



# Moorings Guidance

A guide to the design, laying and maintenance of moorings.

Compiled by: John Spruce (Moorings Rep)

Approved by: DBSC Management Committee

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## Dalgety Bay Sailing Club Ltd - Mooring Guidance

The aim of this document is to provide a set of guidelines to enable a safe mooring to be made and laid at DBSC. It is based on recommendations from expert advice ([see references](#)) adapted for our local conditions, reflecting the many years of experience of club members. The guidance given therefore is not claimed to be the only way to configure a mooring, nor is it necessarily the best way, and indeed existing moorings may differ from the suggestions made below.

The club and its representatives can accept no liability for any occurrence howsoever caused resulting from moorings made according to this guidance. The ultimate responsibility lies with the boat owner. Owners are advised to check with their insurance companies for any specific requirements which they demand and seek professional help if required. Owners are reminded that any mooring failures reflect on the perceived risk by all insurance companies which in turn can affect the premiums charged to all boat owners.

The Club reserves the right to alter this guidance from time to time as experience is gained; indeed many existing moorings may differ from the suggestions made below.

There are only five **mandatory requirements imposed by DBSC** with regard to moorings::

- ) Location of all moorings must be agreed in advance with the moorings rep.
- ) Annual payment to Crown Estates for deep water moorings is required annually via DBSC
- ) All moorings must be inspected at least annually before use at the start of each sailing season
- ) Boats must be adequately insured ([see club rules 13.1](#))
- ) An annual Mooring Owners Agreement must be signed ([see DBSC website](#))

### **General comments**

The Crown owns the seabed below Mean Low Water Springs (MLWS) and charge an annual fee for moorings laid, whether used or not. Dalgety bay moorings are managed by Dalgety Bay Sailing Club by agreement with the Crown Commissioners and in this way a reduced fee (50%) is payable by mooring owners. These are also referred to as 'deep water moorings'. The agreement with Crown Estates allows for moorings only within a specified area ([see Appendix 1](#)) and a maximum number of 80 can be laid.

Moorings above MLWS, also referred to as 'drying moorings' are in theory chargeable by the owner of the land, but this has never been invoked.

Please note that MLWS should not be confused with chart datum and just because a mooring dries at some tidal conditions it does not mean it is classified as a 'Drying Mooring'. In fact MLWS is quite a long way inshore and so most of our moorings are subject to the Crown Estates fee.

The club also holds the Marine Licence for all moorings in the area designated by Crown Estates and in the bay above MLWS.

In accordance with Fort Ports Byelaw (51) moorings are also required to be approved by the Harbour Master, in this case Forth Ports Ltd. The club obtains this approval from Forth Ports on behalf of mooring owners.

This guidance applies equally to 'deep water' and 'drying' moorings.

The main risks to be mitigated are as follows:

- ) Dragging of mooring (adequate and appropriate ground tackle and ground chain in appropriate location)
- ) Collision with other boats or rocks (position of mooring and length of riser)
- ) Failure of mooring (adequately sized chain/rope, correctly sized and seized shackles, secure fixtures on the boat, and regular inspection and servicing of mooring)

## **Positioning Your Mooring**

The moorings area consists mainly of hard and soft mud interspersed with rock reefs. Locating the mooring is important such that good ground adhesion is achieved, and the swinging circle of the boat avoids hazards from rocks and collisions with other boats at all tidal conditions.

All **mooring locations must be agreed with DBSC Moorings Rep.** When you have decided on the size of boat you will have on your mooring in the foreseeable future, come and discuss your mooring with the moorings rep before spending money on what may be inadequate items. Please do so well in advance as it all takes longer than you think to assemble and lay. The mooring should go down in advance of the boat in the case of a weight type mooring, to allow it to sink into the seabed. Help is available to prepare and lay your mooring using the DBSC raft. ([See also guidance on safe use of the raft](#)). The maximum lifting capacity of the raft is 1700 kg.

The DBSC Moorings Rep. will keep a record of moorings and their GPS coordinates to aid the recovery of lost moorings.

## **Constructing Your Mooring**

### **Materials of Construction**

It is important that appropriate quality materials are selected for mooring construction. Often the ground tackle consists of 2nd hand material but the riser and shackles must be of proven material. [Bradney Chain & Engineering Co. Ltd](#) and [FPM Henderson \(Glasgow\)](#) produce useful guides to moorings in general and address the issue of materials of construction. The key point they make is that there are a number of different grades of steel in use, some of which (e.g. high tensile steel for lifting) are totally unsuitable for marine use. Stainless steel chain and fittings must not be used in seawater.

DBSC buys its own mooring equipment from [Mainbrace](#) in Rosyth and although other suppliers are available beware of cheap imports with poor fitting shackles. Mainbrace supply good quality equipment and will provide competitive prices for club members.

The highest rate of corrosion occurs in the top metre or so of seawater as this is where the highest oxygen levels are. When submersed in mud (e.g. the ground tackle) corrosion is virtually zero. With some careful thought the mooring can be designed so that the top part of the chain (above the swivel for instance) is easily renewable every year or two without disturbing the ground tackle from its secure resting place in the mud. Following the sailing season the mooring can be lowered into the mud and marked using a temporary buoy with rope or old chain. This can significantly increase the life of the chain and reduce costs for little effort.

Some success has been had by attaching zinc anodes to the riser which preferentially corrodes and increases the life of the chain.

### **Ground Tackle**

Because of the seabed in the bay the most successful moorings consist of weights (sometimes with additional anchors) that are buried or allowed to settle into the mud. This gives both good horizontal resistance to drag and also some 'suction effect' against lifting. However, like anchoring your boat it is important to have sufficient scope of chain to ensure the main load taken on the ground tackle is horizontal. Whatever ground weight you choose it should be accompanied by sufficient heavy ground chain to provide both a horizontal load on the weight and also help prevent snatch and strain on your boat fitting. A 2<sup>nd</sup> weight fitted circa 2m along the ground chain is a sensible addition. This acts as an angle preventing snatch and also ensures a more horizontal pull on the main ground weight. The distance between weights in this arrangement should not be more than 2 metres to allow both weights to be lifted in a single lift by the raft at high tide for bringing ashore.

Possible ground weights that can be used are train wheels or lorry tyres filled with concrete. Beware of using large steel scrap items with sharp edges that may damage your boat if you ground on it.

The size of weight required depends primarily on size of boat and windage. Where weights are buried in the seabed the holding power can be 4 times greater than the dead weight according to [Bradney \(page 12\)](#). FPM Henderson has supplied moorings for Dalgety bay and recommends that a single railway wheel has proved to work well. They can supply different weights of wheel from the standard at 350kg which they recommend for sailing boats less than 28ft when sunk in mud to extra-large wheels at 500kg which would suit larger boats.

If alternative weights are used remember that in calculating the required weight that concrete and steel when immersed in sea water weigh considerably less than in air. See also [Appendix 3](#). The table below provides a useful guide in respect of weight ‘loss’ that needs to be accounted for.

Material	In Air (kg/m3)	In Seawater (kg/m3)	% weight ‘loss’
Concrete	2300	1270	45%
Cast Iron	7150	6130	14%

The ground chain should be securely attached to the ground weight either by very large shackles in the case of iron weights or by concreting in for concrete weights. The [Bradney guide](#) gives recommended sizes of chain for ground chain and riser chain as does the FPM Henderson table (see below) but the heavier the better. 20mm is recommended as minimum size. Around 3m is an appropriate minimum length and also allows the servicing of the riser on deep water moorings without disturbing the ground weight.

Heavy anchors of the right kind may be successful if well laid, but experience in gales has shown that anchor moorings tend to drag into a single line, (West/East). As a guide, choose a type you would be happy to anchor to on a lee shore in a gale and consider this a minimum. Specialist mooring anchors, when well embedded, can be very acceptable. Because of this it is only practicable to use anchors on drying moorings where they can be securely buried and visually inspected.

It may be that the best combination is that of heavy weight(s) and anchors. This is the most likely to succeed on a very variable and changing seabed.

### Riser

There are many standard tables suggesting minimum chain sizes for boats of a given length and average weight and windage. These relate to good quality calibrated new chain. Used chain of uncertain type when acceptable should probably be of a larger size. The FPM Henderson tables suggest:-

Boat Size	Ground Chain Size	Riser Chain Size
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Up to 20'	12mm	8mm
21' to 25'	16mm	10mm
26' to 30'	19mm	12mm
31' to 36'	28mm	16mm
over 36'	32mm and over	19mm and over

Chain size is measured by diameter of steel used in the link

For the average depth of water in the bay a **minimum length of 20m** and a **maximum length of 25m** should be used. Too short and the boat may lift its mooring, too long and it may interfere with other boats. Chain is usually available in long, medium and short link. Long link is not recommended as it is more liable to tangles and is less strong, short link is difficult to fit shackles to so medium link is a good compromise ([Bradney guide page 7](#)).

Swivels have always given rise to debate. They are seen as introducing a weak link into the mooring as there are inevitably extra shackles are introduced as well as the potential failure of the swivel. They do however prevent twisting and knotting up of the chain which will reduce the effective length. FPM Henderson's guide says 'Swivels - There is always an argument as to whether a swivel is required or not. The rule of thumb is that if a boat is off its mooring regularly (once a week), than a swivel is not necessary - if it's not - then it is! In any case, a swivel should probably be renewed every year as it is always the weakest point in any mooring'. If used they should be of a size for chain heavier than used to ensure adequate strength despite some wear.

All shackles **should be oversized** for the chain and of a type not to set up electrolytic action in the mooring, i.e. **avoid stainless steel etc. All shackles must be of good quality and adequately secured. Monel seizing wire and Araldite are recommended.** Plastic cable ties can be a useful addition but are not a substitute for seizing wire. When using the araldite it should be generously smeared over the threads and the shank of the shackle pin so that it fills any gaps, thus inhibiting corrosion. Araldited shackles can usually be undone for later removal especially if gripped in a vice. Large ground shackles can be successfully welded to keep them from undoing.

Sometimes, e.g. where attaching a riser to a large ground chain it is possible to loop the riser through the larger chain and use two shackles to secure it thus avoiding reliance on a single shackle.

There has been some instances where properly seized shackles have come undone in a relatively short period of time and this is thought to be because of the way they have been attached to the chain resulting in them 'manipulating' themselves against the chain or other shackles and cutting the seizing wire. Whilst this is difficult to predict and not fully understood it is worth trying to arrange the shackles and wire in such a way to reduce the risk of this happening.

### **Buoy**

This **must be adequate to support the weight of the riser** so that it floats conspicuously at high water. Other sailors & RIB drivers find poorly visible buoys a hazard. They should be brightly coloured, kept free of weed, and be marked with the boat's name and, if possible, the owner's telephone number. In the case of a breakaway, the owner is more easily contacted as the buoy may go with the boat.

It is possible to arrange things so that the buoy is removable when the boat is on the mooring to avoid possible loss of the buoy.

If a second (pick-up) buoy is attached then the **trailing warp should be under 2m long**. Long trailing warps must be avoided as they are a menace to all water users.

### **Connecting the boat to the Riser**

Bradley says whenever possible it is preferable to use chain of the same type as the riser. **Based on recent experience of club members, issues with moorings failing can be mainly attributed to failing shackles or moorings ropes. It is strongly recommended that ropes are not used at DBSC and all shackles are properly secured and regularly inspected.** Contact Moorings Rep for further guidance if required. (If rope has to be used then a minimum for a 20ft boat would be 20mm diameter three strand nylon or its equivalent. It is seldom breaking strain that is the problem, but chafe. If rope has to be used it must be adequately protected against chafe at the chain connection by a thimble, and at the bow roller by plastic tube or Kevlar sleeving.

An adequate means of attachment to the boat is required. Simple loops over cleats or bollards can jump off, so secure them firmly. If the primary attachment point gives rise to doubt, then a second point in tandem may be useful.

## **Inspecting & Maintaining Your Mooring**

DBSC requires that **all moorings are inspected annually before boats are launched in the spring**. The club raft is available to do this. See the moorings rep. for raft booking. It is possible to wade out to drying moorings at low tides. Great care should be taken to avoid getting stuck in the soft mud.

Bradney suggest a maximum of 15% reduction of chain diameter before renewal. This of course depends on how much oversize allowance has been included in the first place.

Moorings may be brought ashore for servicing but in most cases it will be easier and better not to disturb the ground tackle and inspect in situ.

As mentioned above it is best practice to drop moorings to the seabed for winter.

Critical shackles that can be checked during the sailing season should be visually checked regularly.

## **Mooring Tags**

Deep water moorings require an annual payment to the Crown Commissioners which is collected and administered on their behalf by DBSC. Owners must display the numbered 'mooring tag' supplied by DBSC on payment. This tag should be visible at all times.

## **Unused Moorings**

All deep water moorings require an annual payment whether in use or not. Any unpaid moorings will be lifted by DBSC and brought ashore and disposed of in line with club policy. Unused drying moorings will also be similarly dealt with.

Members may sell an unwanted mooring to another member but this does not automatically transfer the right to the mooring location without the approval of the Mooring Rep.

## Appendices

- Appendix 1: [Crown Estates Mooring plan](#)  
Appendix 2: [Example Ground weights](#)  
Appendix 3: [Illustration of Mooring components](#)

## References

1. Bradney: '[A practical guide to the anchoring and mooring of small boats](#)'
2. FPM Henderson: '[Yacht moorings – a rough guide](#)'
3. DBSC Moorings agreement



Appendix 2: Example Ground Weights

Diameter (mm)	Depth (mm)	Volume (cu m)	Weight in air (kg)	Weight in seawater (kg)
<u>Tyres filled with Concrete</u>				
560	200	0.05	118	65
630	150	0.05	112	62
590	200	0.05	131	72
950	250	0.18	425	234
750	300	0.13	318	175
1000	400	0.31	754	415
<u>Train wheel</u>				
Standard			350	301
Large			500	430



Railway wheel with heavy ground chain looped through and shackled on



950mm dia tyre being filled with concrete. Note heavy chain secured with steel rod in the middle of the concrete to ensure secure attachment. This weighs about 250 kg in sea water so slightly less than a standard train wheel.

Appendix 3: Illustration of Mooring Components



Moused shackle with crossed Monel wire.



Corroded shackle showing how the pin can become loose. Araldite in this area can help prevent this



Swivel joining riser chain. Note the size of swivel and shackles relative to chain size



Heavily corroded chain!



Shackle joining riser chain to ground chain. Note araldite, Monel wire and cable tie used.



Shackle joining concrete weight to ground chain. Note araldite, Monel wire and cable tie used.