



---

# BADGE COURSE MANUAL

---

---

## SHIP QUARTERMASTER INTEREST BADGE

---



<i>Name</i>	
<i>Troop</i>	
<i>Course Date</i>	

# CONTENTS

Section	Page
Ship Quartermaster - Badge Requirements	3
Rope:	4
Taking rope off a new coil	4
Taking down rope for running out	4
Method of belaying	4
Blocks:	5
Parts of a block	5
Types of blocks	6
Purchase Tackles	8
Anchors:	9
Types of Anchors	9
Select an Appropriate Anchor	10
Anchoring	11
Weighing anchor	12
Sea Anchor	12
Mooring	13
Sails, Sheets & Rigging:	14
Sails & Sheets	14
Standing rigging	14
Running rigging	14
Boat Maintenance and Storage:	15
Securing of foils	15
Fittings	15
Maintenance	15
Storage	15
Leaving a Boat	16
Boat Stability	17
Loading a Boat	18
Combustion Theory	19
Handling Flammable Liquids and Gasses	19

# **Ship Quartermaster - Badge Requirements**

1. Rope:

- a) Demonstrate the correct method of taking rope off a new coil.
- b) Demonstrate the method of taking down rope for running out.

2. Describe the principal parts of a block.

3. Identify the following types of blocks and demonstrate them in use:

- a) Single block
- b) Single block with fast eye and swivel eye
- c) Single block with becket and hook
- d) Scratch or check block
- e) Self-locking block with snap shackle
- f) Fiddle block with shackle
- g) Double block with swivel eye
- h) Double block with shackle.

4. Demonstrate the method of belaying.

5. Describe the principal parts of an anchor.

- a) Identify three types of anchors and differentiate between their uses.
- b) Describe and execute the safest method of anchoring to suit the conditions.
- c) Demonstrate the use of a trip line and pick-up buoys.
- d) Demonstrate the correct method of mooring a boat to a dock or jetty.

6. Demonstrate how to store and take care of sails, sheets and standing rigging.

7. Demonstrate how to leave a pulling boat or sailing dinghy:

- a) After a day's activity
- b) For a short spell, e.g. lunch break, or when called for instruction.

8. Demonstrate how to load a boat with stores and personnel and show how to trim the boat correctly.

9. Explain how to safely store and handle flammable liquids and gasses.

## **ROPE:**

### **Taking rope off a new coil**

Incorrectly removing rope off of a new coil can be frustrating if it is not done properly.

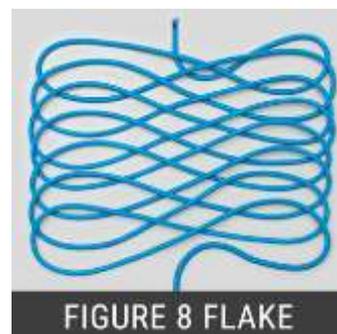
- First figure out which way up the coil should be so that the rope comes out anticlockwise.
- Then cut the banding or rope that holds the coil together.
- Pull the rope anticlockwise from the centre of the coil.



Alternatively, you could build a spinner. A spinner allows you to pull rope from the outside of the coil and comes in very handy for larger coils of rope. A spinner can be made in various ways but the basic principal is to have a platform that the rope will sit on. A post in the middle to keep the rope on the centre of the platform. Then castor wheels or a bearing on the post allowing the platform to rotate.

### **Taking down rope for running out**

This is the process of preparing rope on the deck of a boat or on the jetty, in preparation for the rope to be passed through a fairlead and run out. For example, flaking out the anchor rope to be lowered when dropping anchor, or paying out a tow line to another boat. This method prevents kinks and knots from being introduced into the rope, therefore preventing potential injury to the member running out the rope or possible damage to the boat.



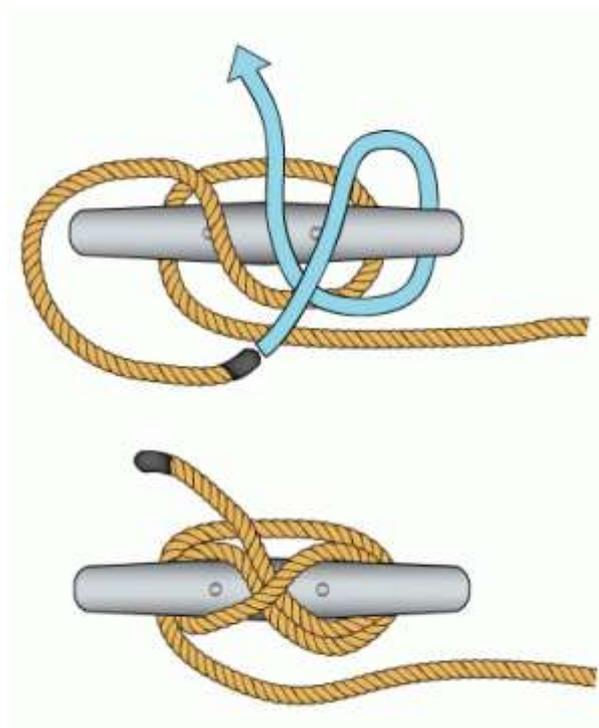
### **Method of belaying**

Boaters should also know how to belay, which is securing a rope to a cleat. The following image and description show the correct way of belaying to a cleat:

The first turn around the base of the cleat must be completed or the line will jam under strain and be difficult to undo, especially when it is wet. If it is belayed by a series of round turns without the figure-eights it will not hold.

A good rule to remember is: One round turn, two figure-eight and a half hitch to lock it. The end is then led inboard.

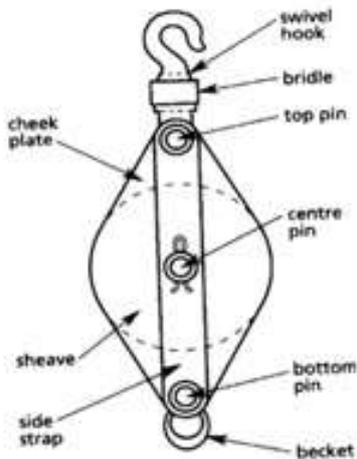
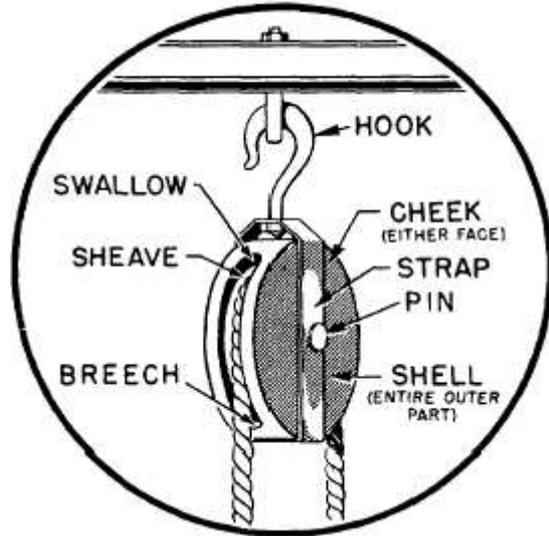
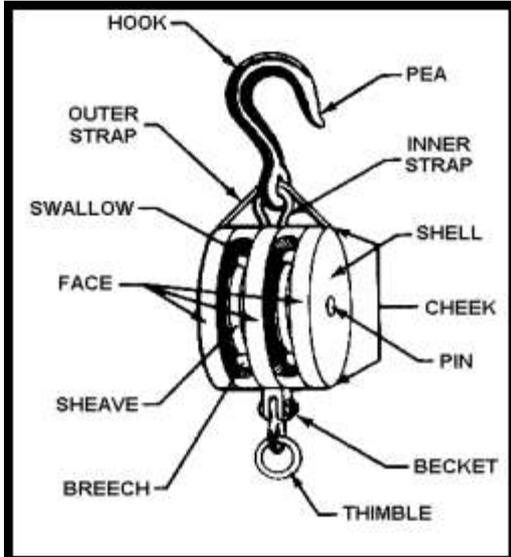
Surplus rope on the free end is to be neatly stowed in terms of good seamanship practises.



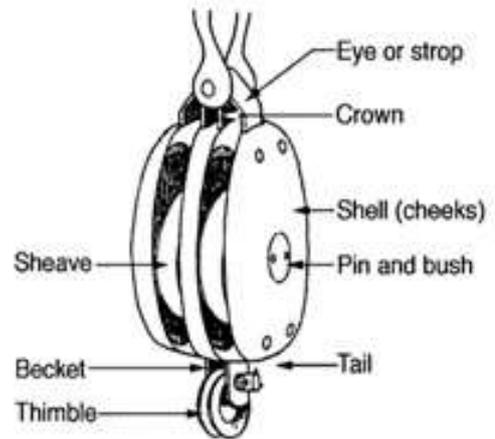
## **BLOCKS:**

### **Parts of a block**

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave.



**Metal Block**



**Wooden Block**

**Types of blocks**

	
<p align="center"><b>Single Block</b></p>	<p align="center"><b>Single block with fast eye</b></p>
	
<p align="center"><b>Single block with swivel eye</b></p>	<p align="center"><b>Single block with becket and hook</b></p>
	
<p align="center"><b>Snatch block</b></p> <p>A snatch block vs single block - a single block is constantly closed and you must thread the line through the axle. The snatch block is designed to open with a gate on the side so the rope can be fitted easily.</p>	<p align="center"><b>Self-locking block with snap shackle</b></p>

	
<p align="center"><b>Fiddle block with shackle</b></p> <p>A fiddle block is a tackle block having two sheaves of different diameters one above the other instead of side by side as in a common double block</p>	<p align="center"><b>Double block with swivel eye</b></p>
	
<p align="center"><b>Double block with shackle</b></p>	<p align="center"><b>fiddle block with a jamb cleat</b></p>

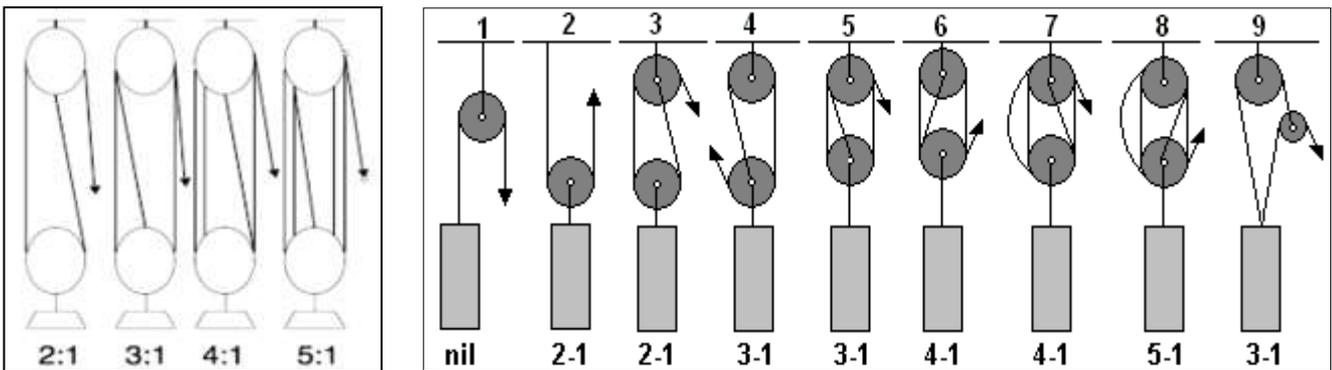
## PURCHASE TACKLES:

A tackle is a purchase consisting of a rope rove through two or more blocks in such a way that any pull applied to its hauling part is increased by an amount depending upon the number of sheaves in the blocks and the manner in which the rope is rove through them.

A block is a set of sheaves mounted on a single frame. A tackle is a system of ropes threaded through blocks, used to increase the force applied to the free end of the rope.

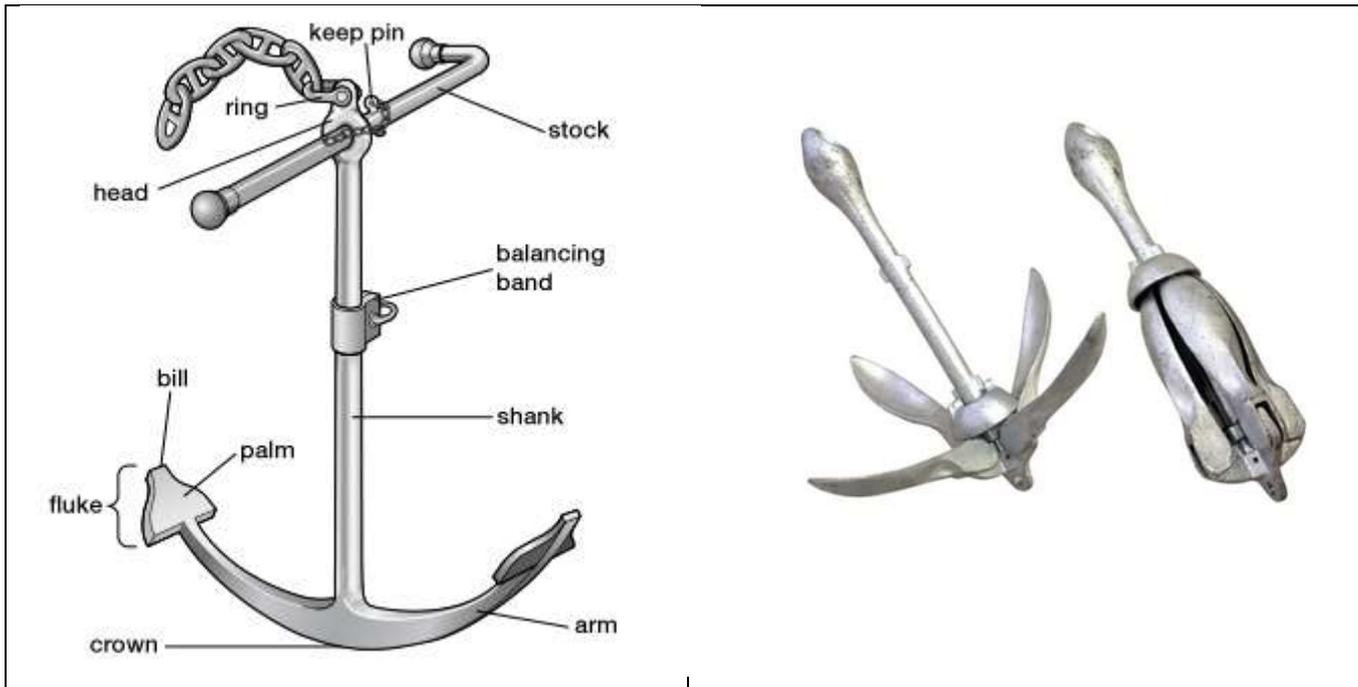
Rove to advantage – The pull on the rope is in the same direction as that in which the load is moving.

Rove to disadvantage – The pull on the rope is in the opposite direction to that in which the load is moving.



## **ANCHORS:**

### **Types of Anchors**



#### **Admiralty Pattern or Fisherman's Anchor**

This anchor is found mostly on small craft and in places where holding power is of prime importance.

It consists of a shank, which carries two arms. On the arms are two flat broad parts called the flukes, which terminate in points called the pea or bill. Near the top of the shank and at right angles to the arms, a bar passes through the shank. This is the stock, which makes the anchor fall in such a position that the fluke must dig into the seabed.

At approximately the middle of the stock, there is a raised metal ring or stop, which positions the stock centrally against the shank and a stock pin that goes through a hole in the stock on the other side of the shank, to lock the stock into position. With the pin removed, the stock may be slipped into a folded position for easy stowage. The top of the shank is terminated in a shackle or ring, to which the cable is attached.

The gravity band is fitted at a point at which the anchor balances and a purchase tackle is attached to this point when the anchor is being hoisted inboard.

#### **Folding Grapnel Anchor**

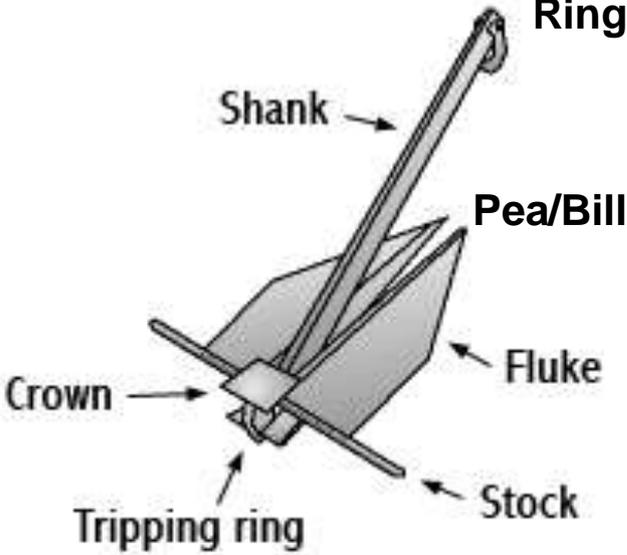
The folding grapnel is a development of the Grapnel used in Elizabethan days, when crews of fighting ships wished to board each other. Fitted with between four and six prongs, the folding anchor is probably the most useful of all small boat anchors.

The anchor features a weighted end to ensure the claw shaped flukes bite the seabed.

Very strong fluke pins ensure good holding power. The flukes on this anchor pivot off pins on the crown.

When not in use, the arms fold up against the shank and are held in place with a sliding ring which one lock closed/open by rotating the collar. These anchors are ideal for yachts and boats where stowage space is limited.

These anchors do not provide a large amount of holding power in sand or mud beds. It is important to use an appropriate amount of chain with this anchor.

	
<p style="text-align: center;"><b>CQR or Plow Anchor</b></p> <p>The Chatham Quick Release or CQR, developed in the UK, is another popular design for small yachts and power craft. It comes from England and also has no stock.</p> <p>It has excellent holding characteristics, up to 30 times its own weight. The anchor sets quickly, rarely fouls and is easy to recover. It will dig in immediately after a 180- degree change in direction due to change in wind or tide directions on an anchored boat.</p> <p>The only con with this type of anchor is that it is not easy to stow.</p>	<p style="text-align: center;"><b>Danforth Anchor</b></p> <p>The Danforth is amongst the best of the small boat anchors and was developed by R.S. Danforth in 1939.</p> <p>It produces strong holding power, because of the thin large flukes and when under a heavy strain, the flukes bury themselves very deeply.</p> <p>Instead of a stock through the head of the anchor, the Danforth has a round rod through the crown that prevents the anchor from rolling. One of its qualities, is that it can be adapted to large and small vessels. This anchor folds basically flat so it is easy to handle and stow.</p>

### Select an Appropriate Anchor

<b>Type</b>	<p>Sandy bed requires a Broad fluke</p> <p>Rocky bed requires a Narrow fluke.</p>
<b>Weight</b>	<p>For sheltered waters, i.e. slow moving river or lake 1 kg. Anchor weight for every 20 kg. of boat weight. Make sure that your anchor is big enough to hold your boat.</p> <p>Therefore, a boat of weight approx. 150 kg. Requires anchor 7,5 kg.</p>
<b>Anchor Chain</b>	<p>Fitted to shackle at head of anchor to hold anchor flat on bed. Size to suit anchor and length should be a minimum of twice the length of the anchor shank.</p>

**Anchor Rope** Called the Rode. Make sure that it is properly tied on, both at the anchor and at the boat. Attached to opposite end of anchor chain so anchor should be of size and breaking strain to suit boat. Length of rope should be at least three times the maximum depth of the water in which the boat may be required to anchor.

In Tidal Waters it is necessary to know state of tide and amount of rise and fall.

Therefore, on water 3 metres deep, the rope should be  $3\text{m} \times 3 = 9$  metres.

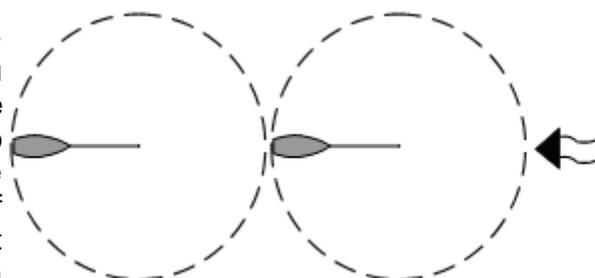
**Release Line** The release or trip line is attached to the anchor at the crown or low down on the shank and is used to release the anchor if it should become fouled. This line must be longer than the anchor rope

## **Anchoring**

There are certain basic steps to be taken in anchoring small boats under normal conditions:

### **Approaching the anchorage:**

Do not anchor where it is so shallow that there is the possibility of being aground in low water. Conversely, you need not anchor in 15m of water if you can find 7m a little close to shore. One prudent rule in strange waters is to check the depth of the water in the area of any possible swing of the boat with a lead line. Note the location of other boats or empty moorings, so that you will not anchor so close to boats that you swing into others with shifts of wind or tide. Hard sand is first choice for the bottom and soft mud is the last. A rocky bottom is generally

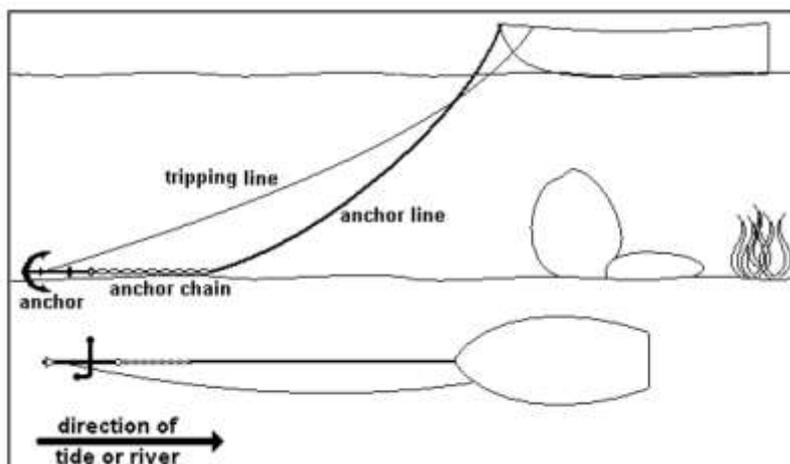


Ensure that swinging circles do not intersect

between the two. However, you cannot know just what the bottom is until the anchor is down.

### **Dropping anchor:**

Under power or sail, come up to your chosen anchorage into the wind or tidal current (whichever is stronger). Under power, bring the boat to a stop and then reverse very slowly. At this point, a crewmember already stationed forward lowers the anchor gently, always maintaining control of the cable. **Never throw an anchor!** Reverse the boat slowly as the cable is paid out to keep the anchor from being fouled. Keep reversing until it takes hold and sufficient scope (the ratio of the length of an anchor line, from a vessel's bow to the anchor, to the depth of the water) has been paid out. If the anchor drags at this point, it is usually because the anchor has been fouled or resting on poor holding ground at the bottom. If it does drag, then you must raise the anchor and try again. Once the anchor takes hold, check to be certain you are clear of the shore and other boats before shutting off the engine. Under sail, of course, you cannot reverse your boat to help you take hold. However, in coming in against the wind or tide, you can use them as a natural reversing power. At the moment you come to a standstill, drop the anchor quickly, but smoothly, and pay out ample scope. Then belay the rode (the anchor line and/or chain) to the bitt or a cleat and wait until you are certain the anchor is not dragging.

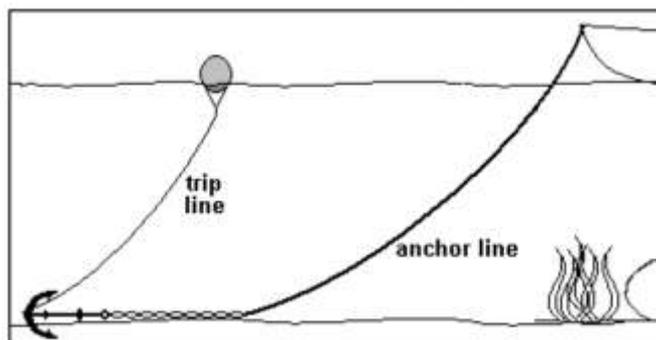


### **Leaving the boat:**

Before going ashore after properly anchoring, make a careful note of the boats' relative position to other boats, or better still, to nearby shore objects. By doing this, you can spot a change in your boat's position caused by the anchor dragging. If a boat stays at anchor during a change of tide or wind shift, she may swing through a 180° arc. This movement can foul the rode of some types of anchors, twisting it around an arm or stock, causing the fluke to be pulled from the bottom. Under these conditions, it is wise not to leave the boat unattended.

### **Weighing Anchor**

When under power, move slowly toward the anchor while a crewman forward, hauls in the slack of the cable. When the anchor breaks loose, come to a stop while he brings in the anchor. This must be done carefully to avoid gouging the boat. If your boat has too much headway while bringing it in, there is a possibility of damaging it with the anchor. When the anchor is brought aboard, it should be secured at once. The wet line should be allowed to dry before stowing. If the anchor does not break loose easily, bring the boat carefully up to the approximate position of the anchor and belay the rode to the foredeck bitt. After this, apply just enough power to give steerage way and run the boat passed the anchor. If it does not work the first time, repeat this manoeuvre again. Under sail, you can usually sail right up to the anchor, while a crewman takes in the slack slowly, and raise the anchor as described above. If the anchor is firmly embedded in the bottom, you may have to sail forward to put added strain on the rode in the opposite direction to the anchor pull.



If you know beforehand that the bottom, where you plan to anchor your boat, is likely to foul, use a trip line. This is merely a light, but strong line secured to the crown of the anchor, long enough to reach a buoy on the surface. When the time comes to weigh anchor, the buoy is retrieved and the trip line pulled to haul in the anchor, crown first. Sometimes it is necessary to carry the anchor away from the boat in a small dinghy. The boat is then pulled towards it by means of capstans or winches, called kedging. Grounded vessels sometimes pull themselves clear in this manner. When a boat lies most often at her home port, it is best to set a permanent mooring, this would make her more secure than being at anchor.

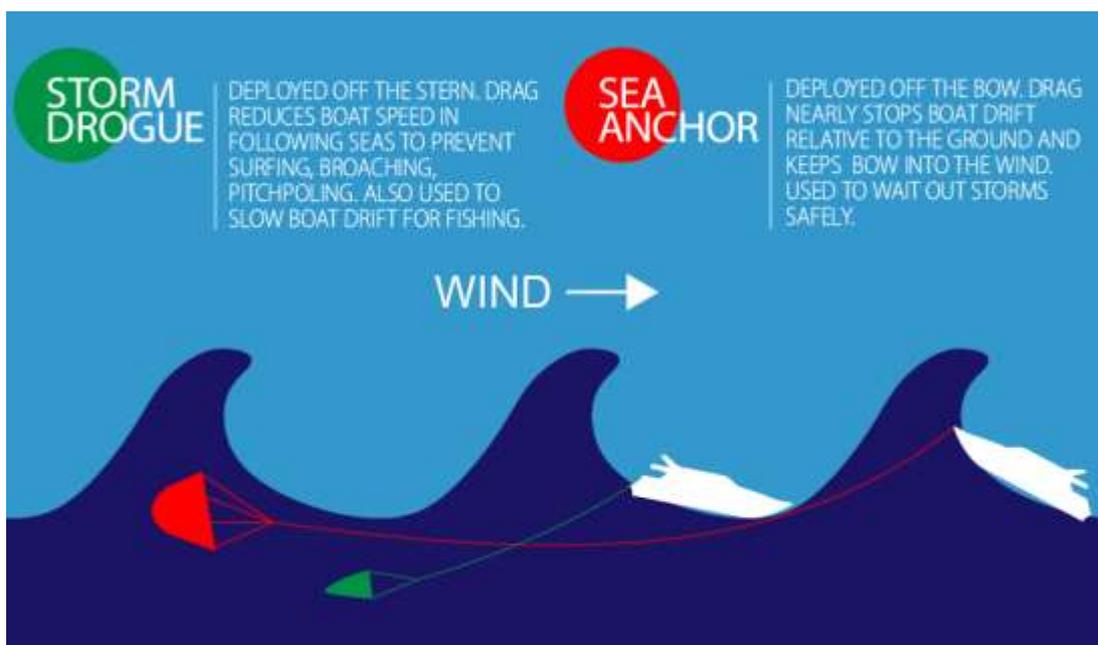
### **Sea Anchor**

A sea-anchor or drogue is used to slow down a boat and give it greater directional stability in emergency circumstances. In general terms it is called a sea anchor when streamed from the bow of a boat and a drogue when streamed from the stern of a boat (to slow it down and prevent broaching). Sea anchors are generally bigger than drogues relative to the size of boat for which they are suitable.

A typical sea-anchor is a conical canvas bag with a small hole at the point of the cone. The mouth of this bag is held open by a metal hoop and a harness of ropes is attached from around this opening to a metal ring. This is then fastened to a line and streamed over the bow.

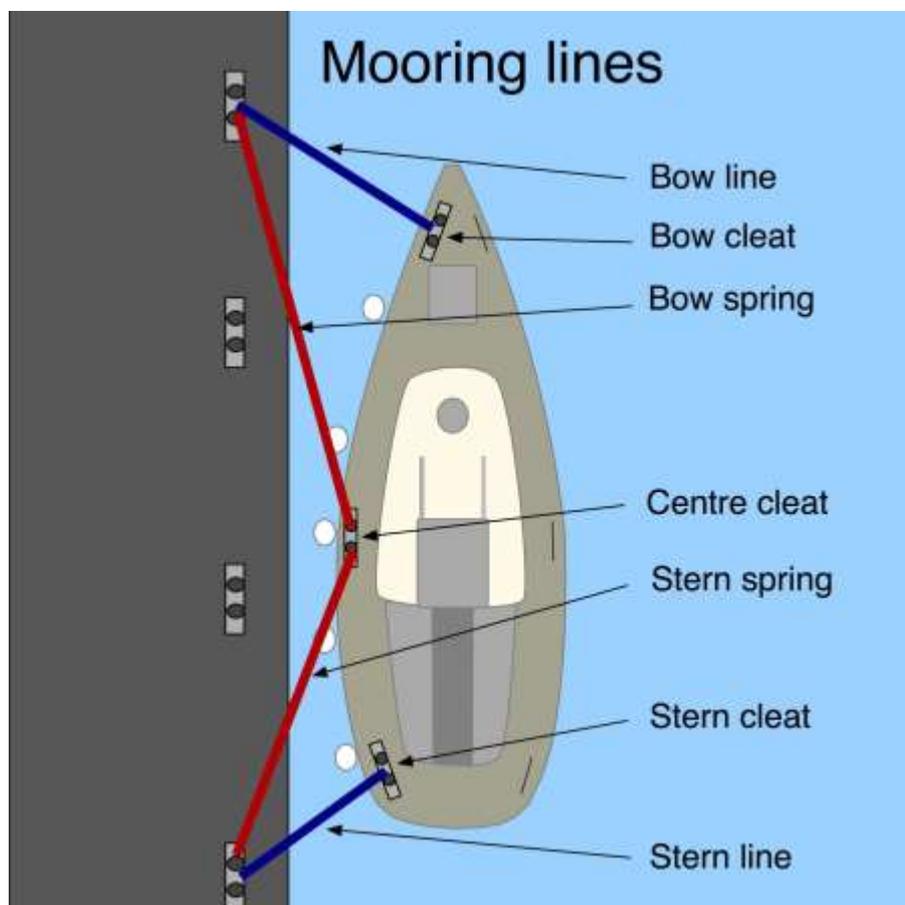
The open mouth scoops up the water as it is dragged along thus acting as a brake and slowing a boat down to give it stability in rough seas. A temporary or emergency sea-anchor can be constructed by lashing together two oars or available spars with a harness to make them drag at right-angles to the direction of drift and act much like a canvas bag as described above. Some weight such as a small anchor usually needs to be added to this rig so that it is only just buoyant, otherwise it can too easily slide over the top of the water to be effective. Almost completely full 20 litre containers also make effective sea anchors in an emergency.

The length of anchor rode paid out should be a minimum of at least the fetch of the passing waves, but preferably double the fetch of the waves. This is to prevent the anchor or drogue being pulled out of the face of the wave.



### **MOORING:**

A mooring is any permanent structure to which a vessel may be secured. Examples include quays, wharfs, jetties, piers, anchor buoys, and mooring buoys. A boat is secured to a mooring to prevent free movement of the boat on the water.



## **SAILS, SHEETS & RIGGING:**

### **Sails & Sheets**

Sails, sheets and other forms of running rigging should be dried before folding or hanking and stowing in sail bags. Stowing of bundles of wet sheets into sail bags will lead to mould and rot and is yet another sigh of poor seamanship.

### **Standing rigging**

Standing rigging refers to all components which keep stayed masts up. These components need to be checked for wear and that they are securely fitted

- The hounds, gooseneck and butt must be securely fastened to the mast
- Stranded stay wire must be free of fraying or kinks, with thimble or swage eyes at each end
- Screw shackles must be tight and all pin key rings in place
- Chain plate fastenings and mast step must be secured to the hull.

### **Running rigging**

Running rigging includes the lines, blocks and pulleys on a sailing vessel that are used for raising, lowering, shaping and controlling the sails. All lines on board must be in good condition and suitable for the intended use and type of vessel

When checking your mast, look for worn halyards and masthead sheaves. The sheave may make it difficult to raise and lower the sails. Old halyards may be prone to breaking and are often found to be badly secured, such that their release is difficult and time consuming in the event of a capsized rescue situation.

Sheets are often scrounged replacements and not suitable for the type of boat or intended use. They may be too thick or too thin, too long or too short. This sort of rigging mismatch can potentially lead to the occurrence of capsize. Woven sheaves on synthetic rope which have worn through to the core are very dangerous, and jam easily.

Control lines such as Mainsail outhauls, downhaul and Cunningham are often found to be any old scrap of light line.

The kicking strap is a vital piece of safety equipment and must be in good condition, properly adjusted and secured to the boom and mast/hull

## **BOAT MAINTENANCE AND STORAGE:**

### **Securing of foils**

Foils is collective term for the fins extending underneath a sailing vessel. These are vital to the sailors' ability to control the dinghy.

The rudder may take significant forces while sailing and it is important to check the blade, stock and tiller for strength. If the rudder pivots, the downhaul/up haul lanyards must be in good condition and need to have a proper securing cleat which can be quickly un-cleated when required

Be aware of using rudders or dagger boards that did not originally belong to the boat. The rudder must fit correctly and be strong enough. The rudder must always be secured to the boat with spring clips or a lanyard. Often rudders which did not originally belong to the boat get used and the spring clips which are supposed to prevent the rudder from falling off the pintles are bent or missing or don't fit. A rudder which has fallen to the bottom of the dam is of no use to anyone.

The Dagger board / centre board must be easy to raise and lower in the casing. Dagger boards need lanyards to secure them to the boat, and centre board downhaul/up haul lanyards and purchases need to function correctly, to assist with righting manoeuvres after capsizing.

### **Fittings**

Even a small dinghy can have a large number of fittings attached to the mast, boom or hull. Each of these fittings has a purpose in controlling the boat and needs to be securely fastened to the mast/boom/hull and functioning correctly. Lines should be able to pass free through eyes and blocks, while cleats securely hold. Any fitting which is either broken or not the correct fitting for the job, can potentially be the cause of a sailing accident.

Certain extra fittings of major importance are found in rowing boats, and these have to do with the method of propulsion. Look out for loose socket fittings, worn crutches, crutch lanyards and clips, worn jackets, cracked or bent oars and oars of a suitable size to match the pulling crew.

### **Maintenance**

Boats suffer wear and tear from normal use as well as from the elements. Regular checking of your boat and all the rigging, with timely repairs, will make for safe boating. Allowing the use of poorly maintained boats will increase the change of problems occurring when the weather conditions deteriorate.

### **Storage**

Boats should be stored with suitable weather covers if stored outside. Weather covers should not allow the formation of water puddles, which can easily damage them. The covers must be fitted in such a way as to allow for air movement underneath to assist with drying out of buoyancy compartments.

Boats must be stored such that any rainwater, or leak water must be able to drain out through bung holes or perhaps self-bailers, particularly if they are wooden plywood boats. Compartment covers should be removed to assist with airflow through the hull.

Boats must be stored on their correct dollies with the cradle support pressure being correctly distributed to the hull.

Long term storage of fibreglass and wooden boats on incorrect dollies or trailers will lead to hull distortions which can damage the hull permanently. Life jackets should never be used as cushioning for the storage of boats.

## **LEAVING A BOAT:**

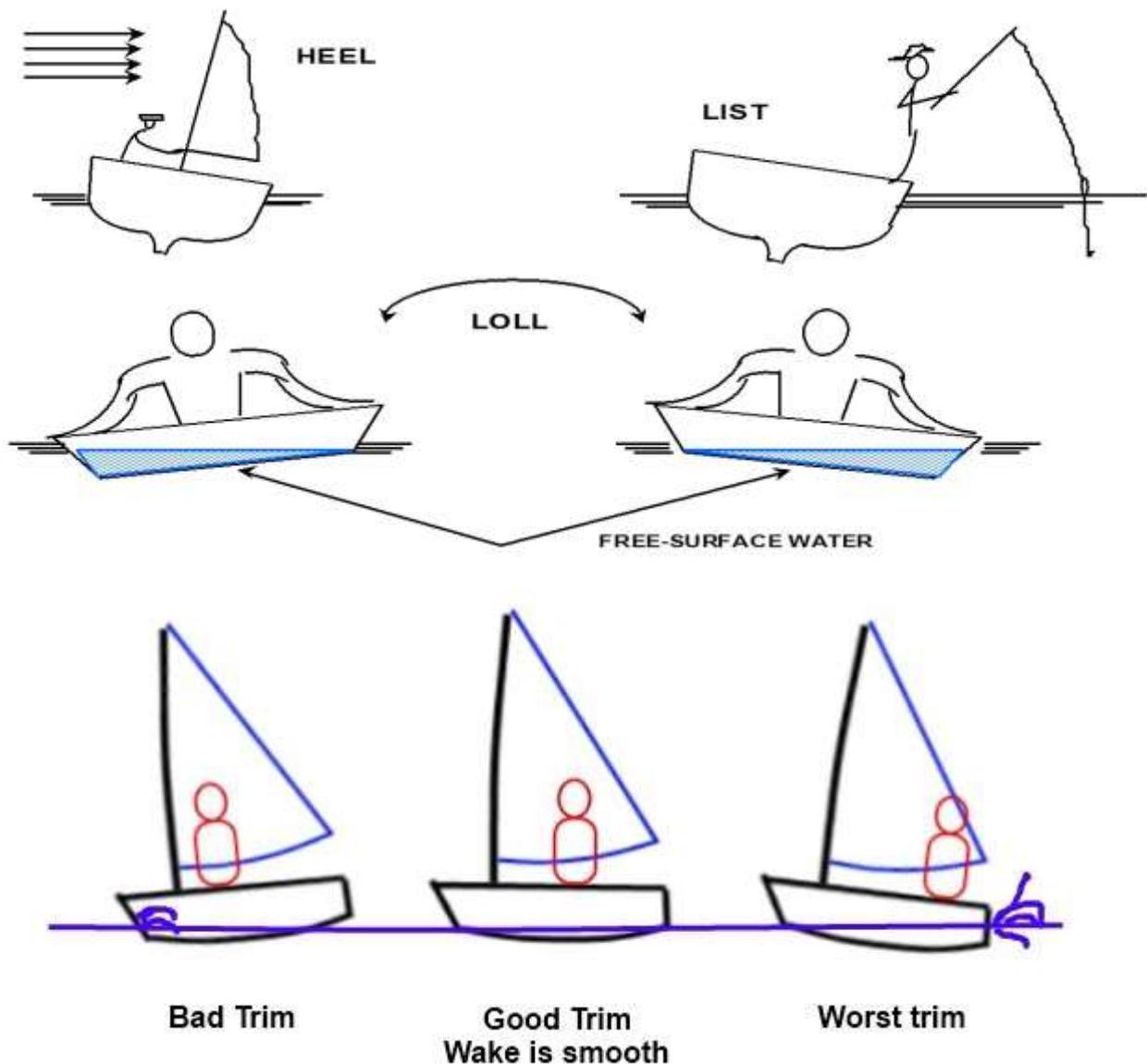
	<b>At the end of the day's activity</b>	<b>For a short duration</b>
<b>Pulling Boat</b>	<p>Fenders shipped</p> <p>Fwd and aft painters secured fast</p> <p>Oars removed from the boat and stored safely</p> <p>Crutches removed from the boat and stored safely</p> <p>Centreboard and rudder blade raised and secured</p>	<p>Fenders shipped</p> <p>Fwd and aft painters secured fast</p> <p>Oars boated and stored along the centreline of the boat</p> <p>Crutches boated and secured by their lanyards</p> <p>Centreboard and rudder blade raised</p>
<b>Sailing Boat</b>	<p>Fenders shipped</p> <p>Fwd and aft painters secured fast</p> <p>Centreboard and rudder blade raised and secured</p> <p>Main sail and jib removed and stored safely</p> <p>All running rigging securely fastened</p> <p>All sheets removed and neatly stowed with the sails</p>	<p>Fenders shipped</p> <p>Fwd and aft painters secured fast</p> <p>Centreboard and rudder blade raised</p> <p>Main sail left to fly with sheets able to run (remember figure of eight stopper)</p> <p>Jib wrapped around the forestay or lowered and secured.</p> <p>Jib sheets secured</p>

## **BOAT STABILITY:**

Stability is the resistance to capsizing and a stable vessel that has been pushed from its upright position by an external force, such as the wind or waves, should return to the upright position. If the vessel does not return upright, it is unstable.

A well designed vessel has adequate stability build into it. However, any changes made to the vessel, or any changes made to her loading, will upset that stability - perhaps to the extent of making the vessel dangerous.

We must be able to recognise the signs of impending instability of the vessel, and we must know the measures needed to correct this. In the long term this may involve consultations with a surveyor or a naval architect, but in an emergency at sea more immediate measures may have to be taken and these will only be safe and effective if we have a basic understanding of the fundamental forces that govern a vessel's stability. The two forces governing vessel stability are buoyancy, provided by the water, and gravity.



## **LOADING A BOAT:**

Water activities are more dangerous than land based activities for two reasons: Firstly because of the risk of drowning and secondly because of injuries caused by the instability of the craft.

All boats are designed to carry a load up to a specified maximum weight. The worse the weather and sea conditions that the boat has to endure, the less load it can safely carry. Remember that the more water that enters the boat, the greater the load that the boat is carrying, and the more it becomes susceptible to free surface effect (i.e. water sloshing about inside the boat).

A “Rule of Thumb” for determining how many kilograms a craft can safely manage is that for each cubic meter in volume a boat can safely carry 185 kilograms. To determine the volume of the boat one must multiply the product of the length, breadth and depth by a factor of 0.6. This gives an approximate volume of most mono hull boats.

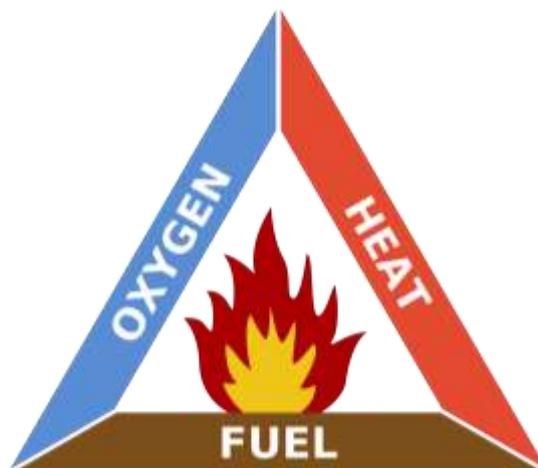
Statistics show that the most common causes of boating accidents are from overloading and improper loading of small boats. Most of the fatal accidents caused by a loading error involved boats under 9m in length and half these vessels had 10 horsepower or less.

There are several things to keep in mind when loading a boat:

- DO NOT overload. Use the above rule and reduce the load if the weather conditions are not perfect.
- An overloaded boat is very unstable and therefore far more likely to capsize. It is also very difficult to handle, both in steering and in propelling.
- Trim the boat correctly. Distribute the load evenly throughout the boat and keep the load as low as possible. The load should be balanced along both axis, port-starboard as well as bows-stern.
- DO NOT have uncontrolled movement in a boat. No item of equipment must be left loose in a boat. No person is to stand up or move around in a boat unless controlled by the Cox.
- If a crew member or passenger needs to move around in a boat, stop or slow the boat, only let one person move at a time and instruct them to keep low and to the centre line of the boat. Before any movement occurs, ensure that the boat is as stable as possible and that there are no dangerous items that could be fallen onto.
- It is far better to make more than one trip or to leave equipment behind than to experience the trauma of capsizing or of trying to handle an overloaded boat in bad weather conditions.

## **COMBUSTION THEORY:**

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat, light, and various reaction products. Fire requires Oxygen, Heat and Fuel to burn, removal of one or more of the elements will extinguish the fire. Cooling, smothering, starving or interrupting the combustion process extinguishes a fire.



Different extinguishing mediums are available for specific classes of fire which necessitates the assessment of the type of hazard in the particular area you are protecting in order to maximise the effectiveness of the extinguisher you are going to have available in a fire emergency. It is important to use the appropriate extinguisher for the type of substance that is burning (wood, oil, electrics, etc.) as shown by the classification below:

<b>Class</b>	<b>Description</b>	<b>Type of extinguisher to use</b>
Class A	Fires involving solid materials such as wood, paper or textiles.	Dry powder, water or AFFF (foam)
Class B	Fires involving flammable liquids such as petrol, diesel or oils.	Dry powder, AFFF (foam) or CO2
Class C	Fires involving gases.	Dry Powder or CO2
Class D	Fires involving metals.	Dry Powder
Class E	Fires involving live electrical apparatus.	Dry Powder or CO2

## **HANDLING FLAMMABLE LIQUIDS & GASSES:**

### **Storage**

In general, flammable materials must not be stored near exits, electrical equipment or heating equipment. They should always be stored in a separate well-ventilated and cool storage area, away from a possible source of ignition. An example of a flammable liquid is the fuel jerry can for the Safety boat. An example of flammable gas is your Patrol box gas cooker bottle.

### **Handling**

Safely handle and use flammable materials in a well-ventilated area. Avoid transporting flammable materials inside the vehicle if at all possible.

For flammable liquids, use only approved equipment, including labelled safety containers. Do not store flammable liquids within food/beverage containers as these can be confused as food stuffs. Keep containers securely closed when not in use.

For flammable gasses, ensure that the gas appliances are not damaged and have the safety washer in place. Always exchange gas related equipment in a well-ventilated space. Ensure that the gas bottle is securely closed after use. Make sure the gas appliances are well maintained.