MOORING – DO IT SAFELY

A guide to prevent accidents while mooring
The guidance has been prepared in close cooperation with the Danish Maritime Authority and the Danish Shipowners’ Association.

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Sources:
Mooring and Anchoring Ships Vol 1-2, The Nautical Institute
Mooring Equipment Guidelines 3rd edition, OCIMF
Effective Mooring 3rd edition, OCIMF
Mooring and unmooring (D101), Nautilus International
Guidelines on minimum training and education for mooring personnel, IMO
UK P&I CLUB Understanding Mooring Incidents
UK P&I CLUB Risk Focus Moorings
Mooring Accidents on board Merchant Ships 1997 - 2006, Division for Investigation of Maritime Accidents, Danish Maritime Authority

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Why guidance on mooring?

Mooring is the operation performed first and foremost by the deck crew as the ship reaches the port – but it is also one of the most difficult, complex and dangerous jobs on board. Mostly things turn out safety. But sometimes an accident occurs and this usually has severe consequences.

Several cases have been reported in the past about accidents during mooring operations and many of them have led to severe injury or death of seamen.

Accidents come unexpectedly
The worst case scenario is of course a crew member getting injured. Accidents always happen while you are unprepared, believing the operation to be going smoothly and efficiently.

You think you are in control doing what you always do while mooring and suddenly you are in the middle of a situation you never thought was possible with a major crisis to be managed - immediately and afterwards.

This guidance aims to help the ship management and the crew prepare and plan a safer mooring. It presents tools and knowledge focusing on how to prevent accidents when mooring. But it is not a catechism in mooring.

You will find many near miss examples in the guidance. Use them to evaluate your own practice. Could this happen on your ship?

The authors are fully aware of the limitations to conducting a safe mooring operation due to poor construction and design of the mooring deck and arrangements. However, with the tools you can improve the safety while mooring. By acting as a team, being well prepared, knowing the risks and looking out for each other, we believe you can make a difference.

But first: Look at page 6. Here you will find a drawing showing dangerous actions. How many can you find?

Who should read this?
The guidance is especially relevant for people in the health and safety organization and members of the ship’s management. They are the ones who plan work, instruct their shipmates and ask the shipowner for equipment and changes to the ship. But ratings can also learn from this guide.

Mooring differs from ship to ship. Here we are concerned with principles.

The material is divided into four sections:

- How to moor safely. Introducing rules of thumb for safe mooring.
- How to prevent accidents. Introducing ways of registering risks, preventing accidents and creating a good safety culture.
- Tools for a better safety culture.
- Appendix: Photos of poor or unsafe conditions.

One moment peace and quiet; the next, an accident strikes like lightning from a clear sky.
Look at the drawing – how many risks can you identify? __________
(The answer is on the next page)

The underlying factors

- Fatigue
- Poor supervision
- Recklessness
- Poor training
- Poor procedures
- Unspoken accept
- Too busy
- Stress
- Not understanding the hazards
- Bad radio discipline
- Management looses breadth of view
- Management too young and unexperienced
Reasons for accidents

Mooring, towing and hauling impose enormous strains on lines, warps, gear and equipment and major forces are involved. Therefore - take care and think carefully when mooring - especially on ships with structures that make it hard to oversee what is happening. Also on ships calling at different ports the specific mooring arrangements may differ considerably.

As humans we tend to believe that things are safe if nothing happens. You might say that the norm for what we believe is dangerous decreases over time. Normally mooring goes well, but as time goes by, the level of safety slowly declines. Maybe you lose concentration, maybe you slacken your procedures just a little bit, maybe you get a little complacent. And then it suddenly happens - not because of one factor but because of a number of interacting factors.

Factors can be found in
- Equipment
- Work processes
- Crew qualifications
- Crew concentration
- Ship's safety culture
- Weather

Preventing accidents is about reducing the risks of those factors. The only parameter that is hard to overcome in this respect is the weather.

In the next two chapters you can read about how to moor safely and how to prevent accidents when planning, training and building up a safety culture.

THREE COMMON REASONS FOR ACCIDENTS

- Seamen standing in bights or snap back zones and when lines part, those involved are often injured.
- Insufficiently trained crew are used during mooring operations and they are often seriously injured if something goes wrong.
- The person supervising the mooring is also involved in the operation and is unable to carry out his role effectively.

1. Poor overview
2. Stopper breaks
3. Oil leak from winch - slip/injury
4. Too cold
5. Crossing line
6. Sea rising
7. Lines in mess on mooring boat
8. Wires/ropes tight and slack or different material, elasticity and breaking strength
9. Line thrown without telling docker
10. Strong current
11. Moving to and fro
12. Standing in a bight
13. Too many turns (on the drum)
14. Sitting on a line
15. Untidy lines
16. Wrong outfit
17. Mess on the quay
18. Line caught in fender
19. Telling off/bad communication
20. Lines lying too long in sun & water
21. Language confusion
22. Bad lighting
23. Poor communication between pilot & captain & tug
24. Line 'singing' before it parts
25. Wet paint
26. Unaware of risk, being in snap back zone
27. Standing on the line
28. Draught changed
29. Line comes off bollard - steep angle
30. Line round propeller
31. Several lines on same bollard
How to moor safely

Although a routine job, mooring often involves huge stress for the teams. There is often little time to prepare, so it is important that all are involved and fully aware of the limitations of the mooring process and that all use their best efforts so that the crew involved in mooring can act as a team.

In this chapter you can read about how to moor safely and what to be especially careful about.

The principles described deal with ordinary mooring.

10 rules of thumb
There are very few rules that apply to all mooring operations, but the following dangers should be absolutely avoided in any situation. You can see the rules on the opposite page.

With these 10 rules of thumb in mind, it is also important to remember basic seamanship. Take the time to consider your own and your shipmates’ work and the work of those who are new or unfamiliar with the ship.

Overall, the mooring operation should have a fixed rhythm and coordination, with crew both fore and aft depending on each other. Timing is often a vital factor when making fast the various lines and if it is not done right the first time, it can put safety at risk.

Ordinary mooring
The sequence of actions is given below:

1 Preparing for mooring
2 Running out lines
3 Hauling in lines/snap back zones
4 Using the drum/capstan
5 Using stoppers
6 Spooling

Preparing for mooring
Before the actual mooring begins, it is important to be well prepared in every detail so that the mooring can be done efficiently, safely and without any delays or disturbances resulting in mishaps. When the mooring operation commences, everyone is busy making the ship fast and there is no time to begin talking about issues which should have been done in advance.

As described earlier, mooring operations are high risk operations. We must never assume that people know the risks involved and the correct way to communicate, etc. People are doing the best they can and what makes sense to them in the context that they are in. When an accident occurs, we much too often hear and read: “Why didn’t they know? Why didn’t someone stop the operation? Why didn’t they take action sooner? How come they didn’t see the risk?”. We have to make sure every member of the mooring team understands

Always wear the correct personal protective equipment (PPE), which is an important part of proper preparation considering that PPE is the last line of defence.

Always consider whether you are in a snap back zone and never stand on either an open line or a closed bight of line. Keep an eye out for all members of the team. If you think they are in an unsafe position, alert them.

All operations need to be carried out calmly without rushing about. Rushing leads to slips, trips and falls.

Never lose sight of what is going on around you and have an escape route from any likely danger (that is, avoid being trapped against the bulwark or other obstacle when a line parts).

Always put an eye onto a bollard or bitts by holding the eye either on its side or by a messenger line to avoid getting fingers trapped against the bollard if the line suddenly snaps tight.

Never heave blindly on a line when no one is watching what is happening at the other end.

Never try to be heroic by jumping onto a line that is clearly running over the side and out of control as you are likely to go overboard with it.

Never run more than one line around a fairlead sheave as the lines chafe through quicker and the sheave is really only strong enough to take the load of a single line under tension.

Never use any equipment that is obviously faulty. If you notice damage, then it should be reported and an alternative arrangement for the mooring line used.

Never let go of a mooring line under heavy load without determining first why the load is so heavy and then taking the proper precautions if it must be let go.
the operation in full, depending on the role and position on board. Preparedness is a vital part of avoiding mishaps.

In some ports, the mooring team is informed quite late about which and how many lines are going to be used and about the need for a tugboat. This information is usually provided by the pilot, who then informs the captain, who informs the mooring teams fore and aft by radio. It is therefore a good idea to carry out a pre-arrival meeting (some call it a toolbox meeting) before the pilot arrives so that alternative arrangements can be discussed in good time without any rush.

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**A PRE-ARRIVAL MEETING MAKES YOU WELL PREPARED**

Ask the following questions:

- Are all mooring gear and equipment ready for use and well maintained according to the maintenance plan? (see chapter II and appendix).
- Has the mooring team read and understood the SMS procedure? If there are any gaps between the procedure and the operational way of doing the mooring, this has to be discussed and corrected.
- Is everyone instructed about the risk assessment and the latest near miss reports, if any?
- Is everybody aware of - and trained to identify snap back zones?
- Does everyone know how to communicate effectively between the mooring station, bridge, engine room, pilot, tugboat and shore: what to say, when, by whom to whom? In busy ports all communication should be prefixed with the ship's name to avoid misunderstandings. Is it clear what is defined as unnecessary communication and how to avoid it?
- Are all walkie-talkie batteries fully charged and are spare batteries available? A selected channel should be used with as little interference as possible from other users at the time of berthing. Check that the mooring teams fore and aft can receive and transmit clearly on the chosen channel.

At the end, you can find a check list you can use at the pre-arrival meeting and a list for evaluation afterwards.

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**ACCIDENT**

A SEAMAN WAS OPERATING A WIRE CAPSTAN WHEN HE SLIPPED DUE TO A DIFFERENCE IN DECK LEVEL

**CONSEQUENCE**

HE TWISTED HIS BACK AND SUFFERED SUBSEQUENT PAIN

Reported accidents
2 Running out lines
When the ship arrives at the berth, the mooring lines must be ready for running ashore. Running out lines often involves major risks to the crew, especially from getting caught in lines.

Be sure that someone keeps an eye on the mooring lines and on what is going on both on board and over the side, so that any problems are spotted before they become serious:

• Apply control right from starting to pay out. It can be downright dangerous to try to tread on the line if it has started to run away under its own weight. If it does, it is best to stand clear and throw the eye at the other end of the line over a set of bitts to prevent losing the entire mooring line over the side.
• The crewman must stand on the correct side of the line.
• The crewman must use suitable footwear, such as rigger boots, if treading on the line.

5 IMPORTANT FACTORS TO CONTROL
• Excessive slack into the water near the propeller risks the line being caught up in the turning screw. The line will then be violently hauled in by the propeller with the risk of injury to the ship’s crew and damage to the ship’s fittings.
• Excessive slack onto a mooring boat creates handling problems for the boat crew and can also foul the boat’s propeller.
• Excessive slack close to the quayside so that the line sags and gets caught under quayside fittings, such as a fender or a ladder, and then cannot be properly heaved tight.
• Paying out too fast so that the increasing weight of the line suspended over the ship’s side overcomes any restraint on the payout speed and the lines run out of control with the risk of getting entangled with fittings on board or one of the ship’s crew.
• The payout being abruptly stopped when a line comes against a buried turn on a mooring winch.
CONTROLLING THE FIBRE MOORING LINE

On ships up to a certain size, pressing down a fibre mooring line with a foot is a very effective way of controlling its run ashore, provided that the crewman is experienced and knows what is going on around him.

THE WRONG PLACE TO STAND IS INSIDE THE MOORING LINE

The crewman has the line behind him and will be trapped between the line and bulwark if the line starts to run out of control.

THE RIGHT PLACE TO STAND IS OUTSIDE THE MOORING LINE

The crewman has the line in front of him and can easily step back out of danger if the line starts to run out of control.

IF THE LINE IS TOO HEAVY TO CONTROL BY FOOT, USE A CAPSTAN

If the line is too heavy to control by foot pressure, then take one or two turns around a warping drum and then pay it out using an extra crewman to ease off turns around the drum.

CONTROL PAYOUT BY VARYING THE PRESSURE ON THE LINE

LEAD THE LINE BETWEEN THE POSTS TO INCREASE FRICTION AND ENSURE THE LINE MAINTAINS A CONSTANT ANGLE TO THE FAIRLEAD
Mooring line on storage reels
Do not run a line ashore directly from a reel because it will tend to spin faster and faster with the pay out due to the increasing weight of line over the side, and from linesmen hauling on the lines ashore.

The reel can be throwing line off faster than it is being cleared from the ship and there is a big risk of a bight getting entangled with the ship’s fittings or one of the crew. Lines stored on reels should have sufficient lengths for running ashore flaked out on the deck.

Line tension due to the weight of the line overside and the pull of the linesmen

LINE BOAT LIFTED OUT OF THE WATER
During mooring operations and due to the incorrect operation of the winch by the winch operator, the mooring boat to which the mooring lines were passed was endangered when the lines were heaved instead of being slacked off while the mooring wires were still made fast to the boat. The boat was partly lifted out of the water.

LINES RUNNING AWAY
On arrival, the deck crew were sending mooring lines ashore. The aft breast line was going to be a long one, so part of the line was unreeled off the drum and flaked out on the deck ready to run out by itself. During this, one crew member positioned himself very close to the line on the deck so that when the line was running out, it hit the back of his legs which led to a serious fall on the deck.
Remember – bights do not always look like bights

THE BEST WAYS TO AVOID ACCIDENTS DUE TO BIGHTS OF LINE ARE:

- The crew must at all times be aware of where they are standing while handling lines or when near them.
- The supervisor must concentrate on others’ actions and should not get involved in operations as a working hand.
- Inexperienced crew such as cadets and fresh ratings should only be allowed to handle lines under supervision.
- Only the crew required should be present at the mooring station. Persons not actively involved in the mooring operation (engine or off-duty crew coming on deck) have often been seen visiting the area of the mooring station. So a restricted entry notice should be posted.
- Sufficient deck hands are to be present at the mooring station to perform the operation smoothly.

Caught by a bight
Watch out for bights. It is very dangerous to stand in a bight of line or wire. It is extremely important that competent personnel are used to operate winches to ensure that mooring, towing and hauling lines are not subject to sudden, excessive loads.

ACCIDENT CONSEQUENCE

A SEAMAN WAS HAULING IN A TOWING LINE. BUT THE LINE GOT CAUGHT IN THE PROPELLER
HE BROKE A FINGER

Reported accidents
Hauling in lines/snap back zones

One significant risk when handling mooring lines is snap backs, which is the sudden release of the stored energy in a tensioned mooring line when it suddenly breaks. When a line is loaded, it stretches and there is thus a lot of energy in the line. If the line then suddenly breaks, this energy is released and the ends of the line snap back, striking anything in their path with tremendous force.

Snap back zones are deck areas where crew are at risk of being struck by one of the broken ends when a line has parted.

It is often impossible to carry out mooring operations without working in snap back zones. Therefore, the crew must be vigilant and recognize when to step clear of a line coming under high load, particularly if the ship is moving for some reason. So it is good to know where the snap back zones are on the ship.

By holding pre-mooring meetings with all the personnel involved, you can prepare mooring operations in a proper way and in good time before starting to moor. This would include a discussion about any snap back zones for mooring lines, towing wires, etc.

Look out for snap backs

No professional seaman would stand under a hanging net of supplies, a hanging container on the move, or any other heavy object above. That is the way we are taught and the way we work. Although we may be confident about our maintenance program and have certificates for all lifting gear, there is always a risk when standing below a load.

The danger of standing in a snap back zone is just as risky, maybe even more so as the lines or wires used could be stressed by poor maintenance or be under sudden tension due to a passing ship.

Real cases from www.nearmiss.dk
THE DRAWINGS ILLUSTRATE SNAP BACK ZONES IN DIFFERENT SET-UPS.
THE FIGURES SHOW THE ROUTE OF THE LINE

The killing force of a broken line
The area travelled by a parted line with enough force to kill someone on its way is known as the snap back zone.

If any line parts with a bang, then its broken ends are moving faster than 690 knots which is the speed of sound in air.

Use attached poster for training.

Mooring line parts at the overside fairlead

When the line parts at the capstan
When the line parts at the roller
When the line parts at the overside fairlead
Snap backs when hauling the ship
When moving a ship along the quay, more lines are to be used simultaneously than when coming alongside or letting go, so the lines should be led through the fairleads that minimize the hazard area on deck.

The drawings below show a high and a low arrangement for heaving two head lines whilst paying out a forward spring at the same time.
When crew are properly trained and know the hazards of being in snap back zones, they can prepare and take their precautions for NOT being in the danger zone. In the above illustration, the crewman tailing onto the line has taken it around the pedestal fairlead to hold on whilst standing clear of a danger zone based on the snap back zones for the line parting at either the windlass drum end or the overside fairlead.

THE BEST WAYS TO AVOID BEING HIT BY BROKEN LINES

• Keep a close eye on your workmates and alert them immediately if any of them are in a snap back zone.

• Treat every line under load with extreme caution and remember to stay clear of the potential path of a snap back.

• Experience shows that the first lines ashore, such as spring lines, have the greatest potential of breaking as they are the only lines holding the ship. So be extra aware where you stand when handling the first line.

• When lines are subject to a straight pull, the snap back zone is minimal, but if the lines are angled round a bollard or roller, then the snap back area increases.

• The crew performing the operation must be thoroughly trained and qualified to appreciate snap back zones. This could be done by a constant focus at pre-arrival meetings and in risk assessment processes.

• Be aware of the risk of a line snapping back onto the deck if it parts outboard of the ship’s side, particularly if the deck is protected only by open railings.
Painting snap back zones

Painting the snap back zones on deck is a good idea if the vessel always moors alongside in the same way and uses the same set-up. This is especially so for ferries always plying between the same terminals. But the markings must never stand alone.

For commercial vessels which have to moor alongside under different conditions and circumstances, their mooring set-up may vary and if you want to cater for all different scenarios, you would actually have to paint all around the different bollards/rollers etc. If snap back zones are permanently marked on the deck, there is a risk of the personnel involved not being so vigilant when a change does take place.

For example, you might have a fixed mooring set-up but in case a mooring line parts during mooring operations, it may be necessary to quickly pay out an alternative line from another location and then this substitute arrangement might not be covered by the snap back zones painted on the deck which could be a hazard. Moreover, after some time, people start to look at the snap back zones as decoration, whereas pre-mooring meetings keep people alert.

4 Using the drum/capstan

Keep a safe distance when using a drum or capstan. There is a great risk of hands and fingers getting caught between drum and line.

No more than four turns should be taken over the warping drum end. If too many are applied, then the line cannot be released in a controlled manner.

The frictional heat generated by a synthetic line slipping can melt fibres locally where they are in contact with the drum, which can cause the line to momentarily bind to the drum. The crewman will find the line starts to jump in his hands. If the line starts surging, it will be damaged as it melts and it may stick to the drum or bitts and jump with a risk of injuring people nearby.

Drum parts that do not come in contact with the line can be painted, but the central working part of the drum or capstan must be kept free of paint, rust or grease. Drum ends should be smooth and coated with a thin layer of boiled linseed oil or other approved synthetic liquid for protection.

ACCIDENT

DURING DEPARTURE OPERATIONS, ORDERS WERE GIVEN TO SINGLE UP. WHEN THE LINES WERE CLEAR OF THE BOLLARD, THE WINCH WAS PUT ON "AUTOMATIC" AND THE LINES WERE HEAVED BACK ON DECK. SUDDENLY ONE OF THE LINES GOT CAUGHT BETWEEN THE WINCH AND THE WINCH DRUM DUE TO TOO MANY TURNS.

A CREWMEMBER GOT HIS HAND CAUGHT BY THE LINE WHEN TRYING TO FREE THE LINE. HE SUFFERED SWELLING AND MINOR ABRASION.

Reported accidents

Watch out for your fingers – don’t get too close
Using stoppers

Too many accidents have happened while using stoppers. The operation where you connect the stopper to the line should be done very quickly since the whole tension is transferred to the stopper and things can quickly go wrong if too many snags arise.

If too many turns have been made on the drum or the line has burnt itself into paint, this can cause precisely the kind of delay that makes the stopper part and an accident happens.

Heaving in a loose line makes the other lines slack off, thus transferring the whole load onto the stopper which then parts as a result.

If the stopper is placed too close to the bitts, the tension can disappear when taking the line off the barrel. If that happens, the operation will have to start all over again.

The illustration shows the procedure.

STOPPERS

It is vital that the correct stoppers are used with the appropriate mooring lines. Stoppers should not be left on mooring lines once they have been made fast to the bitts.

A stopper used on a fibre line should be about two metres in length or either single or double rope with a significantly smaller diameter than the mooring line and with an eye at the one end securing it to an eye pad either on the bitts or on the deck close by.

The ideal line for stoppers should:

- Be made from synthetic fibre rope
- Be very flexible and its size should be as small as possible
- Be made from a high melting point material, such as polyester or polyamide
- Have a combined strength equal to 50% of the breaking load of the mooring line on which it is to be used

How to do

The stopper is poorly aligned with the mooring line because it is too close to the bitts

The mooring line is heaved as much as possible in line with the stopper before it is taken off the drum end or capstan and made fast to the bitts
When tightening the 3rd line during mooring, the whole load from the two lines was transferred to the barrel. When the stopper had been set and they wanted to transfer the line to the bitts, the seaman (1) standing by the stopper called out that there was too much tension and we... hear his shout. When the stopper parted, the line hit the barrel and hit the middle finger of seaman (2)’s right hand. Apparently, the 3rd line had been heaved so tight that it had taken the whole load from the other two lines. This was not discovered until the stopper had been set, which resulted in the stopper taking the load for the whole fore part of the ship.

The stopper was not completely new, but no wear or damage was detected on it. But the stopper failed at the metal hook.

It is emphasized that line 3 must not be heaved so tight that it takes the whole load from the two fixed lines and it must be ascertained that the stopper can hold before taking the line off the barrel of the winch and making it fast to the bitts.

Real cases from www.nearmiss.dk

When the aft spring was to be heaved in, the linesmen released the spring and turned their backs and allowed the line to drag along the quay. The spring got snagged on a corner of the wooden piling of the quay and the line snapped tight. The officer who was watching the mechanic and trainee by the winch on the opposite side only managed to release the remote control but not to press the emergency stop when he heard the line tighten. The line managed to tighten so much that a 350 mm long 100 mm dia. pipe angle iron from the fore bitts was torn off. The approx. 2 – 4 kg angle iron first hit the fairlead roller and was then thrown towards the winch.

Real cases from www.nearmiss.dk
**Spooling**

On departure, crewmen should be very careful when retrieving the lines aboard again safely and securely. At this point, there is still a considerable risk of being caught by line or getting hit by parted lines. It is very important that spooling is done correctly so the lines are properly laid onto the winch ready for the next mooring operation.

The angle of the line onto most mooring winches does not automatically change to lay each new turn immediately next to the previous one when a line is hauled in. The line tends to randomly pile up in one section of the barrel unless each turn is laid next to the previous turn as it comes onto the barrel. The line will lie better on the barrel if it is spooled slowly with some hold-back tension.

In bad spooling, riding turns trap the line in gaps in lower layers. This will cause problems when the line is being run out to the mooring gang ashore the next time the ship comes alongside. Poorly spooled lines should be manually re-spooled properly before each berthing.

**POOR SPOOLING CAN LEAD TO**

- A poorly spooled line may not fit onto the barrel and the pile up of turns can collapse.
- Parts of the line can slip down between the gaps between underlying previously poorly spooled turns and become trapped.
- Trapped turns can be damaged by being crushed if the overlying riding turns later tighten up.
- They can also cause problems for the mooring gang taking the lines ashore, because the line will pay out erratically and may even snag as it is being run ashore. A winch can actually start to pick up whilst turning in the pay out direction after encountering a trapped turn. This is particularly difficult when lines are taken ashore by a mooring boat, as the boat will be pulled up short by the line if the pay out has to be stopped due to a buried turn.

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**Good spooling**

Each turn lies neatly next to the previous one.

**Poor spooling**

The line is not guided onto the barrel so it all piles up randomly in one place.
ACCIDENT

During departure, a 3rd officer injured the fingers on his left hand. The fingers got crushed between the tug’s line and the vessel’s fairlead when trying to let the tug go.

The pilot had requested the master to let the tug go and the master in return requested the 3rd officer to cast off the tug’s line. The tug was made fast on the starboard quarter on the forward-most bollard through the second fairlead.

The tug wanted to use the forward fairlead to avoid having to work under the “shoulder” of the vessel’s hull. After the tug slacked off the line, the 3rd officer tried to pull the tug’s line inboard manually so the winchman could let go the line from the bollard.

The 3rd officer was standing very close to the fairlead when he tried to heave in the line. The tug’s line suddenly and unexpectedly tighten up. The 3rd officer did not let go the tug’s line in time, resulting in his left hand being crushed between the fairlead and the tug’s line.

Immediate causes of the incident:
• Sudden tension
• The 3rd officer was working too close to the fairlead
• The tug operator did not pay attention to keeping the tug line slack

Underlying causes of the incident:
• Crew from the aft station went to the bridge to relieve the helmsman
• Poor judgment by the tug handler
• 3rd officer’s lack of experience in mooring operations and awareness of potential hazards
• A bollard was used from which it was not practical to use a winch to handle the tug line

Root causes of the incident:
• Lack of communication from tug to pilot when the tug was still in the process of positioning itself
• Insufficient crew when letting go the tug
• Officer in charge did not have a complete overview of the crew’s tasks and communication in general was poor
While the aft station was unmooring, a crew member’s fingers got caught between the tug’s line and the bitts when the tug begun pulling on the line without confirmation that the line had been made fast on board.

Real cases from www.nearmiss.dk
How to prevent accidents

On some ships, accidents associated with mooring seldom occur. Why is that? What do they do on board on those ships?

Here you can read about what they do and what we recommend you to do on your ship.

What those ships have in common is that they consciously do the following:

1. Risk assessments
2. Repairs and maintenance
3. Near miss reviews
4. Instruction (training)
5. Safety culture sessions

WE KNOW THE RISKS OF MOORING
I KEEP MY CREW BRIEFD ON EVERY CHANGE
WE GREESE, CHECK AND TURN
WE REGULARLY CHECK LINES
WE ARE TAUGHT AND TRAINED

WE KEEP AN EXTRA EYE ON NEW SHIPMATES
WE KEEP A EXTRA EYE ON NEW SHIPMATES
WE LEARN FROM OUR NEAR MISES
I DIRECT AND HAVE OVERSIGHT
WE ARE NOT TIRED
WE ALERT EACH OTHER
Risk assessments
A risk analysis helps you identify risks you may come across on board when mooring.

Follow the process described here and use the poster included with this guidance as a guideline and pattern for your joint risk assessments.

We know the risks of mooring
STEP 1 – Mapping

Identify the hazards. Call everyone in for a mapping session on deck at the mooring gear. Then, think about each individual work process that you go through when mooring and decide whether there are any hazards.

Just to get your thoughts and imagination going a little, consider taking the drawings from pages 6 and 7 with you to show what might happen.

Note down every hazard on a piece of paper. See the Appendix showing examples of poor lines and equipment.

STEP 2 – Assessment

Go back to the office and assess the hazards. Use the poster attached to this guide onto which you can affix all the hazards.

Assess each hazard according to danger and probability. Then stick the note onto the square that it matches.

Then prioritize which risks you intend to do something about.

The probability for the risk of working mooring winches should be increased since we had a near miss last month when a line broke.
An officer should produce a document comprising what you have decided. Afterwards it should be passed on to all the relevant people, who have helped identify the risks and those who take part in mooring operations.

Then use the document to remind you of what you have decided to do, and do just that.

The document could also be used to tell other crews what has been done and decided on since they were last on board.

Use the programme “Health and Safety at Sea” from Seahealth.
The most common risks in mooring

**Equipment:**
- Use of old, damaged wire
- Poor equipment
- Poorly designed mooring system
- No overview of mooring area
- Hazard/tripping risk sites not highlighted

**Work processes:**
- Lack of communication and planning
- Poor wire/line handling

**Crew qualifications:**
- Lack of knowledge about the hazards of the job
- Unclear instructions
- Lack of information
- Lack of supervision (supervisor involved elsewhere)
- Small, untrained deck crew
- Ineffective on-board mooring training, without identifying and understanding the dangers associated with snap back zones

**Crew concentration:**
- Stress and fatigue

**Ship’s safety culture:**
- Procedures not followed
- Shortcuts taken
- Standing in the wrong places (in the snap back zone)
- Standing/walking on a bight
- Walking over a wire
- Quick mooring versus safe mooring
- No risk assessment process prior to mooring operations
- Cluttered mooring area
- Cluttered deck

**Weather:**
- Icy, slippery deck

The officer should regularly check whether what you have decided is actually being done.
We regularly check our lines

Check lines, wires and stoppers
The great danger in mooring is broken lines and wires. That is the reason why the lines, wires and stoppers used in mooring operations must be in good condition. Lines should be frequently inspected for external wear as well as wear between strands. Wires should be regularly treated with suitable lubricants and inspected internally and externally for deterioration and broken strands. Splices in lines and wires should be inspected regularly to check they are intact.

Take care that paint, chemicals, or any other shipboard or general cleaning items are not applied to spare mooring lines, wires and links. Is spare mooring equipment stowed clear of the deck, preferably on a pallet and kept dry and ventilated? If mooring lines and wires are stowed on deck during sea passages, they should not be exposed to sunlight, sea spray or funnel soot. We suggest using canvas or heavy duty polyethylene covers to prolong the life of lines/wires.
Certificates and logbook

It is important to have a certificate for all lines and wires used for mooring. Crew need to know what kind of lines are on board to prevent them mixing different kinds of line when operating.

So it is good practice to label the certificates clearly and keep them in an easily accessible file ready for inspection.

Different kinds of line, different strength

The most important factor governing a line’s strength and elasticity is the material it is made of. Natural fibre is weaker and more prone to rot than synthetic fibre. There is a wide range of different types of synthetic line available from various makers.

The main materials used for mooring lines are shown in the figure on the opposing page - and also the Minimum Breaking Load (MBL) for each material compared to steel wires. MBL figures refer to a new line being pulled straight, but the MBL may be less for other configurations.

Characteristics of each kind of synthetic line, compared to steel wire with the same diameter

<table>
<thead>
<tr>
<th>Type of Line</th>
<th>Minimum Breaking Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEEL WIRE</td>
<td>120</td>
</tr>
<tr>
<td>HMPE</td>
<td>100</td>
</tr>
<tr>
<td>ARAMID</td>
<td>80</td>
</tr>
<tr>
<td>POLYESTER</td>
<td>60</td>
</tr>
<tr>
<td>POLYOLEFIN</td>
<td>40</td>
</tr>
<tr>
<td>POLYAMIDE</td>
<td>20</td>
</tr>
<tr>
<td>POLYPROPYLENE</td>
<td>10</td>
</tr>
</tbody>
</table>

- **HMPE**
  - High Modulus Polyethylene, Dynema, Spectra
  - Similar to steel for strength and stretch
  - Light, floats on water
  - Melting point 150°C

- **Aramid**
  - Kevlar
  - 75% as strong as steel wire
  - Heavier than HMPE and does not float
  - Melting point 425°C

- **Polyester**
  - Dacron, Terylene
  - 30% as strong as steel wire
  - Heavier than HMPE and does not float but is flexible and durable
  - Melting point 250°C

- **Polyolefin**
  - 30% as strong as steel wire
  - Light, floats on water
  - Melting point 170°C

- **Polyamide**
  - Nylon
  - 30% as strong as steel wire
  - Does not float, stretches more readily than other fibres
  - Melting point 215-250°C

- **Polypropylene**
  - 60% as strong as polyester
  - Floats, reasonably durable and cheap
  - Melting point 165°C

Different kinds of line, different strength

The most important factor governing a line’s strength and elasticity is the material it is made of. Natural fibre is weaker and more prone to rot than synthetic fibre. There is a wide range of different types of synthetic line available from various makers.

The main materials used for mooring lines are shown in the figure on the opposing page – and also the Minimum Breaking Load (MBL) for each material compared to steel wires. MBL figures refer to a new line being pulled straight, but the MBL may be less for other configurations.
Repairs and maintenance

It is important to follow the manufacturer’s maintenance program and carry out routine inspections on board. Doing regular maintenance means equipment lasts longer. Fewer accidents happen, giving considerable savings since any major trouble that might be developing will be detected at an early stage.

It is important that all grease nipples are free, working correctly and have not been painted over. To ensure that each part of equipment is greased, it may help to highlight or number each nipple and record the details on a plan. It is a good idea to highlight them in order to prevent them from being overlooked.

Equipment should be regularly inspected for wear, damage, corrosion and being out of true. A program of maintenance and inspection may help to prevent such failures or alternatively identify potential failure at an early stage, meaning that repair is a relatively simple matter rather than a major task.

Anti-slip surfaces

Treat surfaces to make them anti-slip to help prevent you from falling.

Anti-slip

Mixing sand, or an approved non-slip aggregate, into the paint prior to application can be a very effective way to help reduce mooring accidents.

Anti-slip surfaces can be achieved in three ways, by:
- Using special anti-slip paint
- Using normal paint and strewing fine sand over it while still wet
- Welding naps onto the deck plating
Near miss review

The content and good advice in this material is based on seafarers’ many years of experience of mooring and accidents. But this experience and advice is general. The best learning and advice is for your own ship and crew.

So it is a good idea to learn from accidents. Fortunately they seldom occur, but that also means that you seldom have something to analyse and learn from.

And this is what makes near misses interesting. A near miss is an event that could easily have developed into an accident – but did not.

If we use the metaphor of an iceberg, the tip represents serious accidents requiring medical treatment and leading to deaths. These kinds of accident happen rarely. But near misses happen much more often – and are represented by the part of the iceberg below the water.

SERIOUS ACCIDENTS SELDOM HAPPEN

NEAR MISSES HAPPEN MUCH MORE OFTEN

The same underlying factors lead to a near miss and an accident

We learn from our near misses
The point is that the unsafe factors leading to a near miss are probably the same as those underlying a serious accident. If you learn from your near miss and eliminate the factors that led to it, you can eliminate many of the factors that could lead to an accident. This is the reason for taking near misses seriously.

Behind a near miss you can find a series of factors which are potentially risky. It is a good idea to register near misses and analyse them. They can reveal much of what we need to know about why accidents happen.

Of course, a near miss needs to be out in the open for others to learn from it, which requires a good safety culture underpinned by trustworthy dialogue and a sense of fair play. Experience shows that by working with near miss reporting, we not only learn a lot that can prevent the situation from repeating, but the whole safety culture gets a boost. It does so because we get better at spotting and observing unintended events and conditions, for the benefit of our colleagues and shipmates, the ship and the company.

REMEMBER

Reviewing a near miss goes hand-in-hand with risk assessments.

If a near miss does happen, you need to update your risk assessment with new input, make new procedures and inform the crew.

Behind every near miss you will find many unsafe conditions and actions. For instance:

**Things you can see:**
- Worn-out lines and wires
- Bad, slippery surfaces
- Bad lighting
- Bad general view
- Fairlead roller rusted solid

**Things you cannot see:**
- Bad communication
- Fatigue
- Lack of training, experience, knowledge
- Misunderstandings
- Recklessness
- Lack of information about changes
- Lack of standard procedures

If you constantly share knowledge and experience about near misses, you can all together take action/initiatives to prevent accidents. At the same time, you help strengthen safe behaviour and the awareness of each crew member.

**Analyse – and get wiser**

Whether it is an accident or a near miss - use the same method and approach to understand why it happened.

- Trace the process backwards with those involved
- Investigate how multiple issues, situations and actions interacted to cause the incident
- Find the background and complication of the actions that were taken
- Ask why and what until you know enough about the incident to plan preventive actions.
- Remember to be inquisitive, not prejudicial, when asking questions; otherwise you will learn nothing

**ACCIDENT**

**THE CREW WERE IN THE PROCESS OF MOVING THE SHIP ALONGSIDE THE QUAY WHEN A LINE CAUGHT ON A BOLLARD**

**CONSEQUENCE**

A SEAMAN’S KNEE WAS INJURED WITH A LESION TO HIS CRUCIATE LIGAMENT
HOW TO ANALYZE THE NEAR MISS
– A DIALOGUE ABOUT “WHAT AND WHY?”

Asking what happened and – most importantly – why it happened will help you identify many factors that led to the near miss?

Why did this happen?

The line parted

The seaman was nearly hit by a broken line

The seaman stood in the snap back zone

Missing light made the seaman stand in an unsafe place

The seaman was not aware of the risk of being in the snap back zone

The seaman’s VHF was broken and he did not hear the last instruction from the bridge

Mooring set-up created a big snap back zone

Weather and oil had ruined the line

There was a big swell from a passing vessel

The winch was set too high for the minimum breaking load of the line

No time to check gear before mooring

Poor maintenance

Poor instruction and planning

New unknown port

The procedure was unclear and the crew were unaware of the risk assessment

First officer just arrived and poorly trained

Most of the crew were tired and stressed

A NEAR MISS EXAMPLE
Imagine that you are on the foredeck when mooring. A line breaks and slices through the air just 30 cms from the head of a seaman who is busy paying out a line through a hawse pipe. If the seaman had been standing 30 cms closer, he could have been killed or very seriously injured. In a near miss situation like this, you might just wipe the sweat from your brow and say “thank goodness nothing happened” and continue working.

Then ask yourself if someone has to die or be seriously injured before we learn anything. Why did the line actually break? What do we need to do to find out? Is there something we have not talked about?

Consider holding an inquiry, inviting everyone involved in mooring for an extraordinary safety meeting to find out how such a “deadly” near miss could occur. By being curious and talking openly about the near miss event, you can identify many of the factors that led to it.
Instruction

Ensure that everyone on board knows, and is confident with, how you moor on your ship.

If there are any inexperienced persons on board, you must train them in mooring operations.

All new crew on board should have thorough instruction in how you moor your ship. And if a seaman has little experience, instruction should be even more thorough. Instructors need to ensure that all important messages are understood.

The best way to learn new things is to train other people, the second best is to do it yourself. The diagram below shows the kind of instruction we learn best from.

Lack of hazard highlighting or warning markings

Highlighting hazards is particularly important for the safety of crew who are new to the vessel – cadets and other trainees and visitors. It is also important for the benefit of experienced crew who may easily become complacent, tired, or too busy in their work to notice a hazardous situation developing.
5 Safety culture and behavior

When we talk about the safety culture, we mostly talk about behavior. What kinds of action are OK, which are not. Does the behavior of the crew create dangerous situations or is there something that prevents individuals from interfering if they discover something unsafe?

Safety culture can be described as “the way we work on board when nobody is watching us.”

I keep my crew briefed on every change
We keep an extra eye on new shipmates
I give directions and have oversight
We are not tired
We alert each other
Seamen on a vessel with a good safety culture do more than they are required to do. They identify unsafe situations, alert each other and are always on the lookout for ways to improve the way they work to promote safety and avoid accidents. Sharing information and learning from near misses is an integral part of their safety performance. Not only to comply with safety rules, but because they are committed and because safety makes very good sense.

We are often not aware of our (safety) culture - that is what is so special about it. It is unspoken and more or less invisible - but if someone does something that a culture does not allow, you notice it.

That is why it is a good idea to try to raise its visibility, otherwise you cannot assess whether it is safe or unsafe.

### ACCIDENT
A SEAMAN WAS PAYING OUT A MOORING LINE WHEN IT SUDDENLY SNAPPED TIGHT

### CONSEQUENCE
HE CRUSHED A FINGER SO BADLY IT HAD TO BE AMPUTATED LATER

Reported accidents

Tools to improve safety culture

- Pre-arrival meeting check list
- Evaluation check list
- Instruction session
- Safety culture session
- Ongoing focus on the safety culture
PRE-ARRIVAL MEETING – CHECK LIST
(STOP, OBSERVE, THINK AND DECIDE)

<table>
<thead>
<tr>
<th>No.</th>
<th>Focus point</th>
<th>X</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Are mooring deck and - arrangement, gear and equipment ready for use?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Is everybody familiar with the latest risk assessment? Otherwise, read it out loud and ask for questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Have you had any mooring accidents or near misses? If so, what to do to avoid it happening again?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Any changes relating to gear or equipment since last mooring that you need to talk about?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Is there anything special about this mooring?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Do you know how to communicate (language/hand signals/radio)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Do the persons who control the winches have the necessary view during the operation? Any blind angles? How do you deal with it?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Imagine the snap back zones as they become apparent during the operation with the lines in use. Where should you “watch out” and in which sequence?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Are there any subjects related to the procedure that you need to discuss?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Do you have any new crew members who need special attention?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Who controls the winches, the lines and in which sequence?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Which anchor do you have to prepare?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Are the throwing lines ready and in good shape? If an “air gun” is used for throwing the line, is it ready and is the line in good shape? Do you have an extra air cylinder, if needed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>If remote control is used for the winches, are the batteries charged?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Are the batteries for the radios charged?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>If a tugboat is used, which line is used? Prepare a special risk assessment for the use of tugboats.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Which side is coming alongside? Anything relevant to inform about?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Do you know how many lines are used? Go through a mooring plan step by step.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Do you need to use lines you normally don’t use? Strength? Elasticity? a. Do the extra lines create extra snap back zones you need to discuss? b. Which rollers and fairleads are going to be used?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Is everyone prepared and does everyone know their tasks?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EVALUATION – CHECK LIST
(REVIEW THE LATEST MOORING AND PLAN THE NEXT)

Take a few moments to review the operation to find out if anything could have been done more effectively and more safely.

<table>
<thead>
<tr>
<th>No.</th>
<th>Focus point</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What seemed to work well?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>What can we improve the next time?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Should we mark snap back zones on our vessel?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Should we have training lessons in identifying snap back zones?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>How experienced are the crew members involved?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Have recent incidents been considered?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Could we improve the communication between deck and bridge?</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Do we have any language issues that we need to discuss?</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Do we have any fatigue related issues?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Where and how do we discuss lessons learned and ideas for improvement?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>How do we as a team ensure that action is taken on lessons learned?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Do we improve our SA based on the lessons learned?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>What prevents us from being 100% safe during mooring?</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>What can we do to change that?</td>
<td></td>
</tr>
</tbody>
</table>
Instruction session

1. **READING MATTER (READ)**
   
   Give the new deck hand something to read about mooring. It would be best if you have something that exactly describes the mooring procedures on your ship. Ideally, the reading matter should include a description of:
   
   - The equipment that you have on board
   - The equipment and issues in the ports you call at if you are on a fixed route
   - The procedures you have on board for duties and assignments
   - The ground rules of communication
   - The risks
   - The accidents and near misses you have had

   If possible, supplement with film of mooring. Best of all, a film of your own mooring procedures.

2. **ORAL/PRACTICAL INSTRUCTION**
   
   On the basis of what they have read, review: (lecture)
   
   - The procedures you have on board for duties and assignments
   - Ground rules of communication
   - Risks – consider using the illustration from pages 6 and 7
   - Accidents or near misses you have had
   - The equipment you have on board
   - Equipment and issues in the ports you call at if you are on a fixed route

   Gather at the mooring station on board and demonstrate how it all works (demonstration)

   Ensure that the people you instruct have the opportunity to ask questions. Consider asking them for good suggestions about how various risks could be avoided. (discussion).

   Try asking those you are instructing to review the equipment, procedures and communication for themselves so that you know how well they have understood it all. If possible, also select various tasks and ask them to give a practical demonstration (exercise).

3. **ASSESSMENT**
   
   After the first time new crew have taken part in mooring, you should assess how it went and deal with any questions/issues.

4. **INSTRUCTING SHIPMATES**
   
   Ask those you instructed last time to instruct the next hands to arrive – under your supervision (instruct others).

---

**ACCIDENT**

A SEAMAN WAS IN THE PROCESS OF BELAYING THE TOWING LINE, BUT THE LINE GOT CAUGHT IN THE PROPELLER AND HIS LEG GOT TRAPPED

**CONSEQUENCE**

HE INJURED BLOOD VESSELS AND NERVES IN HIS LEG

Reported accidents
Safety culture session
for use at a meeting of the safety committee or a meeting of the entire crew

1. PREPARATION
   • Make copies of the illustration on pages 6/7 for all crew present

2. IDENTIFYING DANGEROUS SITUATIONS
   • First, everyone present should sit and think for themselves about the situations that could arise on board
   • Then they should jointly note down all the situations that could occur on the ship
   • Then they should mark situations where behavior makes a difference
   • Situations where behavior is important should then be written down for everyone to see

3. DISCUSSION
   • What behavior leads to dangerous situations?
   • What are the reasons for this behavior?
     - Attitudes
     - The demands of the job, e.g. being busy
     - The equipment
     - Other issues
   • Could any of these issues be removed or changed?
   • Who could do something?
     - The individual
     - Safety committee
     - Officers
     - Company

4. SUMMING UP
   • How can we help each other to behave more safely?

ONGOING FOCUS ON THE SAFETY CULTURE

To make the crew on board remember things and to get their commitment, you could start an ongoing discussion on:
   • “What dangerous actions do we not accept on board this ship?”
   • “Which actions do we take to prevent accidents?”

You can hang up two blank posters in the office or mess – one for the actions you will not accept and one for preventive actions. Everyone can then use them to write down their answers to the two questions.

From time to time, members of the safety group should consider and discuss the comments on the poster, such as: “Haven’t we missed out stepping across the line?” or other missing issues.

ACCIDENT
A SEAMAN JUMPED DOWN ONTO THE QUAY WHEN MOORING AND LANDED BADLY
HE FRACTURED HIS TIBIA

Reported accidents
Examples of poor and unsafe conditions.

**Source:**
Mooring and Anchoring Ships Vol. 1 / 2, The Nautical Institute
Photos: Walter Vervloesen (Chairman IMCS)

Special thanks to the Nautical Institute and Walter Vervloesen.

---

**Lines and wires should not look like this**

**Stopper line frayed/unravelled and weak**
Failure of the stopper line whilst under tension may result in unexpected loads acting on the mooring line while it is being manually belayed and endanger the crew who are either holding the stopper line or handling the mooring line.

---

**Mooring line surface showing evidence of heat damage**
Heat damage can be caused through friction or direct contact with external heat sources.

Generally caused by surging, and affected lines will show glossy or glazed areas on the line surface.

A heat-damaged line is generally more seriously weakened than commonly believed.

---

**Pinching damage**
Results in pulled or cut yarns, which directly affects the strength of the mooring line.
Cut strand on a braided nylon line
Like cut yarns, cut strands have a direct though more serious effect on the line’s strength.

Mooring lines stained with grease
Contact with chemicals may cause deterioration of the line.

When it is likely that a line will get in contact with grease from winches, roller fairleads and so on, select lines with good chemical resistance.

If a line passes along/over/around greased fittings and equipment, those involved in maintenance/greasing should be instructed to remove excess grease/oil.

Mooring lines stained with paint
Contact with chemicals such as paint may cause degradation and should be avoided.

Contact with paint can cause the line to harden, which affects its grip on the drum end.

Mooring line stained with fuel oil
Oil and petroleum products generally do not affect synthetic fibres, but should be avoided and may cause pollution when lines have absorbed oil and are then dropped into the sea.

Buried turns
Improper reeling or spooling (without the right pretensioning) causes the tensioned part of the mooring line on the dedicated winch to become buried underneath the underlying turns.

If not noticed in time, buried mooring lines may be dangerous for the linesmen as the line initially pays out when slacking away for letting go, but when wound/spooled back onto the drum, it will continue to turn in the slacking away direction if the line has not been freed in time.

Improperly spliced wire mooring line
Splicing generally reduces the strength of the wire by 10%. Ensure that the correct method of splicing is used (contact the manufacturers).

Good practice requires a number of five full and preferably two additional half tucks in a wire.

Synthetic mooring line heaved tight on the storage section of a split-drum type winch.

Fairlead rollers being “strangled” in order to improve the incoming angle on the winch drum
Strangling the roller causes the mooring line to chafe.
Improper spooling of wire line
Wire mooring line irregularly/unevenly spooled onto the winch drum.

Note crossed wires in underlying layers which are severely damaged or crushed by upper layers of the wire.

Abrasion damage to mooring lines from frozen fairleads
Chafing between a mooring line and other equipment such as cocks and fairleads causes surface abrasion.

Rust or evidence of wear may be an indication that the rollers do not rotate freely.

Mooring wire and lines through same Panama lead
Friction or chafing between mooring lines and mooring wire causes damage from surface abrasion and contamination of the line.

The lubricated mooring wire leaves grease deposits on the panama lead and stains mooring lines with grease residues.

Kinks
Kinks cause permanent distortion of the strands and seriously affect the line’s strength.

Kinked lines should be removed from service until they have been examined and properly repaired. Despite being repaired, this line has been weakened.

Expect kinks to cause about 30% reduction in strength. A kinked line means poor contact between line and drum end surfaces and may cause the mooring line to slip.

Chain stopper for stoppering mooring lines
Fibre line stoppers should be used for stoppering fibre mooring lines.

Using chain for stoppering might cause crushing and pinching damage to yarns and strands when tension comes on the chain stopper.

Mooring line chafing against winch structure
Lines not paid out properly may rub on the ship’s structure (winch frames, platforms, etc.) involving a considerable risk of damage through chafing, abrasion or cutting.
Excessive clearance between roller and pedestal table, two lines acting on the same roller
This indicates that the roller pin is worn, meaning it will have lost part of its original strength and may fly back when under tension.

Allowing two lines on the same roller is very bad practice as it may result in overloading the roller/pedestal fairlead and chafing between the two mooring lines.

Chafing damage to line due to rust
Rusty, knife-edge flakes on the storage drum cause chafing damage and accelerated wear on the mooring line due to contact during operation or as a result of vibration.

Unsafe or damaged equipment

Extreme wear and grooving on rollers
Grooving over part of the surface of the roller indicates that the roller is frozen and that the line/wire is always chafing against the roller in the same area.

Grooving or corrosion and scale accelerates damage to the mooring lines/wires.

Generally, and when under tension, lines/wires will tend to settle in the groove which will cause further/accelerated wear to the grooved surface.

Extreme grooving in button type roller fairlead
The depth and size of the groove indicate that it has previously been used for wire lines, which might cause bird caging or corkscrewing when new wires are installed.

If the fairlead is subsequently used for lines with a different diameter, the sharp edges of the groove will damage the line through abrasion and chafing.

Eye screw pin of D-shackle for connecting the line stopper to the stoppering eye/lug not properly fitted.
Visit www.seahealth.dk
Mooring – do it safely is a new guide to an old and crucial maritime operation.

The process of securing a ship is as old as sailing itself but there are few areas on board which appear so frequently in accident reports.

This publication is a document of instruction and technique but is also intended as a trigger for discussion, making the regular questioning of changes and challenges an important part of mooring routines.

In the publication you will also find checklists, agendas and posters for motivation and discussion on board.

We hope Mooring – do it safely will motivate a fresh, new approach to the ancient practice of mooring.