

## MOORINGS AT CARGREEN

Cargreen Yacht Club has been making, laying and maintaining moorings for more than 30 years. Methods of construction have been consistent over the last fifteen years, but before that were rather variable. Many of the oldest moorings have been replaced. Moorings consist of:

- a. A sinker, usually a concrete block
- b. The ground chain (or Ferry chain), a 2 to 5 metre length of heavy chain. Historically second hand chain from the Torpoint Ferry, though now often ex Admiralty mooring chain.
- c. A 10 or 12 metre riser of 20mm chain
- d. A hippo buoy, now an SB1 for deeper moorings, and an SB2 for shallower moorings
- e. A stainless steel swivel
- f. Strops and shackles provided by the mooring owner or tenant, though the Club has strong views about how these should be made and fitted.
- g. The fairleads, bow roller, cleats or samson posts on the moored vessel.

Looking at each component in slightly more detail:

### **Sinkers:**

The weight of the sinker varies according to the size of the vessel expected to use the mooring. The largest sinkers, which are expected to be adequate for a 15 ton yacht or motor boat, contain 1.0 cubic metres of concrete weighing about 2.5 tons. Sinkers intended for vessels up to 4 tons weigh about 1.2 tons, and those intended for small boats weigh about 0.5 tons. All recent sinkers have been reinforced with man made fibre and/or steel reinforcing rods. Some of the older sinkers were not reinforced and were of various shapes and sizes.

### **Ferry Chain**

The Ferry chain on recently made moorings has been matched to the weight of the sinker and to the depth of the water so that the riser chain can be inspected and, when necessary, replaced at low water springs without raising the sinker. (Sinkers tend to sink into the mud and have to be raised from time to time). Heavy sinkers have 4 or 5 metres of 45mm ex Admiralty chain, lighter sinkers have 3 to 4 metres of 30 or 35 mm chain. In all cases the chain is embedded in the sinker and reinforcing rods are passed through the embedded links. Some of the older moorings used lighter chain, others had a steel loop or eye to which the ferry chain was shackled, knotted or threaded through. Conventional shackles with a threaded pin do not last well underwater because threads tend to corrode and the pins become loose. Mooring shackles are better but not as reliable as having the chain embedded in the concrete.

## **Riser Chain**

We use 20mm long link grade 30 steel chain. Most moorings need a 10 metre riser chain. Very shallow moorings can have 8 metre lengths and deep moorings have 12 metre lengths. The riser chain is secured to the upper link of the ferry chain with a knot, (a turn and two half hitches) and the tail is secured to the standing part of the riser with a moused shackle. After two years a second moused shackle is usually added to the tail. This is a belt and braces method which is used because threaded shackles are unreliable in salt water, and a knot can work loose if the tail is not secured. Riser chain usually lasts 5 or 6 years at Cargreen. It is replaced when it is no longer strong enough to lift the sinker out of the mud at the next annual service. This is often an issue with the owners of smaller boats who feel that their riser would have held their boat securely for another year, but the financial benefit of leaving a riser chain for an extra year is small, and the cost of losing a sinker and ferry chain is large.

Riser chains normally corrode most severely about half way along their length: heavy vessels which are more likely to lift the ferry chain clear of the bottom in strong tides tend to show most wear at the lower end of the riser. Sometimes only one link is corroded. It may very occasionally be possible to weld good lengths of used chain together, but a lot of time and effort is involved and it is not something in which the moorings team wish to become involved.

## **Rope Risers**

Rope risers have been used in the past and one remains in use. They do not corrode underwater, but connecting a rope riser to a hippo is complicated and they are difficult and time consuming to lift, and are therefore not used.

## **Hippo Buoys**

Hippo buoys are used in preference to balloon mooring buoys because they remain afloat when damaged, and the swivel is above water where the rate of corrosion is less, and they can be inspected much more frequently. The SB1 buoy with a potential lift capacity of about 145kg is now used on the deeper mooring (10 metres of 20 mm riser chain weighs approximately 100kg). This is for several reasons:

- a. They are easier to see and so are less likely to be run down by motor boats
- b. If damaged their greater reserve buoyancy enables them to remain useable for many years.
- c. Painted numbers remain legible for longer because the top of the buoy is rarely submerged.

Smaller buoys (SB2 & SB3) have been used in the past, but with a deep mooring they do not support the weight of a riser especially when the riser is encrusted with mussels or weed or in a strong tide. SB2's will still be used on shallow moorings.

Hippos can cause more damage to a yacht's topsides than balloon moorings buoys either from the metal work on the top of the hippo or abrasive growth on the underwater part of the hippo. This damage can be reduced by using short strops, covering the metal work (old gumboots work well) and cleaning growth off the hippo.

Old hippos tend to become less buoyant and more wrinkled. When they can no longer support the weight of the riser chain or cannot be numbered clearly they need to be replaced.

## **Swivels**

Stainless steel swivels with a central pin diameter between 12mm and 20mm are used depending on the size of the mooring. Stainless steel lasts well in air but corrodes under water. Mild steel swivels are preferred for under water use.

## Strops

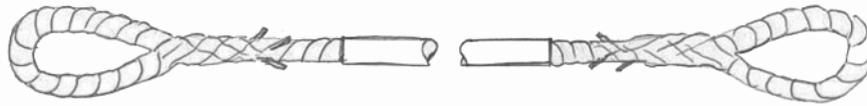
These are the responsibility of the boat owner, but a number of boats have gone adrift over recent years, usually because shackles have not been properly moused, and the club has developed some opinions on how yachts should be attached to moorings. The sketch below shows the general arrangement.

There are soft eyes at each end, one suitable for attaching to a 19mm stainless bow shackle at the swivel with a form of Cowhitch (see below); and the other suitable for the cleat or Samson post on the boat.

There should be five tucks to each splice then trim the ends with two or three taper tucks, heat seal or whipping to finish.

A longish length of plastic pipe (or other suitable material see 'Chafe' below) should be passed over the strop before the second splice is made.

*Strops should be kept short to reduce the vessel's swing circle*, an angle of 45 degrees from the top of the Hippo buoy to the boat's fairlead or bow roller is appropriate.



- a. **Which material should be used?** As a result of recent experience we have changed our advice on this.

*Polypropylene* is buoyant and may therefore be less inclined to become entangled around the riser chain when the vessel is not on the mooring. It is also cheap but lacks the elasticity and strength of nylon.

*Chain* is strong but lacks elasticity and this may have caused or contributed to the breakage of a cleat on a 34ft yacht in 2016. Chain while itself being resistant to chafe, can damage the bows and foredeck fittings of a yacht, unless encased in plastic tubing or other anti chafe device. Grade 40 or better-galvanised chain should be used and we recommend 12 mm chain as a minimum because the links permit the insertion of reasonable sized shackles.

*Nylon* is negatively buoyant and because it sinks when the vessel is away from the mooring is more likely to become tangled around the riser than buoyant polypropylene. Nylon is however stronger size for size than polypropylene, has greater elasticity, which reduces shock loads, and provided that adequate anti chafe is incorporated, is probably the best all round material to use.

*To summarise:* Polypropylene is satisfactory for summer use. Nylon is the all round winner and is the only material recommended for vessels left on moorings over the winter months. Chain should only be used with deck fittings that are guaranteed to take the shock loads.

- b. **Attachment to the swivel.** Strops should be attached to the top loop of the swivel with moused stainless steel shackles. 19mm stainless D or bow shackles are recommended for larger boats; 16mm is adequate for smaller boats. Either hard eyes or soft eyes, doubled over themselves and the shackle, are equally effective. (see photo) Strops should be removed at the end of the season because of the risk of entanglement with either the riser or the mooring barge. This is a simple task with stainless shackles but galvanised or ungalvanised steel shackles tend to rust solid and often need to be cut off. *It is important that no strops are attached below the swivel.* If this is done they can become so tightly twisted that they cannot be separated and need to be cut off, and there is a greater risk of strops breaking.



30mm Polypropylene attached to a 19mm bow shackle

- c. **How many Strops and how thick a rope should be used?**

Table 1

| LOA up to 6 metres        | LOA 6 to 9 metres          | LOA 9 to 12 metres         | LOA12 to 15 metres        |
|---------------------------|----------------------------|----------------------------|---------------------------|
| Typical disp. up to 1 ton | Typical disp. up to 4 tons | Typical disp. up to 7 tons | Typical disp. over 7 tons |
| Rope size 20mm            | Rope size 22mm             | Rope size 24mm             | Rope size 30mm            |

*There should always be two strops firmly shackled and moused to the top of the swivel. Table 1 above gives rope size for nylon. For polypropylene it is suggested that the next size up is used.*

- d. **Chafe.** Chafe is the greatest cause of strop breakage. *All strops should be suitably protected with poly tubing, fire hose or canvas serving.* Carpet wrapped around the strop at chafe points and secured with light line or cable ties can be a very effective short term protector. It is recommended that strops should be about 20cm different in length to reduce chafe above the swivel.
- e. **Securing strops to deck fittings.** An eye splice is preferred. Cable ties or light line can be used to ensure that the splices do not lift off the cleats

### **Deck fittings**

There are a number of boats on the moorings with bow rollers, fairleads, or cleats that are too small, or insufficiently robust. There are several bow rollers that lack retaining pins, have sharp edges that can cause chafe, and in a few cases decks seem to be inadequately reinforced to withstand the strains imposed by attached fittings. Owners with any doubts about the strength of their deck fittings should seek advice from the Moorings Officer particularly if they plan to spend the winter on their mooring. If the Moorings Officer considers that the deck fittings are inadequate the owner may be requested to remove his vessel from the moorings over the winter months.

### **Mooring Service**

All Cargreen Yacht Club moorings are inspected annually to ensure that they are strong enough to hold any yacht or motor boat that may be secured to them, and that all components are sufficiently robust to lift the sinker the following year.

Any strops left on the unoccupied moorings are usually removed to avoid fouling the barge propeller and to prevent the strops from becoming tangled around the riser chain during the winter.

Hippo buoys are checked for integrity and buoyancy, and those that have insufficient flotation or are too wrinkled or discoloured for numbering are earmarked for replacement. The Moorings officer will normally discuss a hippo change with the mooring owner because of the cost of replacement, and if possible will arrange to change the buoy at the same time as the riser chain.

All riser chains are lifted, cleaned and thoroughly examined to check that no links are excessively corroded. Shackles are replaced if necessary, and an additional shackle may be added.

The heavy ferry chain on the newer moorings will last in excess of 30 years, and an annual examination is therefore unnecessary. It is examined every 5 or 6 years when the riser chain needs to be changed. Older moorings with worn or lighter ferry chain, and those with the ferry chain shackled to the sinker are examined more frequently, usually annually.

The Moorings Officer endeavours to give mooring owners advance warning of riser or hippo replacement to soften the shock of large bills.

### **Vessels left on Moorings**

Fifteen years ago there were fewer than 10 yachts and motor boats left on their moorings over the winter. Owners of these vessels were requested to move them at a mutually convenient time to allow their mooring to be serviced. In recent years more than 30 vessels have been left on moorings over the winter and with such a large number of owners and the barge programme being affected by tidal stream, wind strength and direction, and therefore being somewhat unpredictable, it is no longer practical to arrange definite service times with each owner. Small vessels are therefore taken alongside the barge while their moorings are serviced: only larger vessels are requested to move. If for any reason large vessels cannot be moved by owners, servicing may be deferred, or if the riser chain is likely to need replacement, the vessel will be moved off the mooring by other means, and owners may be charged for the time taken to move the vessel.

Despite the club's requirement that strops are inspected by owners at least every three weeks, inspection of the moorings by the barge team during the winter months commonly finds that about 15% of strops are inadequate, usually as a result of chafe. In the past these have been replaced or supplemented free of charge from barge stocks. A charge will be made in future. Owners are informed if their stopping arrangements are changed or are in need of attention, and all owners of boats afloat on the moorings over the winter are strongly advised to check their strops as soon as possible after mooring servicing. *The responsibility for strops and deck fittings remains with the owner of the moored vessel.*