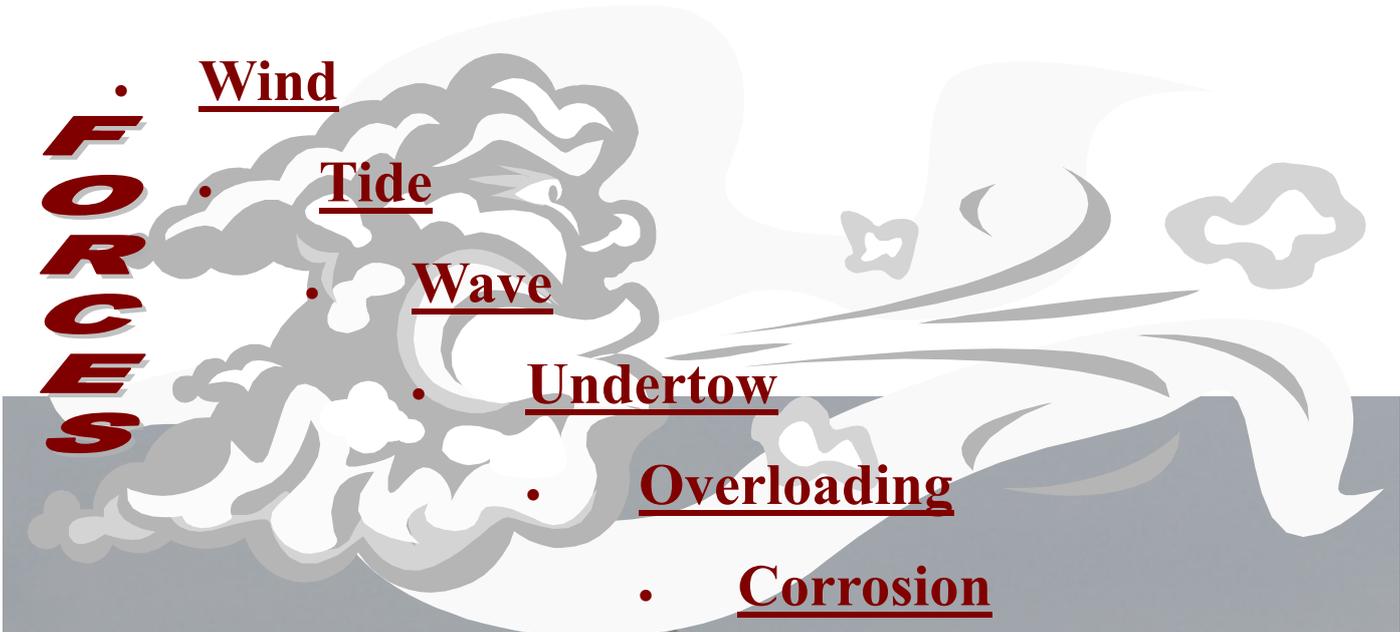


PERMINANT MOORING

METHODS and SYSTEMS

The Objective is to securely restrain a vessel within a limited position having regard to the potential natural and manmade forces placed upon it.

The Problems are the potential strains and loads that are placed on boat moorings, they can come from a number of forces which act either singularly or in combination, they include:

- 
- Wind
 - Tide
 - Wave
 - Undertow
 - Overloading
 - Corrosion

These **FORCES** vary in degree, they can act either independently or jointly, trying to accurately calculate them is an inexact science.

Prudent practice

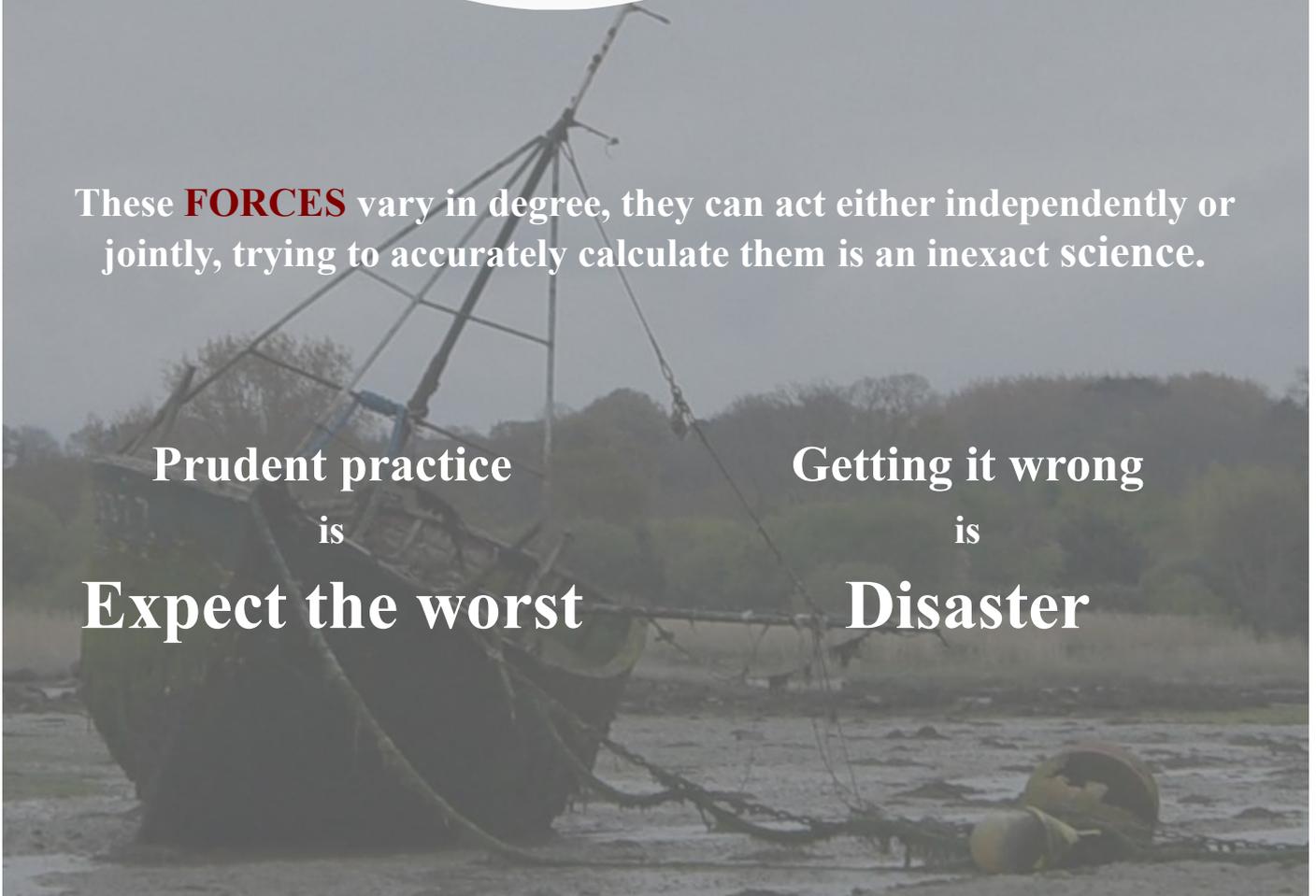
is

Expect the worst

Getting it wrong

is

Disaster



FORCES – explanation

Wind

Hull, superstructure, rigging, sail stowage, spray hoods and underwater shape all have a bearing on the load placed on the vessel by air load. Wind velocity aerodynamically increases with the square of the wind, if the wind strength doubles the load is multiplied by four and if it quadruples it goes up by twelve. It's impossible to quantify the effect of wind caused by boats yawing and veering from side to side due to the tide trying to overcome wind or visa versa, what can be said is that these additional forces add greatly to the strain placed on both the mooring and boat parts. Additionally, within crowded mooring areas there is the additional hazard of 'charging'* if there is too much scope allowed within the riser.

*The effect of a vessel being driven forward by the weight of the wind.

Tide

Generally tidal stream speeds are known, but the force on the mooring system can vary according to the boats underwater area, shape, the amount of marine fouling, and the aspect of the craft to the tidal stream.

Wave

Waves and swell have the most damaging effect on moorings. The various motions brought about by these conditions include violent pitching and rolling with its consequent stress on both the mooring assembly and boat equipment.

Undertow

As demand on available river space increases the practice of laying moorings ever nearer to navigation channels grows. The possibility of scouring should be always be considered. We are aware of a number of instances where freshly laid mooring systems have become untenable due to anchors/sinkers moving probably triggered by the river bed around them being washed away by undertow, this is can be caused by factors such as passing ships, speeding boats and dredging.

Overloading

Can be caused by large craft using moorings laid for small boats or rafting!

Corrosion

Is an ever-present problem, it varies between locations to such an extent that identical moorings only short distances apart will be affected differently.



One length of chain within the same system can corrode quicker in some places than others.

Prudent practice is expect the worst.

MOORING - hint plus some do's and don'ts

Know the surface that mooring will be laid on, e.g. mud - sand - rock. Varying bottoms sometimes require different systems, remember mud and sand give better holding for anchors.

Be aware of the direction of tidal streams. Multipoint moorings laid across the tidal stream require heavier tackle.

Know the water depth at the designated mooring position at both HWS and Low Water.

Although new tested chain is always available, good quality used chain is often adequate for use as ground chain.

The recommended minimum riser-chain length is the depth of water at HWS x 1.5. This chain must be new, good quality and tested, you should ask for a test certificate and know its weight.

Never use 'high tensile' (lifting grade) chain as riser-chain.

The size/diameter of the riser chain should be determined by the boat that will be moored to it. To facilitate the use of shackles that are larger than the chain size we recommend a mid-link chain, alternatively we can forge large end links into short link chain. We can always give the weight per meter for any size of chain.

The various parts of the mooring assembly should be connected using only the best quality products, this means TESTED shackles of either genuine British Standard 3032 Screw Pin manufactured from C15 steel or 'Green Pin' US Federal Specification Safety Shackles. A 'Test Certificate' is always available for good quality products.

Shackles and swivels should be of a larger diameter than the riser chain, e.g. if using 12mm riser chain the shackle should have a pin with a minimum size of 16mm and the swivel should be either 14 or 16mm.

Be wary of using the type of shackle known as 'Commercial Shackles', these are badly engineered from poor quality steel, zinc plated, cheap, shiny and not suitable for underwater use, you can easily identify them, the material of the body and the pin are the same size.

Mousing 'screw pin' shackles is essential, this can be done with either stainless steel seizing wire or plastic cable ties.

Where light sinkers are used it will help if they can be dug in.

We've seen various methods of deploying sinkers, besides the professional approach of using a mooring barge/workboat with Hiab type crane, these include; towing, skidding on sledge, floating under buoys and supported between two boats.

Unless it is very heavy avoid using an anchor for single point moorings. The constant turning and re-setting of a small anchor will eventually reduce holding power and result in dragging or chain fouling.

Remember, the mooring buoy must be able to support the weight of the riser chain. The buoyancy given in buoy specifications is total buoyancy in kgs, 60% of the total buoyancy is usually adequate to allow the buoy to support the weight of the riser chain and remain above the surface, taking into account tide run and rough conditions.

An all chain assembly offers the best option for reducing movement within the system.

Inspect mooring systems annually and replace anything that is more than 10% worn. The degree of wear will vary according to use and location together with the specifications of the equipment used relative to the size of boat using the mooring. (e.g. a light boat on heavy mooring gear will not cause as much wear as a heavy boat on light mooring gear).

Consider asking a local contactor him to lay the mooring using your equipment.

Ask us for 'Test Certificates' for your equipment because your Insurers may ask you for them.

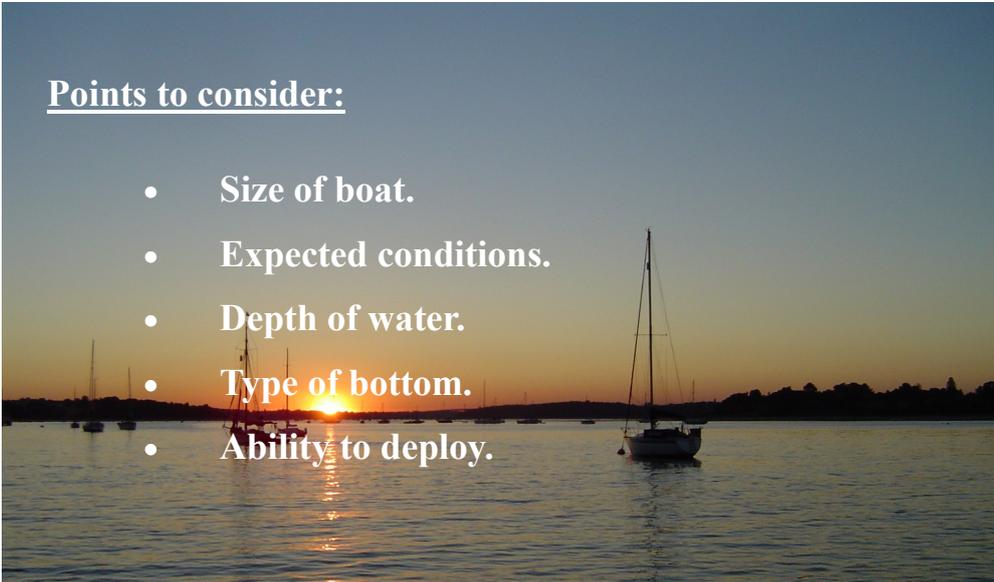
When in doubt.....increase the size!

SINGLE POINT MOORINGS

Single Point Moorings usually consist of a steel or concrete sinker on the river bed with chain or chain/rope riser to a mooring buoy. There is no reliable or simple formula or recommendation that will allow us to say what weight of sinker will be required for a given size of boat within a specific location. However we always try to give good advice.

Points to consider:

- Size of boat.
- Expected conditions.
- Depth of water.
- Type of bottom.
- Ability to deploy.



Hints and Suggestion – single point moorings:

- Having decided the sinker weight, make sure that the chain attached directly to the sinker is very heavy duty (we recommend at least 34mm).
- If on a drying mooring or the Low Water level is shallow, the minimum length of the heavy duty chain should be at least three meters. Long experience has shown that this heavy duty chain is an essential part of a good quality mooring assembly, the weight helps to eliminate much of the damage and wear caused by wave snatch, it reduces the possibility of the sinker being jerked out of position. This heavy duty chain will have a long life span and when it's time to service the mooring it is easier to remove and replace lighter riser chain when the tide is low.
- Remember, concrete sinkers lose more than 25% of their weight when submerged, they can be damaged and unless made of very special materials they can decompose or crumble.
- The sinker shape should include a concave underside to increase suction effect on the sea bed.
- Where lighter sinkers are used it will help if they can be dug in but it is still advisable to use heavy chain between the sinker and the riser-chain.

You will need the following equipment:

- **Sinker**
- **Heavy duty ground chain**
- **Riser-chain**
- **Shackles and Swivel***
- **Buoy**

Why - do BGD manufacture their buoy centres with the swivel at the top?

Because - years of hands-on use has shown that it is easier to see any potential problems and easier to maintain.

BGD buoy centres are also easy and inexpensive to change.

*Not required if you use a buoy that incorporates a swivel.

We supply Mooring Contractors - Harbour and Port Authorities - Yacht Clubs - Boatyards - Trinity House - Fish Farms and Boat Owners throughout Europe.

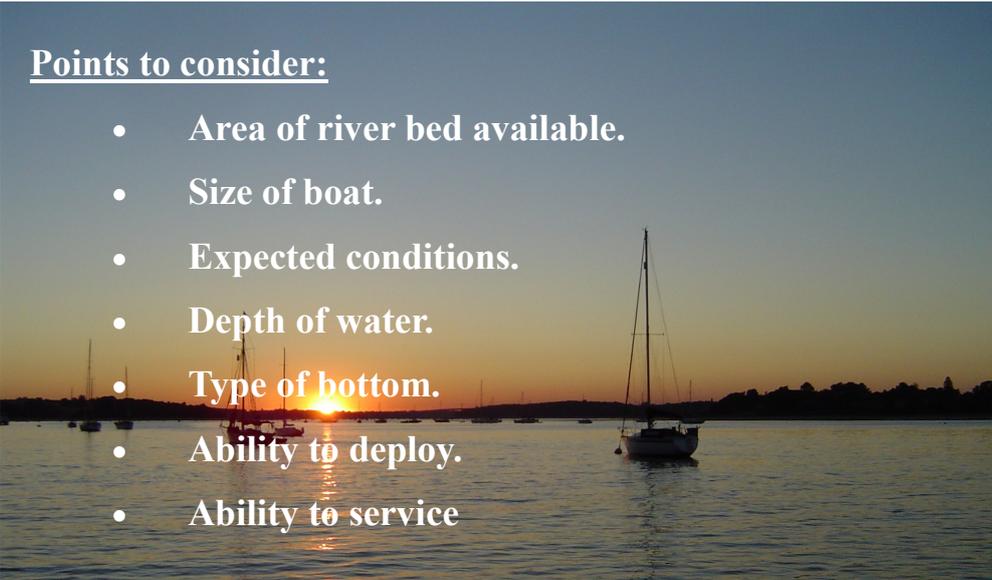
IF WE haven't been there and done it we can ask plenty who have!!!!

MULTI POINT MOORING

As the name suggests this system of mooring uses two or more anchoring points and requires a larger area within which to deploy the mooring assembly. Although there are more component parts within this system the reduction in the weight of individual parts means that with anchors at each end the mooring does not require heavy lifting equipment to position it. There is not a reliable or simple formula or recommendation that will allow us to say what weight of anchor will be required for a given size of boat within a specific location. Experience has shown that in very extreme conditions 'multi point' because of their inherent flexibility can generally be more secure than 'single point' moorings.

Points to consider:

- Area of river bed available.
- Size of boat.
- Expected conditions.
- Depth of water.
- Type of bottom.
- Ability to deploy.
- Ability to service



Hints and Suggestion – single point moorings:

- A. Use either purpose designed single fluke Admiralty Pattern (AP) or stockless anchors.
- B. Use the heaviest ground chain that is compatible with boat size and deployment capability.
- C. Good quality used chain is often adequate for use as ground chain.
- D. Lay two-anchor mooring systems parallel to the tidal stream.
- E. Ground chain can be laid in two sections and joined at the riser-chain.
- F. Do not over tension the ground chain, a little slack is desirable to reduce snatch .
- G. Anchors should be 'set' in the normal way.

You will need the following equipment:

- **Anchors**
- **Ground chain**
- **Riser-chain**
- **Shackles and Swivel***
- **Buoy**

Why - do BGD recommend AP type mooring anchors?

Because - they are specially designed for mooring use with very high holding power relative to size and they have been proved for many years.

**Not required if you use a buoy that incorporates a swivel.

We are the only UK specialist mooring equipment company that offer everything from the anchor to the spliced rope that attaches the boat to the buoy.

F.A.Q's.

Tested Chain – what does it mean?

Chain supplied by Boat Gear Direct is tested by the manufacturer and given a 'Works Certificate'. The manufacturer relies on batch testing, they do not check every link.

The 'break load' shown on the 'Works Certificate' is when the link starts to deform it is not when the link actually breaks.

At Boat Gear Direct we have our own testing facilities to enable us to check that manufacturer's certificates are accurate.

Test Certificates issued by Boat Gear Direct relate to the manufacturers certificate which sometimes show the 'break load' in kN/ton. An easy approximate conversion to change this to tons is to divide the figure by ten, e.g. 75kn = 7.5Tons.

Chain Grades – what do they mean?

Chain 'Grades' relate to the hardness of the material from which the chain is manufactured. The lowest currently available is Grade 20 which is classified as a soft material, the Grades go up to Grade 100 which is a very hard material. The Grade also defines the strength of the chain, unfortunately hard metal materials do not perform well when subjected to marine conditions, showing a tendency to fracture and rust to a higher degree than lower Grades.

Experience has shown that Grade 30 and 40 chains are generally best suited for use in a Marine Environment. Grade 40 is slightly harder and stronger than Grade 30, it is also more expensive to manufacture.

Calibrated – what does that mean?

Calibrated chain means that every link within its length is the same size and consequently suitable for use with a windlass that has been manufactured for use with a given chain size. Newer chain making machines automatically calibrate the chain within its production cycle, previously it was necessary to calibrate the chain by stretching it after it left the machine.

Used Chain - what has it been used for?

At BGD we buy top quality used chain from Holland and Germany where it has been used either on inland barges or in the mining industry. Historically we have always sold used chain from these sources, primarily for use as ground chain on moorings.

Stud-link Chain - what's that?

Stud-link chain is primarily used as anchor chain on large ships, it is similar in shape to open link chain but has a metal 'stud' inserted across the link to prevent distortion under very high loads. The 'stud' also causes the chain to weigh more, this is beneficial when anchored in bad weather conditions.

BGD Chain - where does it come from?

Our ability to do our own testing and over 20 years experience of listening to both good and bad feedback from customers has caused us to select two chain manufacturers - Italian and Chinese (There is no UK manufacturer of the type of chain that we use). The Italian chain is of superb quality and if money is of absolutely no object (this is supplied for 'super yachts' and to MOD contractors etc.), then this is the chain for you. But as to if it will last longer in a harsh marine environment then we can't give you an answer. Testing on our test facility has shown that apart from the variation expected between Grade 30 and 40 chains there is little to choose between them. What we can say is that we have been down the road of trying CHEAP chain from bad Chinese manufacturers and found that as with everything 'you get what you pay for'. For a number of years we have had our more economically priced range of chain manufactured by the leading Chinese factory who also produce much of the anchor chain used by the worlds shipping companies.