Water Awareness and Charge Certificate Manual

Module 33: Introduction to the Keel Yacht

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Module Contents

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Module 33:	Introduction to the Keel Yacht	Initial Release	1.0	11 Sep 2013
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Outcomes

After completing this module, the certificate holder will:

- Be able to explain the major differences between keel yachts and dinghies.
- Be able to identify the auxiliary systems found aboard keel yachts.
- Be able to perform sea worthiness checks.
- Be able to perform basic maintenance functions.
- Be able to rig, sail and derig a keel yacht

1 INTRODUCTION TO THE KEEL BOAT

1.1 Differences between a Keelboat and a dinghy.

Keelboats rely largely on a heavy mass which forms part of the boat to supply a righting moment, whereas dinghies rely almost solely on the weight of the crew to supply a righting moment. Small keelboats may be very similar in design to large dinghies but the critical difference is that small keelboats which are designed to be easily road trail able and operable in shallow waters will have a heavy steel centre plate instead of a lighter centerboard. Keelboats should be self righting in the event of a knockdown without the assistance of crew weight.

1.2 Types of Keelboats

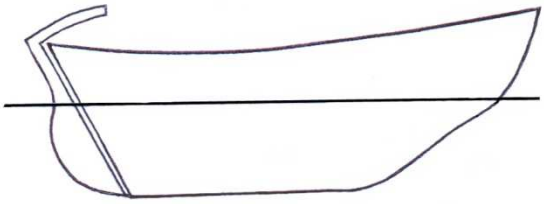
There are three basic types of keelboats commonly used for cruising inland and along coastal areas. Fast ocean racing yachts have pivoting high mass, high aspect ratio bulb keels and dual dagger boards and dual rudders.

The fin keeler usually has a single fin keel. In older heavy displacement hulls the keel may extend the full or almost the full length of the underwater hull, and have the rudder attached to the foot of the keel. When the keel runs the full length of the hull the rudder is hung on pintles on the transom. With these types of boat the weight is concentrated as low as possible usually in the form of a cast steel or lead weight which is bolted to the keel which is an integral part the hull.

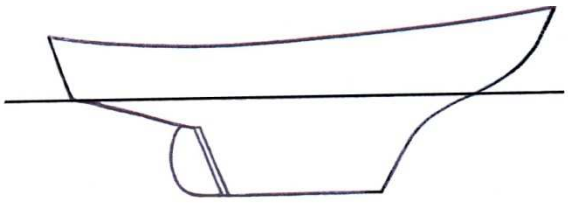
In modern light displacement hulls the keel is more fin-shaped in area, and the rudder is either mounted on a skeg or as a "spade rudder". The keel is most often bolted to the hull.

A bilge keeler has two fin keels which results in a shallower draft design, and the ability to allow the boat to stay upright in a tidal mooring which dries out. They are slightly less efficient when sailing close hauled and require slightly more combined weight in the keels to afford the same righting moment. They usually have transom mounted single rudders, but some have a skeg mounted rudder which can assist with drying out stability of the boat.

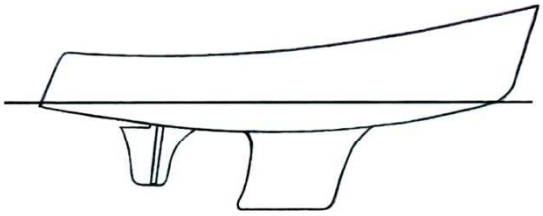
A centreboarder will have a heavy pivoted steel plate which will require some sort of mechanical means of raising it into the centerboard housing. In larger heavier displacement boats one may find a stubby shallow fin keel through which the centreplate is lowered. This frees up the internal cabin space which is then not taken up by a centerboard casing.



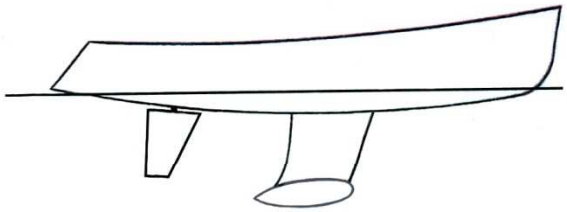
Full Keel heavy displacement



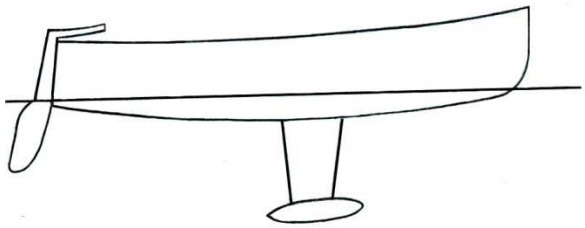
Long Keel pintled rudder



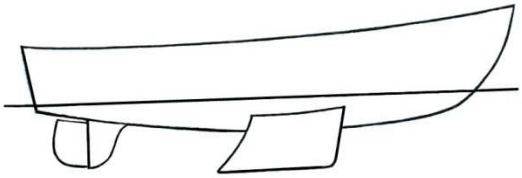
Fin and skeg



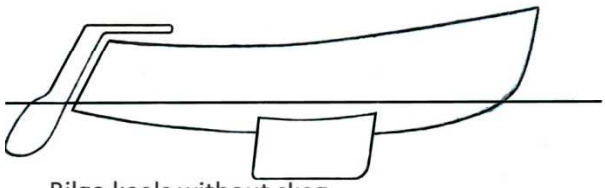
Bulb keel and balanced spade



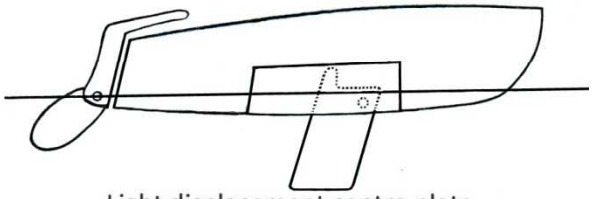
High aspect ratio foil with bulb and transom rudder



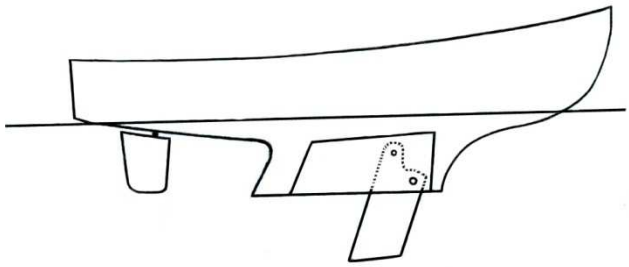
Bilge keels with skeg



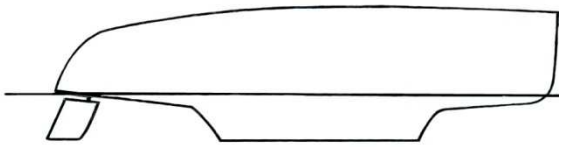
Bilge keels without skeg



Light displacement centre plate



Heavy displacement with centre plate



Catamaran shallow skeg keels

1.3 Multihull yachts

While a large catamaran or trimaran is not strictly a keelboat, what applies to keelboats in general applies to them as well. Multihulls are generally faster sailing boats than keelboats, but their maneuvering capabilities are restricted in some respects. Tacking a catamaran in light airs can be difficult. Catamarans cannot point as well as monohulls. An advantage is that their draft with respect to LOA is usually significantly less than a fixed keel monohull. They have a lot more windage than a monohull of similar length and this should be borne in mind when selecting or using anchors.

Multi hulls are not usually self righting, but have a much higher initial stability curve. This feature is abused at your own peril. Do not overpower a multihull in heavy weather.

1.4 Keelboat buoyancy

In general keelboats do not have positive reserve buoyancy, so if they fill up with water they sink very well. Therefore in rough weather all precautions should be taken to prevent water being taken onboard and finding its way into the bilges. While keelboats are on their moorings all below waterline through hull fittings, propeller stuffing boxes, and deck access way covers are a potential source of water getting into the hull and causing flooding and subsequent sinking.

The majority of cruising keelboats have some sort of cabin and under deck accommodation; therefore all seaworthy keelboats should have an efficient bilge pumping system, which is another feature which differentiates them from their smaller dinghy cousins.

1.5 Keelboat rigs

Small keel yachts are generally masthead sloop rigged, which means that the forestay goes up to the truck of the mast. Often keelboats have a fixed backstay or a pair of running backstays to keep the mast upright when broad reaching or running off the wind. Larger keel yachts may have a second mast and are either ketch or yawl rigged depending on the position of the second mast in relation to the rudderpost. If the aft mast is taller than the foremast it is called schooner rig.

Larger keelboats sometimes leave their basic sails bent on and furled. The headsails are furled by means of roller reefing systems and mainsails are either roller reefed onto the boom or contained in lazy jacks or a stack-pack.

1.6 Winches

The large sails found on a keel yacht often require more force to raise and control than a sailor can muster. For this reason, keelboats normally have winches to aid in this. Winches use both leverage (difference between the drum radius and the winch handle radius), and gear reduction (the number of times the handle turns for every rotation of the drum) to increase power. `

Winches come in all shapes and sizes from the simplest one speed winch, through electric and hydraulic winches to the highly complex "coffee grinder" winch systems found on large racing yachts. Winches can also be simple capstan winches (where the loose end or "tail" of the line must be tensioned by the crew) or self-tailing.

It is important to select a suitable winch for the size of the sail it will control and to learn to use and maintain it properly.

1.7 Keelboat Power options

Usually keelboats have the ability to be propelled by motors. Small keelboats usually employ outboard motors fitted to a permanent or lifting transom brackets or sometimes in a lazarette. Larger keelboats usually have an inboard motor driving a directly in line propeller shaft or a sail drive. Propellers on most modern yachts have self furling blades to minimize drag. In many cases the astern performance of these propellers is limited and this must be borne in mind when maneuvering in confined

spaces and when taking way off the boat in a hurry. By virtue of the fact that motor fuels (petrol or diesel) are therefore usually carried on board, safety procedures pertaining to the handling and storage of the fuels need to be adhered to.

1.8 Electrical systems

Permanent electrical systems, ranging from the very simplest lighting circuits, to complex lighting, instrumentation, pumping, winching, and heavy duty motor cranking can be found on the modern yacht. The majority of small keelboat systems are 12 volt DC, and in bigger yachts 24VDC systems can be found. Battery banks for motor starting must be able to be isolated from the "house battery". 220VAC inverters are becoming more common onboard yachts to run electrical appliances like television sets and microwave ovens. 220VAC supplied by an inverter is just as dangerous as shore mains power, and accorded the same treatment and respect as power in your home.

1.9 Fresh water systems

Keelboat fresh water systems can range from carrying a few 5 litre bottles of fresh water sufficient for a 2 day cruise, to pressurized systems and large fresh water tanks usually under the cabin sole. It is part of the skipper's duties before embarking on a voyage, to ensure what the freshwater situation is onboard his boat. Fresh water stored for long periods in tanks onboard can become unpotable, and it's better to find this out before you depart on your voyage. It is always best to carry an emergency ration of fresh water in plastic containers in the event of the normal water storage becoming contaminated for whatever reason.

1.10 Raw water systems

Inboard engines usually require raw water circulation systems for cooling, either by direct means or indirect means through heat exchangers. This therefore requires through hull valve fittings below the normal waterline. Faulty raw water systems are potentially boat sinkers and therefore proper attention needs to be applied to these systems to ensure that they are serviced and tested regularly. NEVER leave a boat for any extended period of time without closing all through hull valve fittings. Marine growth can enter into the raw water line and prevent the valves closing in an emergency. It is a skipper's duty to check all raw water systems and valve positions before departing on a voyage, or leaving the yacht at a permanent mooring.

1.11 Grey water systems

Depending on the size and sophistication of the keelboat one may find various types of grey water systems. Grey water can be defined as non sewerage waste water. Usually galley sink drains, hand basin drains, and shower drains are the major source of grey water on a yacht. In the simplest plumbed systems on small boats the galley sink drains overboard through a through hull outlet which may or may not be above the static waterline. Care should therefore also be taken to check the outlet when embarking on a voyage or leaving the boat at a mooring. More complex systems may allow for grey water to be stored in tanks onboard, to comply with environmental regulations. The skipper must check the levels of these tanks and know how and where they may be emptied. He should also have a mental picture of how long the tanks take to fill with normal usage.

1.12 Black water systems

Black water is a nice name for sewerage. Onboard systems may range from buckets, to chemical Porta-Loo's, to raw black water OB discharge, to head flush storage, and onboard processing systems. Similar safety precautions and checks need to be made with respect to black water systems, as to any other water system onboard. Tank vent integrity is important when dealing with black water systems, as there is the possibility of gas build up which can have nasty repercussions, the worst of which could be a methane explosion.

1.13 Gas systems

Gas is commonly used for cooking onboard keelboats, no matter what size of boat it is. Gas systems may range from a 3Kg portable cylinder used and stored in the cockpit, to a sophisticated galley gas cooker/oven and shower water heater. Extreme caution needs to be exercised when using gas onboard a boat. Do not do gas installations aboard a boat by yourself. Any gas installation on board a yacht should be done by a qualified installer. There are various gas alarm systems which will indicate dangerous levels of gas which may have leaked into the bilge and interior spaces of yachts lying on moorings. If you have gas stored onboard it should be in lockers which are open to the external atmosphere and have good ventilation. Never switch on any onboard electrical systems when preparing a boat after it has been laying unmanned for any length of time, until a gas check has been done.

1.14 Safety systems

Safety systems can be divided into two groups, boat safety and crew safety.

Boat safety systems primarily are bilge alarms, automatic and manual bilge pumping systems, gas alarms, and circuit breaker/fuse panels. The competent skipper needs to know where all these systems are located onboard and needs to understand their operation and test methods.

Personal safety systems are most commonly the provision of lifejackets suitable for the different types of people who are onboard. Life belts and Dan buoys are commonly found on larger yachts to assist with man overboard situations. Heavy weather harnesses and deck safety lines must be available for all crew on deck during night time and during heavy weather.

Boarding ladders must be available and easily deployable for recovery of crew who are in the water for any reason. It is virtually impossible to clamber back onboard any keelboat unaided.

A means of communication with other persons not on the boat needs to be available. Today there is cell phone coverage of most inland dams and all coastal estuaries. Remember you are relying on people answering their phones, so preparations in that regard need to be made before undertaking a voyage.

VHF radio coverage and monitoring is poor on inland waterways and coastal estuaries which are not developed ports. Do not assume anyone is going to acknowledge a VHF call on inland waters, not even NSRI or SAPS Water Wing, unless prior arrangement has been made for monitoring of the relevant VHF channels.

Emergency flares should be carried in accordance with SAMSA regulations, but do not assume that they will be seen or reacted to on remote sections of inland dams.

Various GPS tracking systems are becoming available which operate using the mobile networks and these can offer very good emergency alarms. Voyages to remote regions of inland waterways can be afforded a good emergency alarm capability using this technology, but first check that coverage is available by asking local people during your voyage planning stages.

Never sleep below decks unless there is very good ventilation, especially if there is a naked flame from devices such as paraffin lanterns or heaters or stoves. Insidious carbon monoxide poisoning and death may result.

Always keep a sharp fine serrated breadknife with a wrist lanyard handy for clearing fouled propellers.

2 Keelboat sailing

Obviously the principles of keelboat sailing are the same as dinghy sailing, but there are numerous extra factors to be taken into consideration.

Save for the heavy centre plate designed small keelboats, draft of the yacht is a limiting factor on where and how you sail the yacht. The skipper needs to know what the draft of his yacht is for obvious reasons.

Keelboats usually have loose items below decks, items such as food supplies, clothing, bedding, tools, equipment cooking utensils etc. All of the above need to have their correct and secure stowage place, so that they do not move around below when the yacht moves and heels significantly. A cabin which has deteriorated into a shambles is a dangerous place for many reasons.

In general keelboats have the ability to reduce sail in a number of ways in heavy weather. This point is often forgotten by skippers who are used to dinghy sailing where this is not an option once on the water. Sail can be reduced by taking away a sail such as a genoa or mainsail, reefing a mainsail or headsail or replacing a headsail with a smaller size (storm jib). The prudent skipper will learn the sailing characteristics of his yacht with different sail configurations so that he will know how the yacht will behave in heavy weather conditions. Some yachts will sail very well under genoa alone or mainsail alone. The objective is to maintain sail balance so that excessive weather or lee helm is not introduced.
Keelboat skippers should not carry excessive sail area in strong winds and rely on "dumping the main" or "dumping the genoa" to reduce excessive heeling during gusts. This puts excessive wear on sails which flap violently in strong wind and is basically poor seamanship.

Most keelboats can effectively "lay a-hull" or "heave to" in heavy weather. Again this is usually a practice foreign to, and unpracticed by skippers who come from a dinghy sailing background.

Practice lying a-hull in a keelboat in heavy weather by starting from a position which is well to weather of a lee shore. Take away and secure all sail and leave the boat to lie in whatever manner she will naturally settle. This is usually a far more comfortable situation and may reduce the anxiety and stress of passengers who are not used to

rough weather. The yacht will drift slowly to leeward. Do not hesitate to get underway again if sea room to leeward becomes limited.

Practice heaving to by taking away the mainsail and sheeting a storm jib to weather (or amidships if the jib can clear the mast) and lashing the helm to leeward. This will cause the yacht to sail a slow zigzag course in a general beam reach direction. This will reduce the lateral drift of the yacht and afford extra time before getting too close to a lee shore. This exercise needs to be practiced by skipper and crew to ascertain the best sail and rudder settings for the particular yacht.

It also builds confidence in the skipper and crew with regard to their ability to handle heavy weather in a calm and unrushed manner. It is also a comfortable way to ride out a storm by leaving the yacht to its own devices while you carry out other tasks on board apart from keeping a good lookout.

3 Keelboat Maintenance

For the vast majority of a keelboats life it is left on a mooring or trailer to fend for itself. Ventilation issues are probably the greatest issues to deal with in terms of the internal condition of the yacht. Good ventilation prevents heat build up and humidity build up inside the cabin. Those two factors are the greatest cause of equipment deterioration. Ventilation systems must be designed and used in such a way as to prevent rain water and spray from entering the boat, and also to prevent the ingress of nesting birds. Through flow of air is important.

Nesting birds are probably the biggest cause of problems on deck. They not only make a stinking mess of the deck but their droppings can be corrosive and damage fittings. Their nesting materials can block cockpit drains. Buckets with a lanyard for sluicing down, and soft scrubbing brooms are essential items for making the boat habitable for the weekend.

Permanent mooring gear failure is one of the greatest causes of total loss of yachts, particularly on inland dams. There are various reasons for this; however moorings should be checked for corrosion and wear at least once a year. Permanent moorings can also seriously damage a yacht if the correct precautions to prevent wear are not taken.

Inland dam water levels can drop making moorings too shallow which can result in keelboats grounding. This is a serious problem in strong wind when wave action can cause the keel to smash into the dam bottom and very soon damage the hull, resulting sinking. Conversely dam levels can rise in the space of hours and if moorings have been shortened the bow can be pulled underwater and the boat may sink. In strong wind shortened moorings cause the boat to snub harshly and wear and damage very quickly results. This can also result in waves breaking continuously over the bow of the boat which can also contribute sinking in a surprisingly short space of time.

Bilge cleanliness is a must as stagnant water it helps to promote wood rot and fungal growth and corrosion inside a boat.

Do not leave unregulated solar chargers or wind chargers connected to batteries, it will overcharge them and damage the cells.

If possible stow synthetic running rigging out of direct sunlight.