

SYC Moorings – Guidance for Maintenance

General – Your boat spends the majority of the time on a mooring. Failure of any of the relatively low cost components can result in the loss of a very high cost boat and perhaps damaging others. **It is not just your own boat that is put at risk.**

To prevent such failure the correct design & specification of the mooring's components and their **regular annual maintenance is essential.** *It is the owner's responsibility to ensure that this is done.*

Components need to be of a size that maintains adequate strength despite the inevitable wear & corrosion that occurs during a number of seasons (2-3).

SYC expects all moorings to meet adequate standards for all components when new and for **annual inspection and replacement as necessary. Your insurers will expect this as well.**

(Tip: save your mooring specification and invoices of components as evidence and perhaps take photos of the assembled mooring onshore)

Advice & assistance with all aspects of mooring may be obtained from experienced SYC cruiser members – Please contact the Cruiser Secretary for further information.

Mooring Components

Sinker – A heavy concrete block with a short length of very heavy chain embedded (the ground chain). Sometimes old railway train wheels are used. This is buried in the seabed.

Alternatively two “mooring” anchors (only one fluke) joined by a length of very heavy chain (typically old ship's anchor chain - 28mm+). In most cases unless you are laying a new mooring these items are already in place and your concern is with the following components.

Riser - Shackled to the Ground chain. Length should be 1.5 x depth of water at max springs +0.5m to allow for surges and low barometric pressure. Typically 6-7m at SYC.

Mid (best) or long link G30 or G40 grade. (Mid & long link accept larger shackle pins than short link chain). High grade chain (>G40) is prone to higher degree of corrosion.

14mm chain for boats with displacement < 1000kg

16mm chain for boats with displacement < 2500kg

19mm chain for boats with displacement < 5000kg

(Example Displacements:- Sadler 26 2100kg / Contessa26 2500kg / Halmatic 30 4000kg / Folkboat 2100kg / Westerly Fulmar 4400kg)

Short chain links restrict shackle pin size. The shackle pin size should be bigger than the chain size. The assumption that the size of mooring chain relates to anchor chain size is incorrect.

Swivel – an essential item shackled to the riser & buoy or buoy chain if “through-buoy chain” type is used. Next size larger than chain. (e.g. 18mm for 16mm riser, 22mm for 19 mm riser. Use a galvanised swivel. Stainless is acceptable **only above water** (and is more expensive and unnecessary.)

Buoy – Buoys of a variety of types are specifically made for moorings . They must be large enough to support the weight of riser+shackles+swivel +pendant .(16mm chain weighs 6kg/m, 19mm 8kg/m approx.)

Using round fender-type buoys is acceptable, but attention must be given to the plastic loop, which wears against the shackle attachment. Sleeving the shackle pin with plastic pipe will reduce wear.

All buoys should be marked with the appropriate PC or SYC number, (not always easy or permanent with plastic buoys). Permanent marker pens will have to be refreshed every season.

Riding pendant or strop – May be chain (this is heavy). Otherwise 24mm multiplait, sleeved with antichafe (hollow webbing, hose or both), eyes spliced with thimble. where shackled to riser. Hose may be plastic, rubber or layflat (available in a wide range of sizes)

Chain strop – minimum 12mm. Preferably used in conjunction with a shock absorber, either of light nylon or covered bungee as per strops made up by Westward Rope and Wire, Bakers' Yard, Marsh Barton.

Pick-up buoys should be spliced to the riding strop with rope.

Shackles – BS 3023, or green, blue or black pin type. Others should not be trusted. Shackles that fit the chain and have an SWL or WLL (Standard Working Load or Working Load Limit) greater than the chain's (SWL = Breaking Load/4) should be used. SWL may be stamped or cast on shackles. (See section on SWL/MBL & chain strengths at end of notes.)

N.B. A larger, higher SWL shackle may be required to fit the ground chain. If the riser chain will fit through the ground chain, it can be shackled back onto itself. It is important to check that all components fit together before taking them out to work on the mooring.

Sealing the shackle threads -Shackles may be locked either with: Loctite 241 (liquid) or 248 (solid in glue stick type dispenser).

If Loctite (or similar) is not used threads may be greased with waterproof grease (Duckhams Keenol) to prevent corrosion. Alternatively Holts Underbody sealant (also 3M and Hammerite) available online, which is sticky, more durable than grease and may provide some retention of the shackle pin as well.

All shackles should be firmly tightened. This may require significant leverage to attain sufficient torque not obtainable with a spanner alone. It requires a large adjustable spanner and extender tube, particularly for bigger shackles. These tools are also very necessary when undoing the gear! Holding the shackle while tightening the pin will require equal force. At the mooring an assistant to hold a pickaxe head or crowbar to immobilise the chain will be necessary. Ashore a vice may be used (available in the SYC workshop).

Mousing – A mechanical method to prevent shackle pins from unscrewing. **It is recommended that this is done for all shackles.**

They should be wired (Monel or 20 S.W.G. stainless steel wire available from www.lasaero.com)

Cable ties are of dubious value and are not recommended.

Onboard

Pendant via a stemhead fitting with keep pin or lashing (to prevent it jumping out of the fitting and damaging itself and the boat.) Attached to a **large cleat or samson post very firmly secured with backing plates** (ideally of 4mm aluminium. *Penny washers on their own are not adequate.*)

Winterising moorings – The end of the season is a good time to inspect and replace components as necessary. On shore mooring gear may be pressure washed to remove marine growth allowing thorough inspection and easy replacement as required.

Ideally mooring gear, including the riser, should be removed each winter and a temporary marker buoy attached to the ground chain. *Tip: Removing tackle each winter approximately doubles the life of components, and therefore saves money. It also permits close inspection of tackle and early replacement of components.*

The club has a mooring raft, equipped with lifting tackle, available at the beginning and end of each season to enable members to do their own winterising and maintenance of moorings. It also has a large 'Commodore's barge' equipped with a wooden plank specifically for lifting moorings; this is used on the drying SYC moorings. There are Club members able and willing to assist those who wish to carry out their own mooring maintenance.

Marker Buoy

With the mooring gear removed it must be replaced by a marker to locate the ground chain for next season. A smaller buoy with a suitable length (same as riser) of lighter chain (8/10 mm short link) is ideal. If a large loop is created in one end this may be passed through the big ground chain link and the marker buoy passed through the loop for a quick and simple attachment requiring no fixing of shackles on the water. Although rope may seem suitable large items of debris (tree branches etc) float down the estuary in the winter months and may chafe through rope. If your marker buoy is lost finding your mooring will not be easy and if the mooring is lost it will be costly to replace.

Next Season

With any worn items replaced the mooring may be assembled on shore before being taken out to be reattached to the ground chain. This is a relatively quick task with only one shackle to fit.

Replacement -Components should be replaced when a maximum of 15% diameter loss is measured. 10% is safer. (Bear in mind that 15% wear is $.85\text{Radius} = 72\%$ of original cross-section so nearly 30% reduction in strength.) *Base decisions on replacement using "Worst Case" measurements.*

Wear Measurement - Wear which is visually obvious will almost certainly already exceed safe wear limits, so visual inspection alone can be misleading. A simple and effective way to measure component wear is to use digital calipers. These are available on Ebay at very low prices (£5-15) and allow easy accurate measurement to 1/10 mm.

Measure all diameters at 0 and 90 degrees. The wear will be greatest on the side which is in contact with the adjoining chain link. Average the two measurements for an approximation of diameter.

Shackles - Measure Pin and Bow diameter.

Chain - Measure link at both ends. Ideally measure the first few links as wear is greatest there. Measure a few links at BOTH ends of the chain -wear is often higher at the top of a riser

Swivel – Measure both bows and the central pin top and bottom.

Calculate % wear by comparing the measured "worn" chain/shackle/swivel diameters to the original. (Tip: measure & record for future use)

Wear is more significant than corrosion alone, and for this reason the whole system should be inspected closely. Swapping the riser end-for-end may result in more even wear, especially on drying moorings which seem to experience greater corrosion and wear. It is

possible to remove a few badly worn end links to extend the chains working life. **Remember: the whole mooring is only as strong as the weakest component.**

Safe Working Load (SWL) & Minimum Break Load (MBL)

Break Loads may seem higher than necessary (e.g 20,000kg for 19mm G40 chain) but this is the load at which it will fail. The components should not experience this level of load or anything near it in the normal range of use or they may suffer permanent damage. The SWL is a fraction of BL typically 1/4 for chain & shackles, but 1/6 for some shackles (e.g green pin, & black pin). So SWL has a built-in Factor of Safety – normal good practice in engineering. Incidentally this applies to ropes as well, with typically SWL ¼ of Break Load recommended by manufacturers. **Use SWL not MBL for specifying mooring components.**

Loads experienced by moorings **are not continuous, constant or due to wind only** (e.g. 10m boat in 45kt wind (F9) approx 400kg). The boat will likely be swinging about her mooring and being brought up with a jerk at the end of each swing. It will be far worse with wind against tide (S/SE & spring ebb); she will be plunging up & down in the waves with 1 / 2 / 4 tons being brought up sharp and producing **much higher snatch loads on the mooring**. Forget chain catenary - it will be stretched out straight in these conditions (ie >F6) and be of no help in reducing snatch loads. If you have a chain pendant only (and no rope snubber) there will be nothing to absorb the energy and reduce the peak load. Rope pendants will be better at this depending on construction and material.

Chain Specifications

CHAIN	SWLkg	SWLkg	MBL G40 Mid Link		
Dia	G30	G40	Shackle Pin <		KG/m
14	2000	2500	10000	23	4.2
16	2500	3125	14500	24	4.6
18	3500	4375	16000	26	6.2
19	4000	5000	20000	30	6.5

Suppliers & Information

Lower Exe Mooring Authority (LEMA) have considerable experience with moorings and their recommended specifications can be found at: <http://www.lemainfo.com>

Suppliers such as Boat Gear Direct will also advise on suitable mooring components

Laying , Servicing & Winterising Moorings

Exeter Port Authority - <https://exeter.gov.uk/leisure-and-culture/sport-and-leisure/exeter-port-authority/exeter-port-authority-marine-services/>

Simon Turl - [<simonturlmoorings@gmail.com>](mailto:simonturlmoorings@gmail.com)

Mooring Components

Boat Gear Direct – www.boatgeardirect.co.uk

All components

Westward Rope & Wire (Exeter Marsh Barton -

Pendants / Strops ,shackles?chafe sleeving

Jimmy Green Marine (online & in Beer)

Shackles

Safety Lifting Gear – www.safetyliftinggear.com Good range of shackles at excellent prices

BS3032 Shackles - www.liftingsafety.co.uk

Responsibility – the maintenance of a mooring is at all times the responsibility of the boat owner. The mooring should be inspected annually (as a minimum) and components replaced as necessary. These specifications are issued in good faith as guidelines only, and Starcross Yacht Club does not accept any responsibility for actions taken by mooring owners or their representatives.

SYC Cruiser Committee
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