical stress points - look at the ends of the welds first.

**Rivets** – look for any that are loose or missing.

*P.S. If you are replacing rivets, replace with the next-larger size. If you are replacing one or two rivets holding a cleat or gooseneck ideally replace them all.*

- **Galvanic Corrosion**

**Galvanic corrosion** – occurs when two different metals are in contact such as stainless steel or bronze fittings (usually used for mast fittings).

**Check** – mast fittings: replace sealer, when necessary, with material such as zinc chromate paste, Teflon or nylon, to protect the mast from galvanic corrosion. Silicone does a good job of protecting the mast, but the fittings may be difficult to remove.

If a mast is painted, look for bubbles near fittings, which indicate corrosion. On an unpainted mast, look for white powder around fittings – this indicates corrosion.

# The Mast & Boom

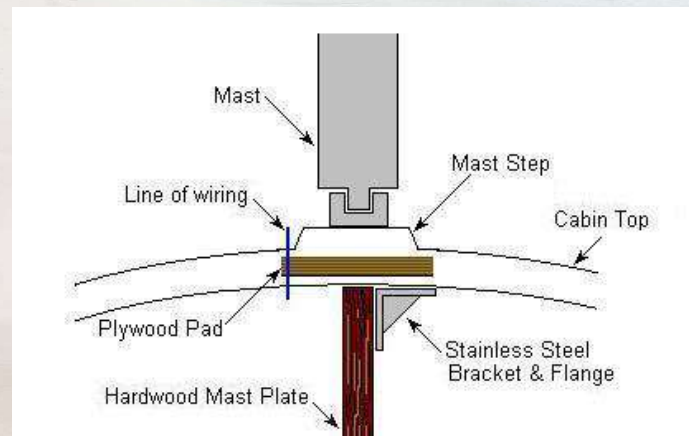
- **Wooden Masts**

Wood masts – they look nice but require more maintenance than aluminum masts. Wooden masts are usually made of spruce wood, a material that is light and flexible and has a good workability, but prone to rot.

Rot is easier to detect when a mast is varnished. Painted masts hide rot, but only for a while. Rot is most likely to appear around fittings.

Any areas that are badly discolored on a varnished mast, or won't hold paint on a painted mast, are suspect and should be sounded with a hammer for indications of soft wood.

Weep holes, used to drain water at the base of a box mast as it can become plugged with debris, leaving water to fester inside the mast.



## Standing Rigging: Stays and Shrouds

Stays and shrouds should have some "give", but not too much.

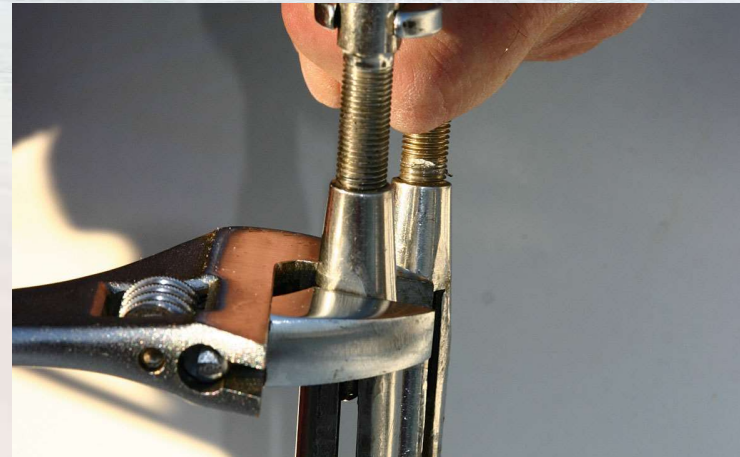
Check with the palm of your hand – a stay that is too tight feels rigid. A stay that is too loose feels limp.

Make sure any necessary adjustments are done evenly so the mast doesn't get cocked to one side. And adjustable (mechanical or hydraulic) backstays should be slackened when not in use.

**Remember, turnbuckles should have sufficient thread inside the barrel.**

Wires – look for broken strands or "fishhooks" by wrapping a piece of paper around the wire and running it up and down. If the paper shreds, the wire is nearing the end of its useful life and should be replaced.

Check the wire where it enters the fittings for rust, which also indicates weakened wires that should be replaced.



## Standing Rigging: Stainless steel routine cleaning

Routine cleaning is imperative for the stainless components on your vessel.

Remember that there is a reason it is called “**Stain-LESS**” and not “**Stain-NONE**”!!

Use fresh water to rinse accessible stainless-steel rigging and lifelines after returning from sailing.

Stainless steel rigging, lifelines and fittings also need to be cleaned and polished several times per year. A simple wipe down is sufficient – any rusty spots should be polished out.

While cleaning stainless steel rigging, keep an eye out for any corrosion, pitting, cracks, and of course broken strands on the wire rigging.

Look for spots with discoloration or rust as a crack in the stainless will generally promote rust. Any areas showing signs of rust should be thoroughly cleaned, polished and inspected to confirm there are no hairline cracks.



# Standing Rigging: Stainless steel routine cleaning

## THE DO'S AND DON'Ts OF CARING FOR STANDING RIGGING

**DO** – Rinse with fresh water and a water-soluble detergent.

**DO** – Inspect all unusual stain and corrosion spots before, during and after cleaning.

**DO** – Use spreader boots, turnbuckle covers, and chafe tape where chafing or snagging is possible.

**DO** – Ask a rigger or a surveyor about any unusual signs of corrosion, stress, or cracks found in the rigging.

**DON'T** – Use a cleaner containing chlorine as it is destructive to stainless steel.

**DON'T** – Use a steel wool or scrubbing pad to remove stubborn stains.

**DON'T** – Wrap rigging or terminals with tape as that deprives the stainless of oxygen and promotes corrosion.

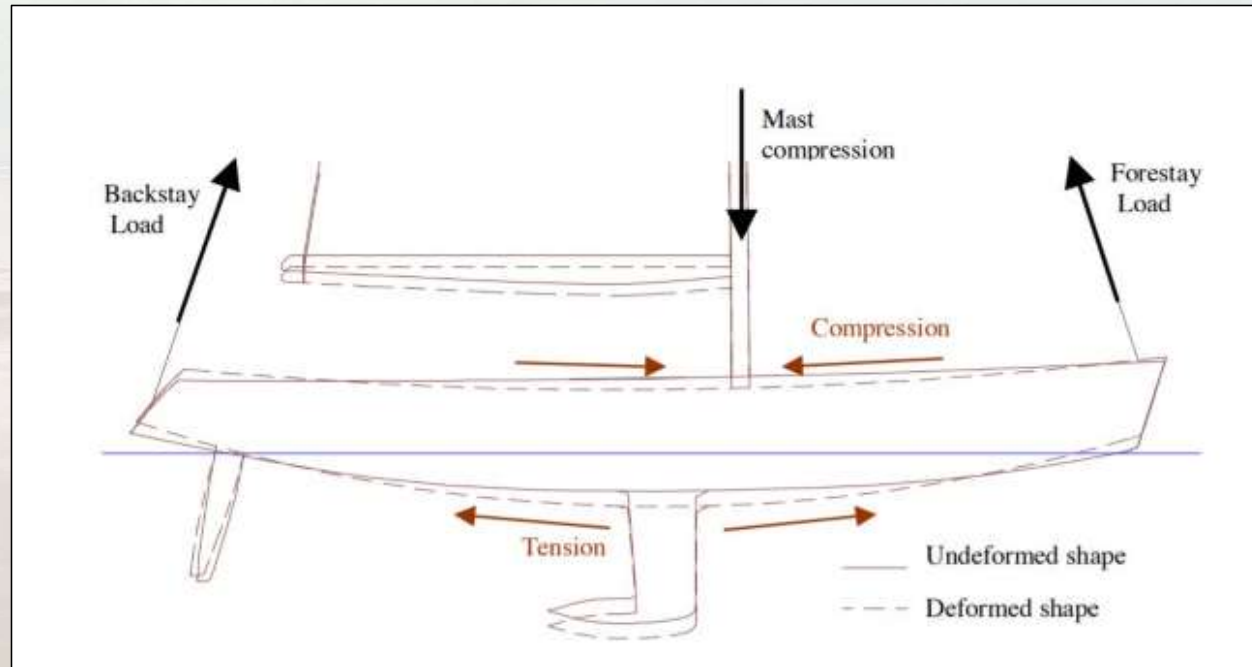
## Quick Sail Check

- **Inspect all attachment points of the sail** - Take a close look at corner attachment points including reefing systems. Investigate any damage at these points and evaluate suitability for continued use.
- **Look over all edges of the sail** – So much can be gained in understanding the life of a sail by examining its edges, which can provide insight into any stretching or misshaping, or potential UV damage.
- **Evaluate entire sail for chafe, tears and damage** - including not only the body of the sail but also batten pockets, leech reinforcements, etc.
- **Assess entire sail for UV damage** – Some exposure is normal, but one must be careful. Ask for professional advise.

Sail checks can also indicate other potential rigging or tuning issues based on evidence of wear. A simple annual sail check by a professional can save you money by avoiding replacing sail!

## Tensions & Stress Points

Tension loads in forestays, and backstays and the compression force of the mast bend the hull and put the deck into compression and the hull bottom into tension. The movement caused by the rig loads has its maximum at the position of the mast base, that is why stress cracks are always noted in such area.







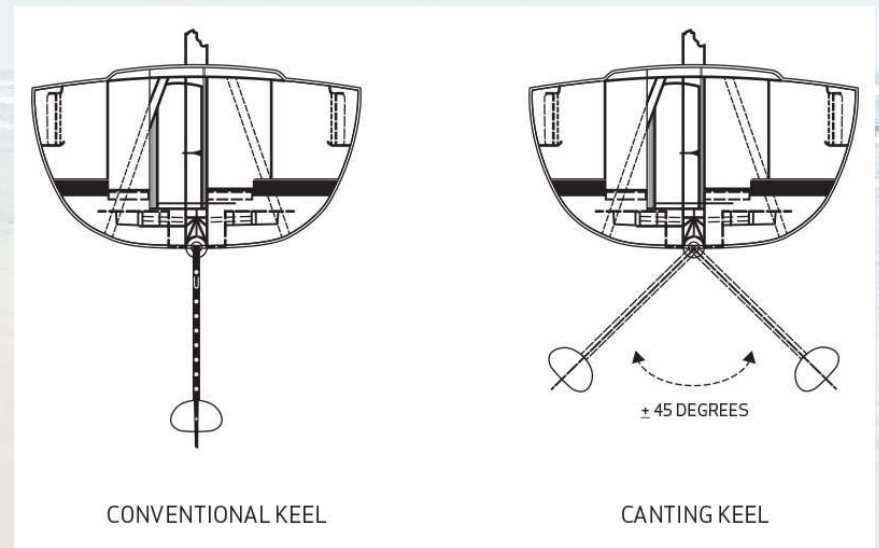
A photograph taken from the interior of a ship, looking out through a window. The view shows a vast expanse of deep blue ocean meeting a clear blue sky at a distant horizon. A thin layer of white clouds is visible just above the horizon line. The text "KEEL & KEEL RETENTION BOLTS" is overlaid in white, sans-serif font across the lower-middle portion of the image.

KEEL & KEEL RETENTION BOLTS

# Keel & Keel Retention Bolts

When a boat loses a keel at sea the first reaction is often to blame the keel bolts however data shows that since 1984 there have been confirmed **72x** cases of boats losing their keels. There were defined causes in 44.5% of cases, but only **(3x)** were attributed to keel bolt failure. Other causes included welded fin failures (**11x**), grounding collision (**8x**), internal structure (**8x**) and canting keel system (**2x**).

This may be reassuring, BUT it does indicate that our checks need to be wider than just looking at keel bolts.





## Checks

Look for swelling or splits around the keel – check the leading edge and underside of the keel where it may have hit obstructions.

Cracks/damage can let water in round the ballast, and iron ballast will swell as it rusts and can split the ballast top or cause humps in the hull.

Lead won't rust or swell, but trapped water will swell if it freezes. If you suspect the keel has hit something, check internal structures for cracks and delamination.

Excessive fatigue on keel bolts should only be an issue where corrosion has removed load-bearing area from the bolts.

Time will tell how long modern hulls last, and no boats seem immune to manufacturing defects. In all cases, small failures can allow the keel to move and this can in extreme cases spread to separation of structures, loss of strength and ultimately to keel loss.



External checks with the boat ashore

**Is there a gap between the keel and the hull?**

Look at the hull-to-keel joint; check if there is a gap between the keel and the hull.

Does the gap close when the boat is put down? *A hairline crack in the antifouling is normal at a hull-to-keel joint, especially if flexible sealant has been used to seal the joint.*

Gap at the aft end of a fin keel. The keel moved at least 5mm as it touched down. Sealant had clearly been added externally.





### Are there rusty streaks from the hull-to-keel joint?

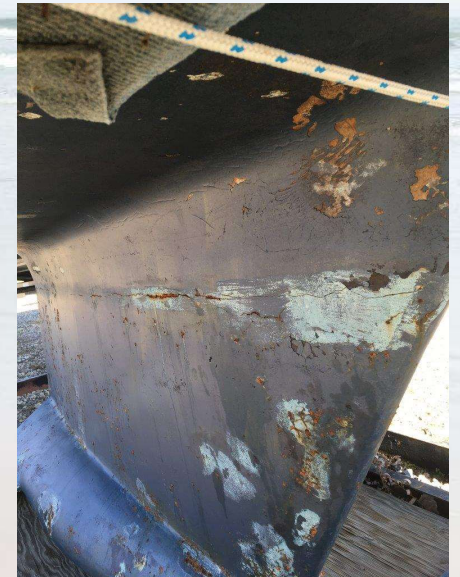
It can be hard to judge the origins on an iron keel, but rust streaks on a lead keel with stainless steel bolts must be taken seriously.

### When the hull has dried out, is there water still leaking from the hull-to-keel joint?

This is a clear sign that, at the very least, the seal has failed.

### Can you see cracks or damage on the hull?

The keel may have moved and dislodged some paint. You may have to remove the coatings to expose the hull, but in some cases the cracks are visible through the coatings.

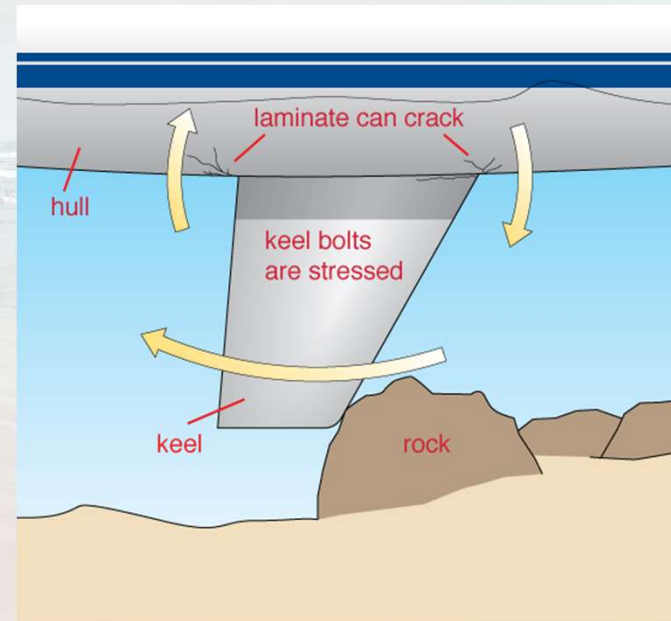


## Can you make the keel swing?

Another obvious test is to push the bottom of the keel to see if you can move it. Does it swing when you let it go?

## With the boat resting on the keel, can you see any upward deflection of the hull?

This can sometimes be seen aft of the keel where the hull should be flat and is less likely if there is a keel stub.





## Internal checks with the boat ashore

### Is there water in the bilge?

Leaking keel bolts are a sure sign that all is not well, particularly with stainless steel. Check for other more obvious leaks, including the plumbing, to eliminate them before tackling the bolts.

Look at the keel bolts, nuts and washers - use a wire brush to remove built-up crusting and debris.

Nuts can be removed to allow inspection of the threads below - recommended to replace all nuts when removed.

Rust stains round stainless bolts should be taken more seriously. If you believe your stainless-steel keel bolts have been wet for some time, you must suspect that they are corroding and take action to investigate.



## Is there any sign that the bolts have moved?

Check for significant marks on the hull which may indicate this.

## Are the nuts loose?

Quick application of a hammer or spanner may reveal a lot.

Glassed-over studs may have rust stains visible, and a light hammer may reveal one that sounds different from the rest.

## Do the sole boards fit, and do the doors still open and close?

Both would indicate that the hull has changed shape. It could be that structures have been weakened or deformed.

Look closely round the structures that support the keel. Cracks are a sign of movement beyond design, and a light hammer can be used to find areas where the structures have deformed, and hull delaminated.

## Are there obvious signs of repair? Are there any record of previous repairs?

Poor finish and different colours are easy to see (as is dust) in hard-to-reach spaces. Signs that the keel was not removed, such as resin over the keel bolts or repair edges around the keel bolts, might be signs of inadequate repairs.

Painted studs and nuts may be a sign of good maintenance but could also be an attempt to hide something.





A photograph showing a wide expanse of blue ocean under a clear blue sky. The horizon line is visible in the distance, with a thin layer of white clouds just above it. The text "ON DECK SAFETY ARRANGEMENTS" is centered in the lower half of the image in white, bold, uppercase letters. The image is framed by dark grey or black vertical bars on the left and right sides, suggesting it's a view through a window or a screen.

# ON DECK SAFETY ARRANGEMENTS



# On Deck Safety

## *Lifelines*

- The lifeline is the link between the sailor and his boat and is the point of attachment of the harness lanyard when moving around the deck. It must therefore be accessible, practical and solid.
- Coated lifelines are prone to corrosion – inspect them carefully, especially where they pass through stanchions, where the coating often cracks. Check terminations and make sure the split rings are in good shape.
- Lifelines should be installed as close as possible to the boat's centerline. It will be well tensioned so that it doesn't float in the wind or give slack in the waterfall. But not too tense either, otherwise we wouldn't be able to get the carabiners through it.



### *Lifelines – Regular Maintenance*

- Like all fibers, lifeline straps **do not** like UV light. They deteriorate over time. Manufacturers advertise a 2-year life span if you do not stow your lifelines when you are not sailing.
- Rinse the lifelines with plenty of water (to desalinate them), dry them before storing them away from light and humidity.

Changing your lifelines at least every 5 years is not a luxury. And if you don't, at least as a rigger/sailmaker to check them.





## Deck Gear

- Hose down all your blocks, turnbuckles, and traveller cars with freshwater and make sure they turn freely.



## Deck Gear – Rope Clutches

Flush rope clutches through with fresh water and let dry – it is recommended that a silicone-based grease is applied only for the handle.

If the halyard or control line is slipping, try and look at the cam face inside for wear. The handles can also fail on older rope clutches; as such be careful about signs of fractures around the pivot point.



## *Deck Gear – Stanchions*

Assess the current state of the stanchions, the pushpit and pulpit together: all the deck fixings, the stanchions in their bases and the overall alignment and through holes.

There is a tendency for the stanchions to lean inboard due to excessive tension over a long period which you may need to address.

### **Rust or corrosion will normally occur:**

1. On the section of wire that immediately protrudes from the PVC coating.
2. On the wire immediately adjacent to the wire terminal
3. On any section of wire where the PVC coating has been compromised and allowed water ingress.

Problems are likely to arise where the wire is unnaturally bent and exposed to chafe.





Plain or bare wire is more easily inspected for signs of damage or imminent failure.



Check also:

1. **Stanchions** – are they bent or damaged, are the eyes causing an ongoing issue with chafe, are they securely fixed into the stanchion bases?
2. **Stanchion Bases** – are they in good condition and with a strong and stable fastening to the deck or toe rail ?
3. **Pushpit and Pulpit Rails** – Is the welding on the attachment intact, are the deck fixings strong enough ?
4. **Lashings** – are they made off satisfactorily, are there enough turns to make up the requisite break load, has the rope suffered from UV deterioration or abrasion ?



A photograph of a vast blue ocean under a clear blue sky, viewed through a window. The horizon is visible with a thin line of white clouds. The text "FIRE & SAFETY SYSTEM" is overlaid in white, bold, sans-serif font in the lower-middle part of the image.

# FIRE & SAFETY SYSTEM

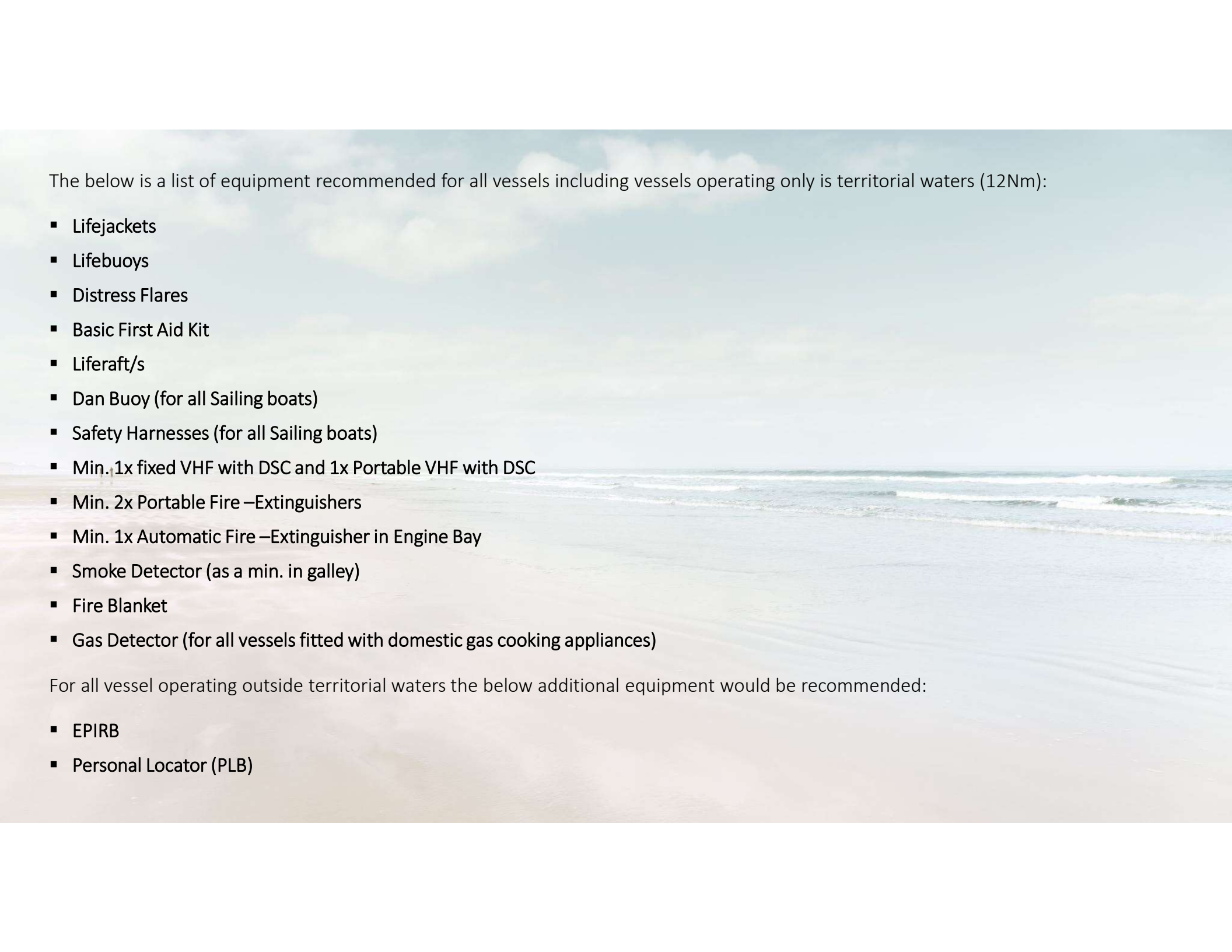
# Life-Saving Appliances

The safety of passengers and crew on boats is of paramount importance both on commercial as well as on recreational boats. Therefore, all crafts irrespective of their type of activities, size, location, etc. must carry appropriate life-saving appliances, to be used by passengers and crew in case of emergency to protect their lives at sea.

Whilst noting that presently there are no rules and regulations for the carriage of life-saving appliances for recreational crafts registered under the Malta Flag, the provision of basic equipment is still recommended and most of the Insurance Companies/Underwriters do require basic life-saving equipment.

**VERY IMPORTANT** – Keep in mind that the location where the equipment is stored is very important.

Safety equipment should be easily accessible, stored in dry areas, not stored in high-risk areas, and Safety Signage and Notices are also very important so that all persons onboard are aware of the location of equipment in case of emergency.



The below is a list of equipment recommended for all vessels including vessels operating only in territorial waters (12Nm):

- Lifejackets
- Lifebuoys
- Distress Flares
- Basic First Aid Kit
- Liferaft/s
- Dan Buoy (for all Sailing boats)
- Safety Harnesses (for all Sailing boats)
- Min. 1x fixed VHF with DSC and 1x Portable VHF with DSC
- Min. 2x Portable Fire –Extinguishers
- Min. 1x Automatic Fire –Extinguisher in Engine Bay
- Smoke Detector (as a min. in galley)
- Fire Blanket
- Gas Detector (for all vessels fitted with domestic gas cooking appliances)

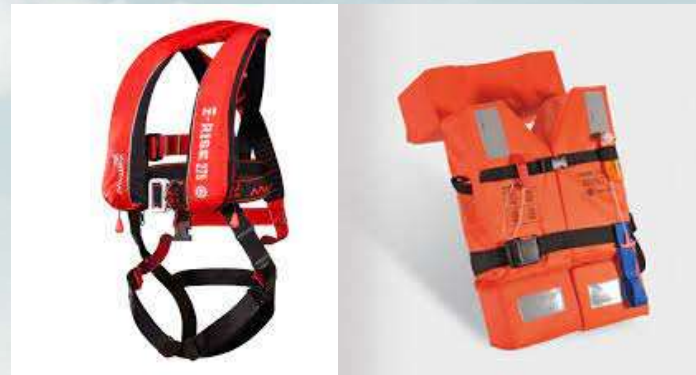
For all vessel operating outside territorial waters the below additional equipment would be recommended:

- EPIRB
- Personal Locator (PLB)



## ▪ Lifejackets – Rigid or Inflatable

- Lifejackets – when choosing a lifejacket, it is necessary to choose one that fits; it is neither too tight nor too loose, so it can be of help preventing the person wearing it from drowning automatically, or as soon as it is inflated.
- Rec. lifejackets buoyancy is **150N for adults** and **100N for children**.
- Inflatable lifejackets – keep in mind that CO2 cylinders should be checked regularly and replaced as recommended by the manufacturer.
- Rec. Quantity: Not be less than **120%** of the total no. of persons for the which the boat is certified.



## ▪ Lifebuoys

- Place them in such a way that they are easily accessible on both sides of the boat;
- **They must by NO means be permanently fastened.**
- Rec. lifebuoys marked with reflective tapes, and with Name and Port of Registry.
- In case of small craft one lifebuoy with buoyant line with suffice; on larger crafts and additional lifebuoy with self-igniting light is also recommended.
- Horseshoe lifebuoy are also efficient and effective.



- **Flares / Pyrotechnics**

- Rec. Min. a set of 6x pyrotechnics: 2x Parachute Flares; 2x Red Hand Flares and 2x Buoyant Smoke Signals.
- Storage: to be stored in the navigation bridge or in a Muster station;
- Important to be stored in a dry bag away for water and humidity.
- **Distress flares and rockets should be used cautiously.**
- In the event of a signal failing to operate maintain it in a firing position for at least 30s. After this time if it still has not operated remove end caps and either place in a bucket of water or throw into the sea.
- **Always verify the expiry dates!**



- **First Aid Kit**

- First Aid Kits provide temporary assistance in case of emergencies. A properly stocked first aid can probably save a person's life.
- A first aid kit is a must on a boat
- **Be careful – DO NOT to make use or give medications/drugs to anyone without his consent or without know his medical history including allergies.**
- **Always verify the expiry dates!**





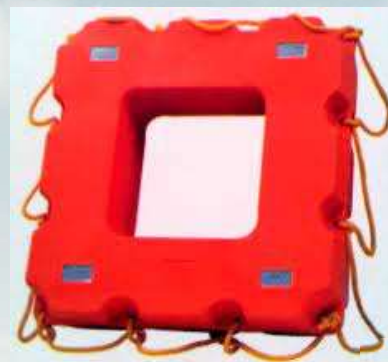
## Life rafts

- Type of life rafts depends on the type of boat (recreational/commercial) and intended navigation area.
- **Rigid type** are recommended for a range up to 3Nm
- **ISO 9650** and **SOLAS B** are intended for coastal and offshore navigation
- **SOLAS A** are intended for ocean-going.
- Life raft must be stored in a float free area and recommended also to be fitted with a hydrostatic release unit.
- **Also keep in mind that some life rafts may be heavy as such it is very important not to store life rafts in areas such as cabins, saloon, underdeck, etc.**

Approximate lifespan: 10 - 15 years – *it is important to remember that the lifespan of a life raft can be significantly affected by how well it is cared for and maintained.*

Life rafts are to be serviced at regular interval by shore-based approved service stations in accordance with Manufacturer specifications –

**ALWAYS ask for a servicing certificate.**





## ■ Dan Buoy

- Designed for the purpose of marking a boat/yacht's location when person falls overboard.
- There is no need to set or activate the SOS Dan Buoy – just throw it into the water, towards the person overboard.
- Throw the SOS Dan Buoy into the water and within seconds of immersion, it inflates, and stands 2.0 meters above the waterline, highly visible up to 1,700 meters.



## ■ Safety Harnesses

- Harnesses are either stand-alone or integrated with offshore type inflatable life vests.
- Tethers clip you to a fixed-location pad eye or to jacklines (also called trolley lines or jack stays); always check their condition before use.
- Be sure that your safety tether isn't so long that you could get thrown overboard while you're clipped onto something.



- **VHF**

- VHF DSC radios are available as fixed radios attached to a vessel or as handheld, personal radios. It is recommended to have both types aboard.
- Fixed radios are generally more powerful and have a better range than handheld radios.
- The fixed radio's range is greatly improved when its antenna is fixed to the top of a tall mast.
- Handheld radios are smaller, portable, most are waterproof and can be very useful in an emergency.



A VHF DSC radio allows users:

- to communicate with shore-based VHF users such as the Coastguard, harbor masters, and marinas
- to dial up other vessels by using a unique identity number
- to have one to one conversations with other vessels
- to send distress alerts at the touch of a button
- to automatically send your vessel's identification number and position to others

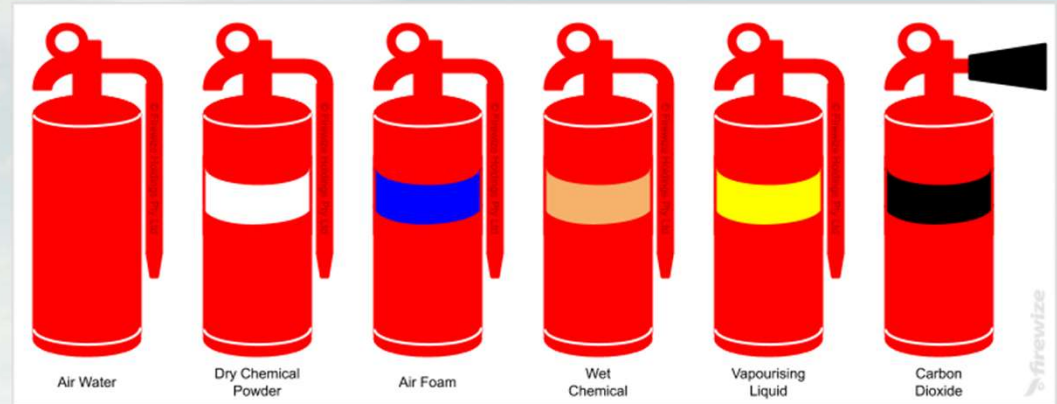


- **P.S. AVOID USING OFFICIAL CHANNELS FOR BOAT-TO-BOAT COMMUNICATION UNLESS IN DISTRESS**

## ■ Portable Fire-Extinguishers

There are six types of fire extinguisher;

1. Water;
2. Air-Foam;
3. Wet Chemical;
4. Dry Chemical Powder;
5. Carbon Dioxide and
6. Fire extinguishers used in special applications such as aircraft and medical equipment.



The selection of an extinguisher must be made with the class of fire in mind.

Fires are classified according to the type of fuel and if live electrical equipment is present. The classification of a fire is important, as it influences the selection and use of the correct extinguisher required to extinguish a fire. The six classes of fire are:

1. Class A - Ordinary Combustibles (paper, wood, cloth, plastics, etc.)
2. Class B - Flammable and combustible liquids
3. Class C - Flammable gases
4. Class D - Combustible metals
5. Class E - Electrically energized equipment
6. Class F - Cooking oils and fats

**FOR YOUR OWN SAFETY – I STRONGLY DISCOURAGE THE USE OF DISPOSABLE FIRE EXTINGUISHERS**



	<b>Class A</b> Flammable Materials	<b>Class B</b> Flammable Liquids	<b>Class C</b> Flammable Gasses	<b>Class D</b> Flammable Metals	<b>Class E</b> Electrical Equipmer
<b>Water</b>	✓	✗	✗	✗	✗
<b>Dry Chemical Powder<sup>1</sup></b>	✓	✓	✗	✗	✓
<b>Carbon Dioxide</b>	✓	✓	✗	✗	✓
<b>Foam</b>	✓	✓	✗	✗	✗
<b>Wet Chemical</b>	✓	✗	✗	✗	✗
<b>Vapourising Liquid</b>	✓	✓	✓	✗	✓



Limited Effectiveness



Not Effective

<sup>1</sup> Dry Chemical Powder Fire Extinguishers are available in three variations AB(E), B(E) and ABC(E). This table displays the effectiveness of the AB(E) variation.



- Using a Fire Extinguisher

A first responder should undertake the following actions:

1. Choose the correct type of fire extinguisher for the class of fire.
2. Make sure the area is safe to access, and that there are no other immediate hazards to safety.
3. Contact the emergency services.
4. To use the fire extinguisher, follow the acronym **PASS** - **Pull, Aim, Squeeze, Sweep**.
  - a) Pull the pin of the fire extinguisher;
  - b) Aim the extinguisher at the base of the fire;
  - c) Squeeze the handle;
  - d) Sweep it back and forth.
5. After the fire has been extinguished it may reignite. If it is safe to do so, secure another fire extinguisher and watch the scene of the fire until the emergency services arrive.

## ■ Maintenance of Fire Extinguishers

- Portable fire extinguishers are subject to periodic inspection, tests and preventative maintenance activities.
- Record inspections - stamp or mark tag/label, securely fixed to the fire extinguisher to represent the maintenance activity performed;
- Fire extinguishers are pressure units - they require also to be discharged, inspected and tested for any condition that is likely to render the unit dangerous or unsafe.
- It is not enough to check that the pressure gauge is indicating that the extinguisher has not been discharged – periodic inspections are to be carried out by shore-based approved service stations.

ALWAYS ask for servicing certificate and for extinguishers to be marked.





## Automatic Fire Extinguishers

- The main difference between a portable and an automatic unit is that instead of squeezing the handle to operate the extinguisher this is replaced with a glass bulb.
- The bulb contains a liquid that expands when subject to heat; typically 68° Celsius, the bulb bursts and the extinguishing agent is released. The extinguisher head acts as a sprinkler and effectively disperses the extinguishing agent across the area.
- Automatic fire extinguisher are also subject to regular servicing and inspections.

**ALWAYS** ask for servicing certificate and for extinguishers to be marked.



### ▪ Smoke Detectors

- Rec. to install a smoke detector in each of the following: Galley, accommodation space, above the electrical panel and engine room / generator compartment.
- On large boats it is recommended that battery type detectors are avoided and wired detectors are instead fitted and connected to a centralized fire-panel.

**Note:** In the galley, smoke detectors should be installed at least 10 feet away from cooking appliances to minimize the number of false alarms. Smoke rises, so smoke alarms should be placed high on walls or ceilings.

### ▪ Gas Detectors

- LPG is heavier than air and will remain in low places - fixed very low at around 30cm from the floor and close to the gas system.
- The detector just needs a 230V supply cable to power it up. In an alarm situation the detector will have a red LED and an acoustic buzzer on.
- Battery operated detectors are recommended only on small boats, while on larger boats detectors are to be wired and ideally connected to the fire panel and/or general alarm.

### ▪ Fire Blankets

- A fire blanket is a sheet of woven fire-resistant material designed to extinguish small fires.
- Fire blankets are usually made from woven fibreglass and work by smothering the fire and cutting off its oxygen supply.
- In case of use leave the fire blanket for around 30 minutes to allow it to cool and avoid re-ignition.

- **EPIRB**
- Emergency Position Indicating Radio Beacon (EPIRB) is a device to alert search and rescue services (SAR) in case of an emergency out at sea.
- It is tracking equipment that transmits a signal on a specified band to locate a lifeboat, life raft, ship or people in distress.
- The signal consists of an encrypted identification number (all in digital code) which holds information such as the ship's identification, date of the event, the nature of distress, emergency contacts and the position.

The signal could help you locate the transmitter even if it is 3 miles away. The vessel or the individual in distress could be identified **ONLY if the EPIRB is registered with the respective Flag.**

The EPIRB should be tested once a month to ensure operational integrity. The procedure to do so is as follows:

- Inform the competent authorities;
- Press and release the test button on the EPIRB;
- The red lamp on the EPIRB should flash once;
- Within 30 seconds of pressing the button, the strobe, as well as the red light, should flash several times;
- After 60 seconds of operation, the EPIRB will switch off.



## Maintenance of EPIRB

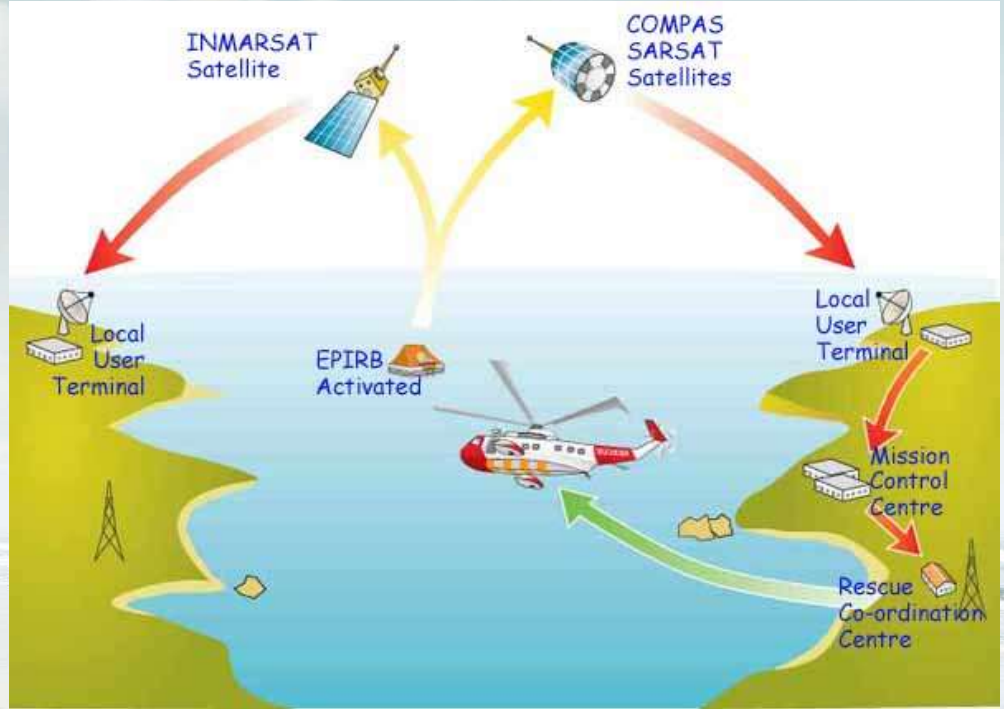
1. The unit must be inspected visually for any defects such as cracks;
2. Clean the unit occasionally with a dry cloth; While cleaning, the switches must be specifically checked;
3. The lanyard of the EPIRB must be neatly packed into the container of the EPIRB without any loose ends dangling about;
4. The expiry date of the battery must be checked – in case of expiry the battery is to be replaced by a competent authority.
5. If the HRU has crossed its expiry date, the HRU is to be replaced. HRU must be marked with an expiry date 2 years into the future.

An annual performance test by an authorized radio surveyor is highly recommend.

**BE VERY CAREFUL when disposing of an EPIRB as it can still be active and release a distress.**

## ▪ Personal Locator (PLB)

1. PLBs are EPIRBs but for individual entities. These indicate distress for an individual not in the proximity of emergency services. PLBs work like EPIRBs and transmit on the COSPAS SARSAT satellite system at 406.025 MHz.
2. PLBs are smaller in size as compared to an EPIRB.
3. They should be kept in a safe place on the vessel, in a ditch bag or in an easily accessible spot. Some have strobe lights and can be manually or auto activated.
4. Once activated, PLBs transmit for a minimum of 24 hours, while the battery life on an EPIRB is at least double (a minimum of 48 hours). An EPIRB is registered to a vessel, whereas a PLB is registered to an individual.
5. The EPIRB is one of THE MOST important emergency pieces of equipment available onboard in the case of distress.



A photograph of a vast blue ocean under a clear blue sky, viewed through a window. The horizon is visible with a thin line of white clouds. The text "ELECTRICAL SYSTEMS" is centered in white, uppercase letters over the water.

# ELECTRICAL SYSTEMS



# Electrical System – Basic Checks

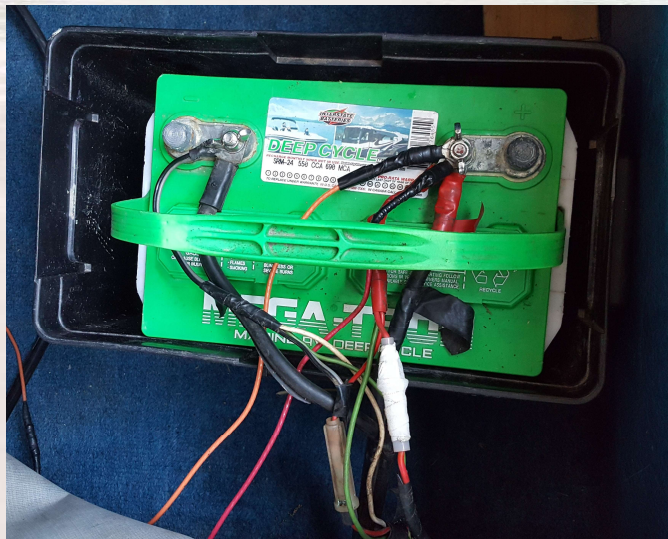
After engine breakdowns, electrical failure is the second most common reason for a yacht becoming stranded.

*If you have problems with your marine electrics, start with checking the batteries!*

- Should you ever suffer total loss of power, the obvious place to start troubleshooting are at the batteries.
- If your battery terminals are corroded or covered with acidic residue (often caused by lack of ventilation), loosen and remove all connected cables, taking care to mark their designation first.
- The key to easy troubleshooting is to label every cable indelibly, ideally using a wiring diagram.



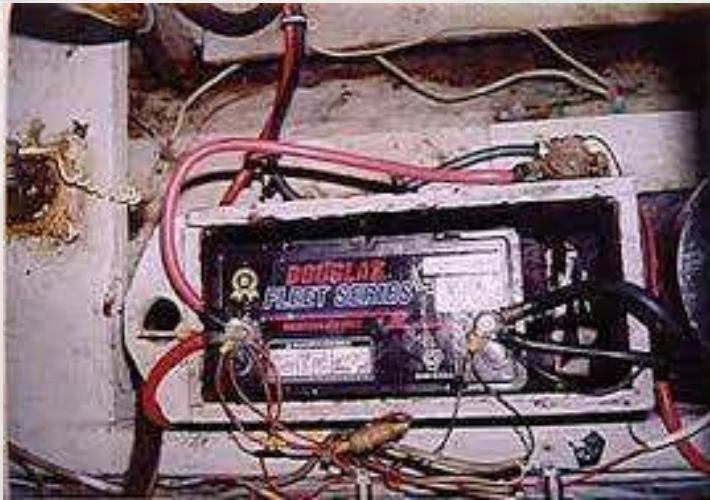
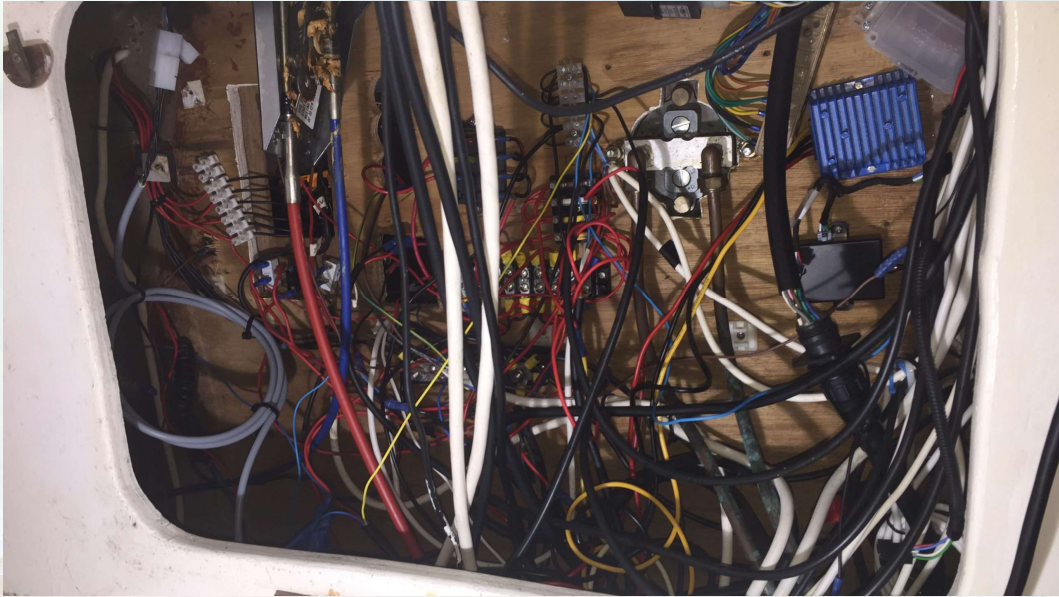
- Wipe the battery terminals with a damp cloth, before lightly abrading with fine emery paper (not wire wool or wire brush) and smearing them with silicone grease before re-tightening each connection.
- Loosen the terminal clamping bolts before putting them back onto the terminals, ensuring they mate together well.
- If there are too many connections made directly to the battery terminals, then complications can arise.
- A better method is to use positive and negative bus bars, taking a single cable to the bus bar from each battery terminal, with the appropriate large fuse in the positive feed.
- This will allow you to use proper crimped and insulated terminals, preferably the heat-shrink sealed type.











## Cabling problems

- If your batteries are charged and there is power at the switch panel but not reaching the device – buzz the cable through with a multi-meter or a small battery and bulb.
- Check that the terminal at the switch is clean and securely connected.
- If there is power at one end and not at the other then check the fuses, circuit breakers or dubious junction along the line.
- It is not unusual to come across cabling that is too small for the job, often caused by owners adding extra items to the circuit without upgrading the cable size.
- If you come across a blown or burned-out fuse or breaker along the line then check the maximum load against the cable's carrying capacity.
- If it has become too small for the increased load, then you'll either have to remove some of the load or upgrade the cable, making sure you replace both the positive and negative wires.

**Undersized cabling can lead to problems with your marine electrics and electronic devices.**



## Meters and battery monitors

- Having a Multimeter on a boat is not a leisure but a requirement.
- Simple ones are cheap and often adequate for basic tasks – ideally get one with a DC clamp ammeter that will enable you to measure current flow through a cable without having to disconnect any wires.
- A battery monitor fitted can be very helpful. It will indicate at a glance (some even remotely on a smartphone) what current is going in and out of the battery bank and its approximate State of Charge.
- A lead-acid battery of any type should never be discharged below 50% of its capacity or it will die prematurely. Lead-acid batteries also like to be fully recharged on a regular basis. Partial recharging is one of the most common causes of premature battery failure.
- Open cell, flooded batteries need checking and topping up with distilled water at least monthly, or weekly if you draw heavy loads and regularly cycle them.





## Alternator problems

- Alternators fail occasionally – knowing the symptoms of a bad boat alternator prior, you can extend their life.
- Signs of a bad boat alternator are your battery keeps dying often, and the voltage drops below 13.5V.
- Overheating and a bad smell from the alternator will indicate that there is a problem with the unit.
- Alternators normally fail “partially,” where it just puts out a lower-than-normal voltage. If the alternator is dead, the most likely culprit can be the brushes.
- Most of the time you must change the brushes inside.
- Importantly look at the connections because fixing the connection between the battery and the alternator or others may be all you need to do after all.
- Note: Putting excessive pressure on a smaller alternator will cause damage, so the rule of thumb is to use one that accommodates your boat needs and don't buy a smaller one due to less price.

## Heavy Loads

- A 1kW hair dryer will pull around 100A, a microwave 150A and a fan heater 200A+, thick cabling with high quality fuses and terminations are required to prevent a poor connection dragging the system down.
- Bow thrusters and anchor windlasses are demanding – some boats wire them to the engine start battery, but this usually requires a very long length of large-diameter cable from stern to bow.
- Saving on the size causes voltage drop, which in turn raises the current and often burns out cables and breakers, causing fires.
- Others have separate batteries forward to take the load over shorter cables, but this presents problems charging them. To take charge from the alternator forward to the bow battery requires pretty large cables too, particularly when the engine is running and your bow battery is low, forcing the alternator and start battery to provide much of the current required.

## SOLAR Problems

- Solar power brings a new set of complications, the most common being low charge, almost always due to panel shading, undersized wiring or poor connections.
- When connecting up a controller with screw-type terminations, it's better to crimp to the wire to provide a solid connection against the bare screw.
- Always tug at the cable when you've finished to ensure it is properly secured.
- Another common mistake is connecting the panels to the controller before wiring the controller to the batteries. Solar controllers need to be connected to the battery first so they can sense the system voltage and set themselves up with the correct parameters.
- Doing it in the wrong order often means the controller doesn't fire up and can damage the less-protected models.



## Recommended Spares and Essential Tools on a Boat

- Alternator belts
- Cables of various size
- Terminal blocks
- Crimp terminals
- Heat-shrink
- Fuses
- Cable-ties
- Insulating tape
- Multimeter
- Test leads with croc clips
- Car headlight filament bulb
- Heavy-duty jump leads
- Head torch
- Wire cutters/strippers
- Crimpers
- Regular pliers
- Longnose pliers
- Range of screwdrivers

A wide-angle photograph taken from inside a ship, looking out through a window. The view is dominated by a vast expanse of deep blue ocean meeting a clear, light blue sky at a flat horizon. A thin layer of white, fluffy clouds is visible just above the horizon line. The text "ENGINE & ENGINE BAY" is overlaid in white, sans-serif font in the lower-middle portion of the image. The window frame is visible as a dark grey border on the left and right sides.

ENGINE & ENGINE BAY

# Engine and Engine Bay

Have you heard the expression: *“That engine room is so clean that you could eat off the deck”?*

One may say: **“Who cares?”**

Well, if your engine/generator or machinery space/engine bay are filthy dirty and corroded up, you won't notice those simple signs of things beginning to go wrong. Such as:

- Spotting leaks quickly
- Corrosion, damage and cracks become obvious
- Equipment life is maximized
- Smells including exhaust leakages that may drift into the cabins
- Mechanics/electrician will appreciate that you are making their job easier (*you may incur less labor charges if they can do the job quicker*)
- Minimizing the impact on the environment (oily water in bilges may end up at sea)



A wide-angle photograph of a beach. The foreground shows wet sand with ripples. The middle ground features waves breaking onto the shore. The sky is filled with soft, white clouds. The overall scene is bright and serene.

## Visual Checks

As a minimum, one would recommend daily engine checks while you're using the boat.

While you're down there and have time, cast your eye throughout the rest of the space as well looking for:

- Leaking joints;
- Evidence of oil or hydraulic fluid around the engine or in the bilge;
- Water where it should be dry;
- Corrosion or cracks;
- Loose or corroding battery terminals;
- Missing or loose nuts, bolts or screws;
- Sounds or smells that are unusual;
- Don't forget to check your raw water intake filters for your engines and generator.

## Boat Engine – Basic Checklist

As a minimum, one would recommend the following basic engine checks while you're using his boat.

### *Engine oil level check*

Confirm that the engine oil level is up to scratch

Carrying some spare oil for the engine is a wise precaution just in case a leak develops.

### *Cooling water check*

Confirm that the cooling level is up to scratch; Check the water level before you start up the engine.

Carrying some spare coolant just in case a leak develops.

### *Fuel filter check*

If your primary fuel filter has a glass bowl then a quick check to confirm that there is no water or dirt in the bowl.

### *Sea water intake filter check*

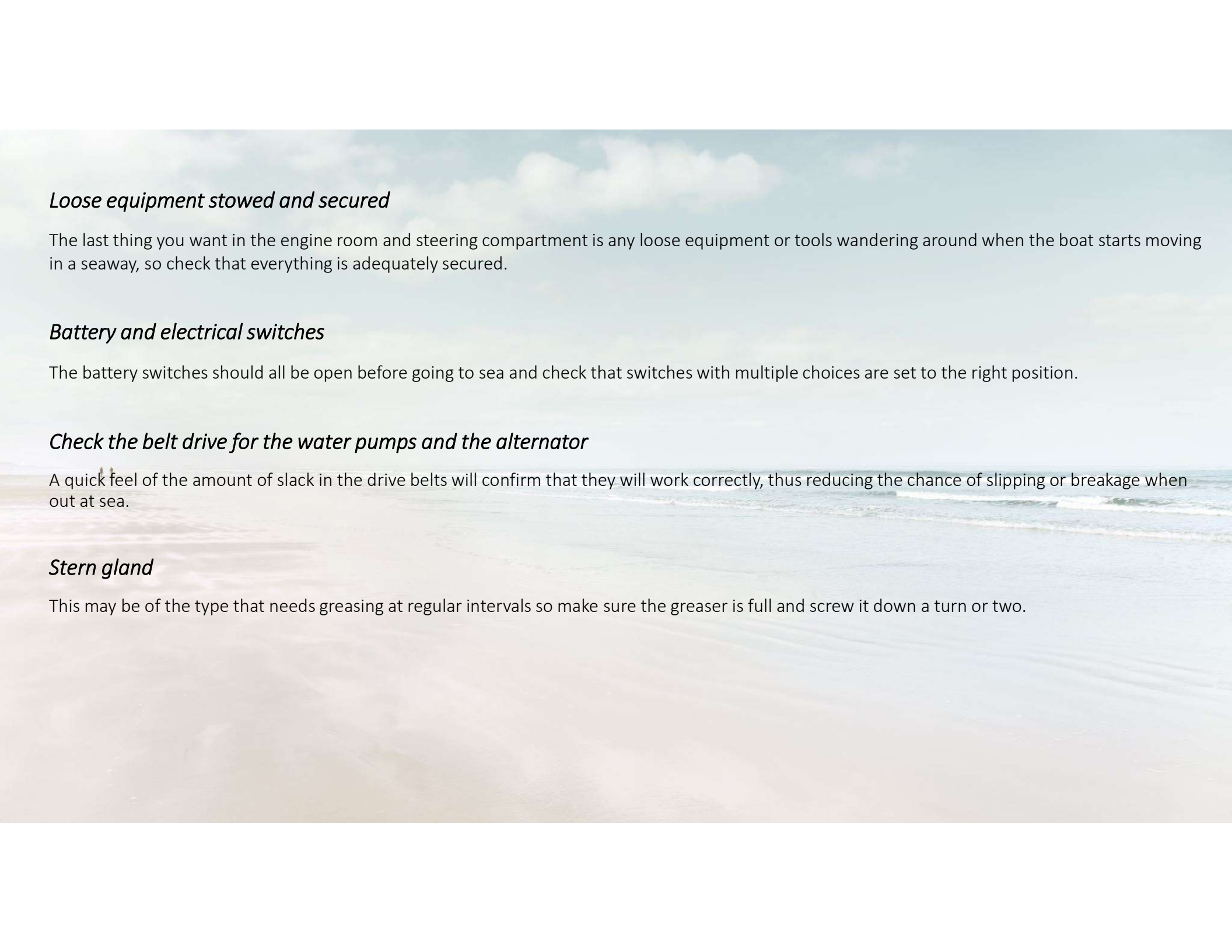
Most water intakes have a clear glass top so you can check that there is no debris or seaweed inside that might block the filter.

### *Seacocks open*

You will often close the seacocks when in harbor so make sure that they have been opened before you start the main engine.

Check that all other necessary seacocks are also open.





### ***Loose equipment stowed and secured***

The last thing you want in the engine room and steering compartment is any loose equipment or tools wandering around when the boat starts moving in a seaway, so check that everything is adequately secured.

### ***Battery and electrical switches***

The battery switches should all be open before going to sea and check that switches with multiple choices are set to the right position.

### ***Check the belt drive for the water pumps and the alternator***

A quick feel of the amount of slack in the drive belts will confirm that they will work correctly, thus reducing the chance of slipping or breakage when out at sea.

### ***Stern gland***

This may be of the type that needs greasing at regular intervals so make sure the greaser is full and screw it down a turn or two.



A great acronym to use is the following:

## **W.O.B.B.L.E.**

*W.O.B.B.L.E. stands for:*

*“W” = Water filters/sea strainers – look for obstructions*

*“O” = Oil levels in your engine(s) – check that it’s in the proper range*

*“B” = Belt(s) – check for correct tension and any damage*

*“B” = Bilge condition – look for water or oil that shouldn’t be there*

*“L” = Levels of your engine coolant,*

*“E” = Engine exhaust – check for good water flow from the exhausts*

## Water Filter

Water filters / Sea Strainers, protect your engines and other on-board machinery as such they need to be checked regularly.

To check a **filter first close the seacock to prevent sea water coming in, then open up the filter.**

Remove the strainer basket and clean it – take out any residues collected inside and give them a good backwash with clean water.

Covers/caps having a rubber seal must be checked for grit and splits or cracks. Ensure that it's firmly seated and secured.

Remember to turn the seacock back on and **Watch for leaks.**



## Oil Levels

Know where the dipsticks on your engines are so that you can check the levels. For instance some require the engine oil to be at operating temperature before dipping.

Carry a spare container of the oils you need for your engines, transmissions, hydraulic systems etc. so that you can ensure that they are always operating at their best.

### Oil Level



oil level  
at maximum  
note in Log



oil level  
below maximum  
top up and  
note amount  
added in Log



oil level well  
below minimum  
investigate reason  
for drop since last  
oil check  
top up and note amount  
added in Log



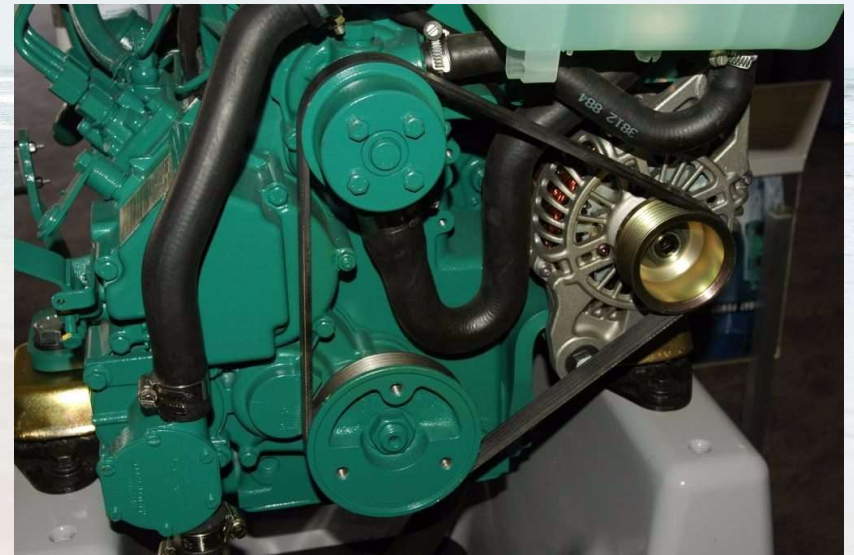


## *Belts*

Any lack of tension on the engine drive belts will reduce the efficiency and therefore cause overall problems with the engine and ancillary systems.

If the charging output from your alternator is reduced, the batteries may not be charged properly / if the freshwater coolant pump doesn't operate at full capacity, the engine may overheat.

Check your belts for damage and correct tension – belts that are damaged will often shed rubber particles about the engine room. Belts that are too loose often “yell” under load.



## Engine Exhaust

Upon starting, inspect the exhaust outlets for at least 30 seconds to ensure that there is a proper flow of water coming out.

If this water is substantially oily, rust coloured or smells of fuel and continues to be, then this is an indicator of a major problem.

**Check also for any possible exhaust leakages especially when exhaust pipes pass through accommodation and/or saloon areas.**

In case of exhaust pipes passing through such areas it is always recommended to fix a Carbon Monoxide Detector.





A photograph of a vast blue ocean under a clear blue sky, viewed from a ship's window. The horizon is visible with a thin line of white clouds. The text 'BILGES – BILGE CLEANING & BILGE PUMPS' is overlaid in white, bold, sans-serif font across the middle of the image.

**BILGES – BILGE CLEANING & BILGE PUMPS**



# Bilge Cleaning & Inspection

Check your bilges for signs of leaks from your engines and other equipment. Many boats will have some water in the bilge so look for signs of “oil slick” on the surface that may indicate oil, hydraulic fluid or fuel is leaking from somewhere. It could also be fresh water.

Keep your engine room and bilge spotlessly clean (and painted)! This will allow you to spot problems like this before they become either very expensive or hazardous.









Use a wire brush to scrub any rust and corrosion of the brass and metal fittings. Be sure to inspect the unit itself for cracks and damage to the hoses.

Once done, test all your bilge pumps and inspect them for any debris that may hinder/block the float switch.

For boats with raw-water systems, it's important to check strainers and seacocks. Exercise every lever to prevent seizing. Leave the system you're checking closed and remove the cover.





Scrub off any barnacles or corrosion with the wire brush, then reinstall and put the top back on. Remember to reset the seacocks to the proper position

Finally, spray any metal or brass with corrosion inhibitor.



# Bilge Pumps

The function of the bilge pump is to remove water that collects in the bilge; most of the time, water that is found in the bilge is incidental:

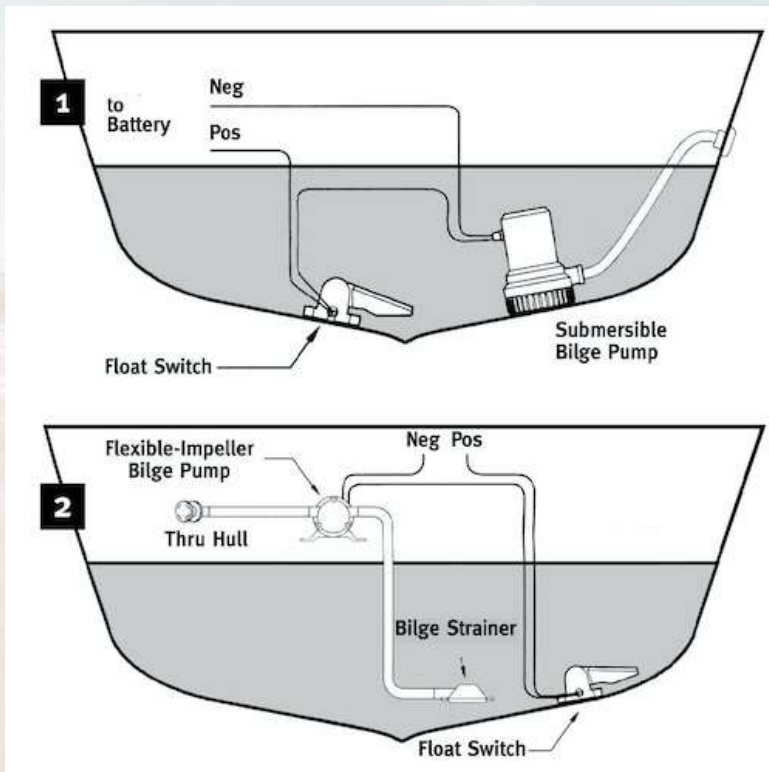
- It could be rainwater;
- Wash-down water that collects in the bilge while the boat is being cleaned;
- Or water from built-in refrigerators that drain to the bilge.

On larger boats, with built-in refrigerators, the lips around large hatches, and even drink holders may be drained overboard, but on smaller boats this water is simply routed to the bilge. Water may also collect in the bilge from minor leaks, such as water dripping from the shaft gland.



## Where should be bilge pumps located?

At least one bilge pump pickup should be installed at the lowest point in the bilge. Larger boats should have one in each enclosed area (watertight compartment) that can retain water. Discharge outlets are recommended to be a minimum of 8" (20cm) above the waterline.



All bilge pumps on the boat should be accessible, so you can inspect the pump and its float, and clear debris from around the pump pickup.

If the pump is located in a spot that's inaccessible or hard to reach, such as below the engine on a sterndrive boat, consider relocating it if possible.



## How and When Should You Turn on a Bilge Pump?

The pump may have a float or switch to turn it on automatically when water collects in the bilge. This is especially important if the boat is kept in the water, as you'll want the pump to activate after a heavy rain storm, for example. The pump may also just have a manual switch at the helm. Often the bilge pump switch has an "auto" and "manual" setting.

Regularly inspect the area around the pump for debris.

**Surprisingly, this is especially important on new boats, as all kinds of construction debris – sawdust and fiberglass dust, bits of foam and epoxy, even screws—can work its way back to the bilge.**

Periodically, check the function of the float switch, which can get crusty or corroded over time.

- Wiring for the bilge pump should be routed up to keep it out of the soggy bilge, and any wiring connections should be watertight.
- If the pump is not on frequently, check its function by running a little water into the bilge.

**It is NOT recommended that bilge pumps located in the engine bay are kept on "auto"; in some countries it is illegal to have that function as oily water may end up at sea.**

A photograph of a vast blue ocean under a clear blue sky, viewed through a window. The horizon line is visible, with a thin layer of white clouds just above it. The word "OSMOSIS" is written in white, uppercase letters across the center of the image.

OSMOSIS

# Osmosis

## What is Osmosis?

- A blister that is considered Osmosis is typically a result of moisture being trapped within the fiberglass below the gelcoat and or top coatings causing softening in those areas.
- **No yacht has sunk from Osmosis, but large blisters still weaken the laminate thus effect the hull integrity.**
- Peeling the gel coat is common but extreme and on its own often adds to problems. Blisters will return, even after peeling, if there are still voids in the laminates and uncured gel coat, more blisters will occur.
- The gel coat is a very effective water barrier and does not allow the passage of moisture, so it must be removed usually using a “Gel Peeler”. This removes a controlled thickness of gel coat/laminate leaving an even surface.
- To scrape the surface left by the “Gel Peeler” usually the peeled surface should be “grit blasted”. Thereafter the hull should be steam cleaned and washed regularly to ensure that the solutions are washed out. Following this an Osmosis treatment should be applied. This cures the uncured resin and reduces the chance of re-occurrence.



# How to Prevent Osmosis?

## High and Dry means NO osmosis!

The best way to prevent osmosis from damaging your boat is to take it out of the water! Boats that winter ashore for more than 2 months a year typically don't suffer this phenomenon.

When dry docking, you absolutely must rinse the hull with fresh water to prevent any salt from retaining moisture.

## It's better to plan for osmosis appearing!

For boats that remain afloat, applying a preventive anti-osmosis treatment every 10 years would be highly recommended.

This involves stripping all the antifouling layers, rinsing thoroughly with fresh water, allow adequate drying time (rec. 8 – 12 weeks) and carefully checking the hull's humidity level before you apply any treatment.

**This check is vital. In fact, applying a waterproof treatment to waterlogged hulls will only trap moisture in the fabric.**

## Make the necessary checks to avoid osmosis!

Blisters are the most obvious sign that the disease is in an advanced stage.

Treatment is lengthy, tedious and quite expensive - once out of the water, the entire hull must be stripped bare.

The gelcoat should be removed - once the polyester is bare and in open air, it should be washed with fresh water to rinse off the acetic acid.

Then begins the lengthy drying phase. This can last from 6 to 12 months depending on the humidity level in the air (if boat is covered and stored in a controlled environment this period may be less), during which the surface will have to be rinsed several times. Once the tester displays acceptable moisture readings, the hull should be coated to restore the surface to a good condition and finally treated with a durable epoxy coating.

# Precautions to Minimise Osmosis

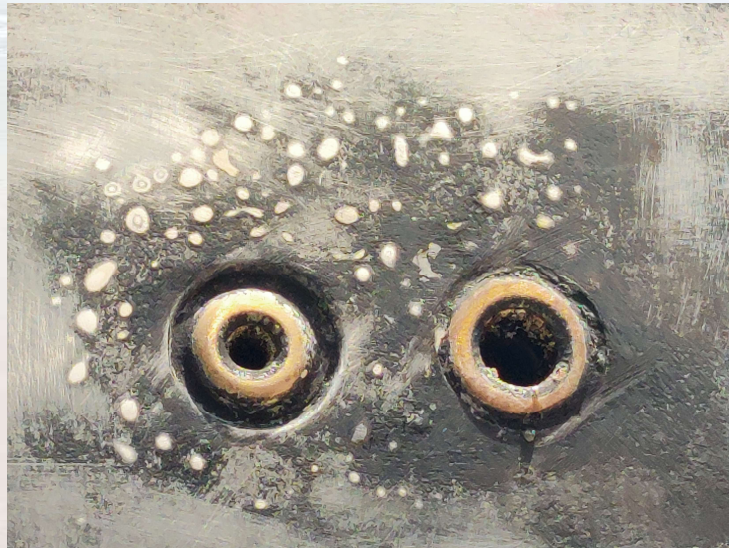
- Regular dry docking will prevent the polyester from becoming saturated with moisture.
- Some units from the early 90's are more sensitive to osmosis than others. When buying second-hand, make sure you get advice from an independent professional with the right measuring tools. Adequate drying time is very important to observe true readings!
- Applying an anti-osmosis treatment to your boat isn't going overboard either!

Faced with the reality that your boat will experience osmosis; you may react in different ways.

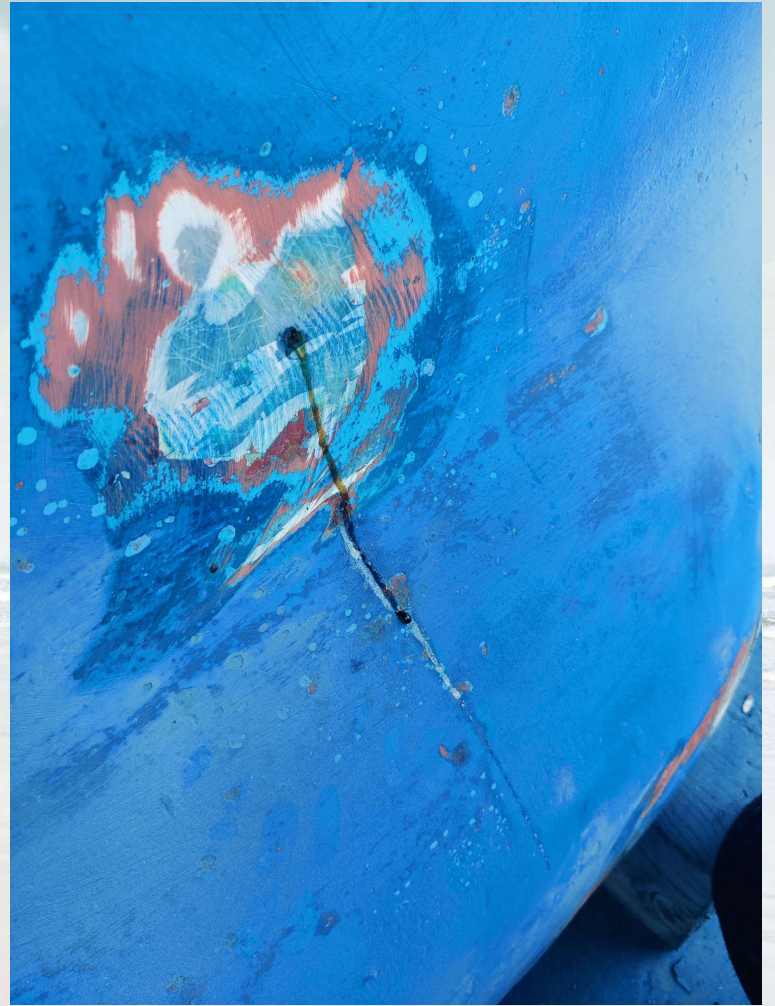
There are those who think “no blistering, no osmosis”!!!!

Then there are those who enjoy pleasure of sailing to the fullest, while being aware that any abuse will end up damaging their boat. They know that if they let the boat gradually soak up water, sooner or later they won't be sailing any more.

**One needs to know that his boat needs to stop drinking and go on a detox so that it can get back into shape.**











QUESTIONS





THE

END

MANY THANKS

