INTERTANKO

Guidance on Line Management Plans (LMP)

TWENTY 19

Guidance on Line Management Plans

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Introduction

Contained within section 5.4.2 of Mooring Equipment Guidelines (MEG4) is a description of the Line Management Plan (LMP). The LMP should contain all the requirements for how the lines are maintained, inspected and retired and each of these parts should be detailed in the plan. For example, in the maintenance section it should detail the installation, storage, repair, maintenance and wear and tear, while at every stage referencing any manufacturer's guidance. Similarly, the inspection section should detail how and when the inspection should be undertaken.

Typical components include:

- Records of mooring hours.
- Line inspection records and plans.
- Manufacturer and operator retirement criteria.
- Test/inspection reports.
- Manufacturer's recommendations following tests or inspections.

MEG4 stresses that it is the responsibility of the operator to ensure the proper development and implementation of the LMP. As with the Mooring System Management Plan Register (MSMPR), it is a live document and can be held either in hard or soft version. It should, however, be integrated into the ship's document control system and be subject to change management controls to ensure a complete history. The LMP should be easily accessible for internal and external compliance verification, ship personnel training and communication with manufacturers by those who need to use it.

Section 1: Objectives of the LMP

The LMP contains the ship operator's requirements for the management of mooring line maintenance, inspection and retirement during the operational phase of the mooring line lifecycle. The LMP can be a standalone tool or it may be integrated into existing safety or maintenance management systems. It can be available as hard or electronic copy, or both. The LMP should be capable of being updated and should be accessible for internal and external compliance verification, ship personnel training and communication with manufacturers. LMP information should be stored in a location that is easy for all users to access.

Relevant Definitions

D/d RATIO

The D/d ratio is the diameter of the bend divided by the diameter of the mooring line. Any bending of the line will immediately reduce its strength and repeated bending will reduce the service life of the mooring line. However, there are factors other than D/d to consider when a line is bending as tension ranges, surface condition and duration of load cycles will also reduce the strength of the line at the bend. The D/d ratio should be as large as possible to maximise mooring line strength and working life. It is recommended that the D/d ratio is at least 15. This will ensure that the performance reduction due to bending is kept to a minimum.

It is the responsibility of line manufacturers to document performance (angled strength and angled endurance) at standardised D/d ratios as part of the procedures outlined in MEG4 appendix B. It is the responsibility of the user to manage the line degradation caused by line bending through the LMP.

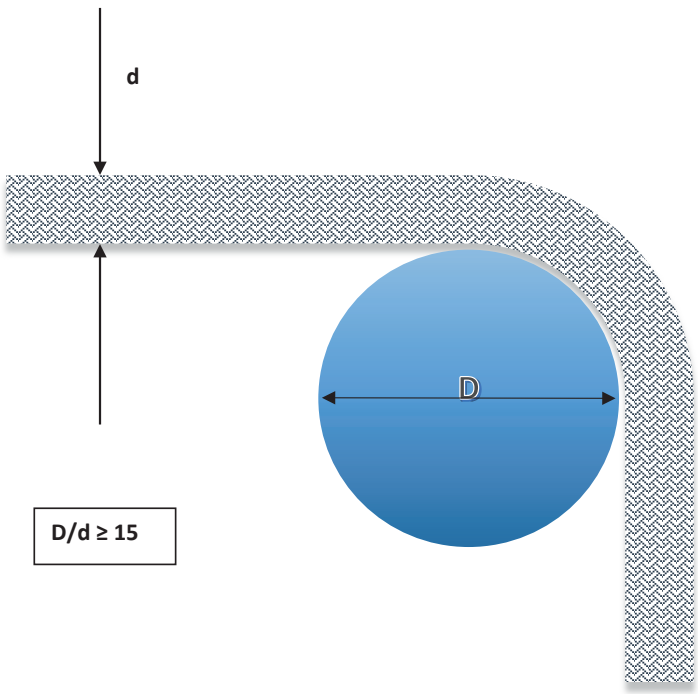

Fig 1. D/d ratio of mooring line to deck equipment

Line Design Break force (LDBF)

LDBF is the minimum force that a new, dry, spliced mooring line will break at when tested according to appendix B of MEG4. This is for all mooring line and tail materials except those manufactured from nylon which is tested wet and spliced. This value is declared by the manufacturer on each line's mooring line certificate (see appendix B of MEG4) and is stated on a manufacturer's line data sheet. As outlined in appendix B of MEG4, when selecting lines, the LDBF of a line shall be 100-105% of the ship design MBL.

The LDBF for nylon (polyamide) mooring lines should be specified as break tested wet because nylon lines change strength characteristics once exposed to water and generally do not fully dry to their original construction state.

Strength of conventional mooring lines should be specified in accordance with the design guidance provided in section one of MEG4. The actual design break load of a line is defined as the LDBF, which should be 100-105% of ship design MBL.

Consideration for Retirement of Mooring Lines and Tails

The Company should actively build up strength degradation data by consulting with manufacturers or other third parties, and should establish non-destructive testing techniques such as condition-based monitoring to assess line condition and trends. The following techniques should also be considered:

- Residual strength testing and analysis;
- Residual fatigue life analysis.

Data gathered from inspections and testing should be analysed by the company to create or refine mooring line retirement and service life plans.

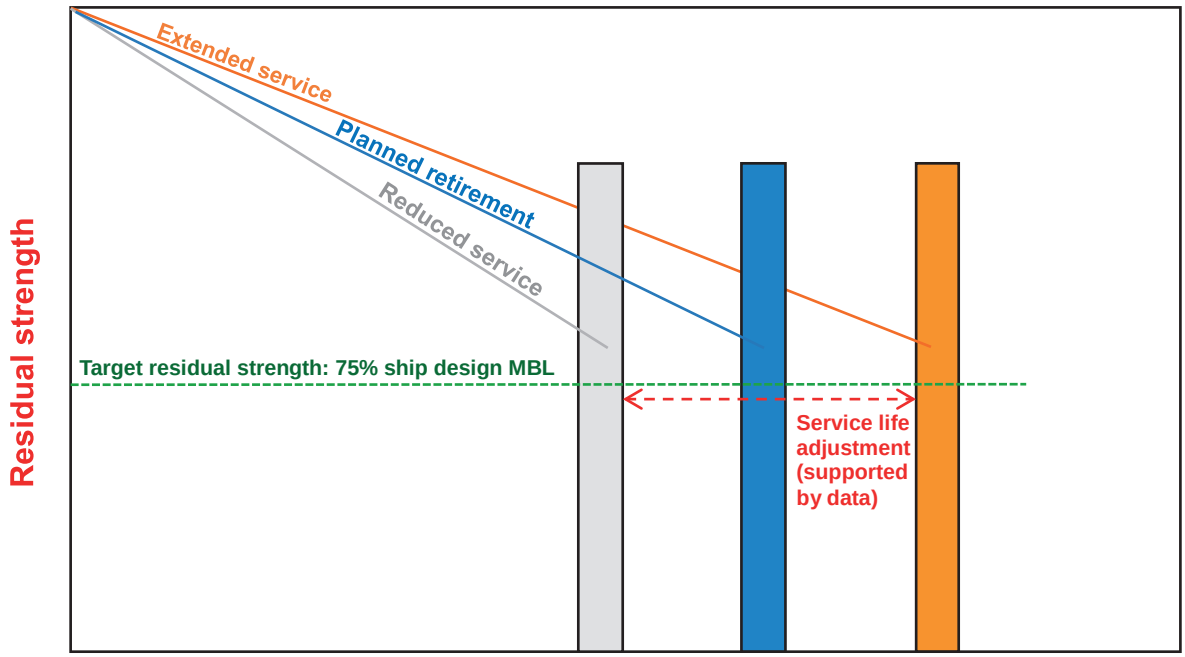

Fig 2. Mooring Line Service Life Management

Section 2: Model Line Management Plan (LMP)

Record of Revisions

Issue Number	Revision Number	Effective Date	Reference to Sections – Description of Revision	Approved by

Part A – General Ship Particulars

Part A	General Ship Particulars
Goal A	Maintain a detailed, continuous and up-to-date record of the ship's ownership history
Functional Requirements	The MSMP records should, as a minimum, match those required under the Continuous Synopsis Record, SOLAS regulation XI-1/5, see IMO A 23/Res.959.
Method of Compliance	- to be updated after every change - HVPQ to be updated regularly – electronic copy to be maintained on board

The ship's particulars are recorded in this section and should be maintained for the life cycle of the vessel. When there are changes, a new document should be issued and numbered. Where there are no changes in the details, this should be marked as N/C in the respective row. The previous SP Documents should be retained on board for the life cycle of the vessel. Copies of the previous SP Documents are to be filed electronically by the managers.

A.1	**Ship details including name, date of build, registration, IMO number, Flag/Class**
Ship's name	
IMO number	
Date of Build	
Flag	
Flag registration number	
Class	
Class registration number	
Class notation	
A.2	**Current owners, operators/technical managers, including (where applicable) bareboat owners**
Owners	
Operators	
Technical managers	
Bareboat owners	
A.3	
Vessel's previous name(s) and date(s) of change	
Vessel's previous Flag and date of change	
Vessel's previous technical managers and date of change	
Vessel's previous class and date of change	

Part B – Mooring Ropes – Conventional Fibre Lines

Line Installation

Line installation guidance is provided by the line manufacturer. See **appendix B**. Conventional fibre lines are used on various types of deck equipment, including single drum and spilt drum winches, warping drums and mooring bitts/bollards. All contact surfaces are kept smooth and free from chafe points.

Where split drum winches are used, guidance on the minimum numbers of turns on the tension side of the winch drum is to be obtained from the line manufacturer.

Ship personnel handling synthetic lines that must be stoppered off and made fast to bitts should have received effective training in line handling and fully understand the risks associated with this process.

Storage

The Safety Management Manual provides guidance on the storage of mooring ropes. All conventional fibre lines should be stored in a clean, dry area. Lines should be stored out of direct sunlight and away from extreme ambient temperatures in accordance with the manufacturer's guidance. Lines should be kept off the deck to provide ventilation underneath and to prevent contamination from chemicals.

Mooring lines installed on winches should be covered with suitable waterproof tarpaulins when not in use.

Mooring lines suppliers' guidance on proper storage should be made available on board. (See appendix B).

Maintenance

Mooring ropes are generally maintenance-free except for jacketed High Modulus Synthetic Fibre Lines (HMSF Lines) ropes that require the repairing of the jacket in case of routine wear and tear. The Safety Management System should contain guidance for checks of ropes prior to use and the vessel's crew should comply with these requirements. Further guidance should be given to the crew on operational precautions to be taken to avoid excessive damage to mooring ropes and minimise wear.

Maintenance activities for conventional fibre lines include the following:

- Monitor and remove induced twist in accordance with the line manufacturer recommendations;
- Maintain the chafe protection to make sure it is working properly and can be safely deployed;
- Keep deck equipment surface conditions free of defects and sharp edges in accordance with the line manufacturer's recommendations;
- Mitigate excessive localised damage;
- Cover winches when lines are not in service;
- Monitor the condition of the lines and repair in accordance with the line manufacturer recommendations;
- Follow instructions for cleaning lines when they are contaminated with oil or other commonly used petroleum lubricants.

Additionally, where available, the manufacturer's guidance is referred to for maintenance of mooring ropes.

When ropes have been damaged beyond use, the line should be cropped and an eye splice may be carried out on board as a temporary measure. The crew on board should not attempt to carry out joining splices at any given stage and office assistance should be sought if needed.

Mooring rope time in use records should be maintained and can be found in the equipment verification file which is stipulated in the Safety Management System (SMS) and/or in the vessel's Planned Maintenance System (PMS).

See **appendix B** for manufacturer's guidance on maintenance, or, if not available, then ship-specific guidance on maintenance should be filed in appendix B.

Tools and resources required

All Company vessels should be suitably equipped with the correct tools required for maintenance and repairs of mooring ropes.

The Company should require all vessels to carry a minimum of two spare mooring ropes.

Additionally the vessel's command should ensure that adequate resources are available for carrying out maintenance of mooring ropes.

See appendix B for a list of tools required for maintenance of ropes.

Inspections

Deployment inspections should be carried out by the mooring team prior to every use as described in the Safety Management Manual. Crew members carrying out the deployment inspections should be trained according to Company requirements and manufacturer's guidance. During the deployment inspection, the working length of the line (outboard of the tension side of the winch) should be inspected for defects which may impair the performance of the line.

Incident reports should be issued in case of line failure or significant damage and the manufacturer contacted when needed. Decisions whether to go ahead/ not go ahead with using lines in mooring operations can then be made and repairs should be properly documented.

On completion of each unmooring operation, the Person in Charge of the mooring station should visually inspect mooring lines and inform the Master if excessive deterioration in the condition of the mooring lines is noticed. With this information, the Master may then consider increasing inspection frequency of the relevant mooring ropes and has the authority to discontinue the use of the mooring lines.

Routine inspections should be carried out regularly (frequency depending on berthing frequency and environmental severity) and records of the inspections are maintained. Only qualified and experienced personnel should be responsible for inspecting mooring lines in service.

Inspections are typically carried out by visual assessment. The main areas of deterioration of conventional fibre lines are external and internal abrasion, cut yarns/mechanical damage and induce twist. Areas that are regularly inspected should include:

- The section of the line in wear zones, particularly those sections that run regularly through deck fairleads and pedestal rollers.
- The section of the line at the crossover point on split drum winches.
- The eye, the eye splice, the crown of the eye and sections of line close to the eye that may have been damaged through abrasion or contamination on berths.

Due to the larger diameter of conventional fibre lines (compared to wire and HMSF lines) the resulting D/d ratio might be smaller than the optimal value of 15. Past experience along with other technical advice from the line manufacturer to assess impacts on performance is taken into consideration.

Detailed inspections:
Mooring lines are replaced when their residual strength reaches 75% of the ship design MBL. This reduction is ascertained through a combination of destructive testing, historical record keeping and visual examination. Non-destructive condition monitoring techniques are further taken in to account as they may be available.

Wear zone Management
The minimum length of line will vary depending on the size of the vessel. Based on standard industry guidelines, the length of rope from the fairlead of the vessel to the shore hook will vary between 30-50 metres and the vessel should have sufficient length to meet this criteria. This length will also depend on the distance of the shore hook from the vessel's freeboard during cargo operations, environmental conditions, length of mooring tail, ship movements of the berth and ship/ berth compatibility. This information shall be considered during a condition-based evaluation on board the vessel. Ropes should be protected when not in use to reduce exposure to the sun and weather conditions. Spare ropes should be stored away from heat-generating sources and chemicals. Where possible, the space should be adequately ventilated. Further guidance on wear zone management should be detailed in the Safety Management Manual.

All mooring lines are susceptible to mechanical damage from exposure to contact surfaces, particularly while under tension. Deck fittings should be regularly inspected and kept smooth and free from chafe points. Steel fairleads should be kept clean, smooth and rust free. Where appropriate, sleeves or liners should be fitted to improve the condition of contact surfaces. Management of Change processes should be followed and line manufacturers consulted before fitting sleeves or liners to ensure their compatibility. Roller fairleads and other rotating deck equipment should be well maintained and kept free to rotate as originally designed.

Abrasion resistant overall jackets or individual strand jackets protect against external abrasion and should be considered.

All mooring ropes that are fitted on the winches should be rotated periodically as detailed in appendix B in order to ensure that ropes, which are exposed to heavy load conditions, are not exposed for extended periods. This practice will increase their service life. In order to ensure continuity, the ropes should be rotated irrespective of whether they have been replaced.

Mooring ropes should be turned end to end, based on the condition of the rope.

Service life and Retirement Criteria
Mooring ropes should be retired when the residual strength of the mooring rope reaches 75% of the ship design MBL. Careful condition assessment should be carried out for mooring ropes considering the criteria provided in the Safety Management Manual and manufacturer's recommendations and any decision to retire the ropes should be based on the condition assessment.

The operator should be consulted as and when required.

When the length of the mooring rope is reduced due to damage and cannot be used on board for mooring operations, the rope should be retired and replaced.

Certificates
Certificates for mooring ropes should be filed in appendix B.

Part C – Mooring Ropes – High Modulus Synthetic Fibre lines

Line Installation

Line installation guidance is provided by the line manufacturer (See **appendix C**) to ensure any product-specific considerations are understood and accounted for.

Handling High Modulus Synthetic Fibre (HMSF) lines often involves the placement of some form of chafe protection. These can be fixed in place or floating on the line for adjustment to different terminal arrangements and ballast conditions.

Procedures are in place to make sure chafe protection is fitted as safely as possible and managed to ensure effectiveness.

Storage

The Safety Management Manual should provide guidance on storage of HMSF lines. All HMSF lines should be stored out of direct sunlight and away from extreme ambient temperatures in accordance with the manufacturer's guidance. Lines should be kept off the deck to provide ventilation underneath and to prevent contamination from chemicals.

Lines should be inspected for damage before deploying them from storage into service.

Mooring lines installed on winches should be covered with suitable waterproof tarpaulins when not in use.

Mooring lines suppliers' guidance on proper storage should be made available on board. (see appendix C).

Maintenance

The Safety Management Manual should contain guidance for effective maintenance and inspection of mooring lines. Maintenance guidance will also be provided by the line manufacturer and this should be made available too. (see appendix C).

Maintenance activities for HMSF lines include the following:

- Monitor and remove induced twist in accordance with the line manufacturer recommendations;
- Maintain the chafe protection to make sure it is working properly and can be safely deployed;
- Keep deck equipment surface conditions free of defects and sharp edges in accordance with the line manufacturer's recommendations;
- Mitigate excessive localised damage;
- Cover winches when lines are not in service;
- Monitor the condition of jacketed HMSF lines and repair in accordance with the line manufacturer recommendations;
- Follow instructions for cleaning lines when they are contaminated with oil or other commonly used petroleum lubricants.

In order to minimise HMSF mooring lines suffering from abrasion, fairleads and other contact surfaces should be maintained, clean, smooth and rust-free. Consideration should be given to fitting chafe protection to the section of line passing through the fairlead. Ship personnel should take care to maintain the effectiveness of the chafe protection.

Mooring rope time in use records should be maintained and should be found in the equipment verification file which is stipulated in the SMS and/or in the vessel's PMS.

See Appendix C for manufacturer's guidance on maintenance, or, if this is not available, then ship-specific guidance on maintenance should be filed in Appendix C.

Tools and resources required

All Company vessels are suitably equipped with the correct tools required for maintenance and repairs of mooring ropes as guided by the manufacturer.

The Company should require all vessels to carry a minimum of two spare mooring ropes.

Additionally the vessel's command should ensure that adequate resources are available for carrying out maintenance of mooring ropes.

See appendix C for a list of tools required for maintenance of ropes.

Inspections

Deployment inspections are carried out by the mooring team prior to every use as described in the Safety Management Manual. Crew members carrying out the deployment inspections should have been trained according to Company requirements and the manufacturer's guidance. During the deployment inspection, the working length of the line (outboard of the tension side of the winch) should be inspected for defects which may impair the performance of the line.

Incident reports should be issued in case of line failure or significant damage and the manufacturer contacted when needed. Decisions whether to go ahead/not go ahead with using lines in mooring operations can then be made and repairs should be properly documented.

On completion of each unmooring operation, the Person in Charge of the mooring station should visually inspect mooring lines and inform the Master if excessive deterioration in the condition of the mooring lines is noticed. With this information the Master can then consider increasing the inspection frequency of the relevant mooring ropes and has the authority to discontinue use of the mooring lines.

Routine inspections should be carried out regularly (frequency depending on berthing frequency and environmental severity) and records of these inspections maintained. Only qualified and experienced personnel should be responsible for inspecting HMSF lines in service.

Inspections are typically carried out by visual assessment. The main areas of deterioration HMSF lines are external and internal abrasion, cut yarns/mechanical damage and induce twist. Areas that should be regularly inspected include:

- The sections of the line in wear zones, particularly those sections that run regularly through deck fairleads and pedestal rollers.
- The section of the line at the crossover point on split drum winches.
- The eye, the eye splice, the crown of the eye and sections of line close to the eye that may have been damaged through abrasion or contamination on berths.

Detailed inspections:
Mooring lines should be replaced when their residual strength reaches 75% of the ship design MBL. This is determined through a combination of destructive testing, historical record keeping and visual examination. Non-destructive condition monitoring techniques should further be taken in to account as available.

Wear Zone Management
The minimum length of line will vary depending on the size of the vessel. Based on standard industry guidelines the length of rope from the fairlead of the vessel to the shore hook will vary between 30 and 50 metres and the vessel should have sufficient length to meet this criteria. This length will also depend on the distance of the shore hook from the vessel's freeboard during cargo operations, environmental conditions, length of mooring tail, ship movements of the berth and ship/berth compatibility. This information shall be considered during condition-based evaluation on board the vessel. Ropes should be protected when not in use to reduce exposure to the sun and weather conditions. Spare ropes should be stored away from heat-generating sources and chemicals. Where possible, the space should be adequately ventilated. Further guidance on wear zone management should be detailed in the Safety Management Manual.

All mooring lines are susceptible to mechanical damage from exposure to contact surfaces, particularly while under tension and, because of this, deck fittings should be regularly inspected and kept smooth and free from chafe points. Steel fairleads should be kept clean, smooth and rust free. Where appropriate, sleeves or liners should be fitted to improve the condition of contact surfaces. Management of Change processes should be followed and line manufacturers should be consulted before fitting sleeves or liners to ensure compatibility. Roller fairleads and other rotating deck equipment should be well maintained and kept free to rotate as originally designed.

Abrasion-resistant overall jackets or individual strand jackets protect against external abrasion and can be considered.

All mooring ropes that are fitted on the winches should be rotated periodically as detailed in appendix C in order to ensure that ropes, which are exposed to heavy load conditions, are not exposed for extended periods; this practice will increase their service life. In order to ensure continuity, the ropes should be rotated irrespective of whether they have been replaced.

Mooring ropes should be turned end to end, based on the condition of the rope.

Service life and Retirement Criteria
Mooring ropes should be retired when the residual strength of the mooring rope reaches 75% of the ship design MBL.

Careful condition assessment shall be carried out for both synthetic and HMSF ropes considering the criteria provided in the Safety Management Manual and manufacturer's recommendations and any decision to retire the ropes shall be based on the condition assessment.

The Company should be consulted as and when required.

When the strength of the mooring rope is reduced due to damage and cannot be used on board for mooring operations, the rope should be retired and replaced.

Certificates
Certificates for HMSF mooring ropes are filed in appendix C.

Part D – Mooring Wires

Line Installation

The procedure for installing the steel wire rope is planned in accordance with the manufacturer's recommendations and should be carried out in accordance with a detailed plan under the supervision of a competent person or persons.

The steel wire rope should be checked to verify that it is not damaged when unloaded and when transported. A turntable should be used for installing new mooring wires to avoid twists and kinks developing if the temporary storage drum is not rotated while running the wire off.

Detailed guidance on installation should be obtained from the line manufacturer (see **appendix D**).

Storage

The Safety Management Manual should provide guidance on storage of mooring wires. A clean, well-ventilated, dry, undercover location, such as a rope locker, is always preferred. If outdoor storage is unavoidable, the rope should be covered with waterproof material to protect it from the sun and weather.

The wire rope should not make any direct contact with the deck and there should always be a flow of air under the reel.

Rope suppliers' guidance on proper storage and guidance on dressing and methods of application should be made available on board.

Maintenance

The Safety Management System should contain detailed guidance on checks of wires prior to their use and the vessel's crew must comply with these requirements. The main areas of deterioration include wear zone areas, eyes, splices and sections of the line prone to be on the top layers of the winch while under load during mooring operations.

Steel wire ropes in service may suffer corrosion damage. Steel wire ropes have corrosion protection provided by both galvanised individual wires and the application of an appropriate lubricant, which is reapplied as required through the service life of the wire. Further guidance is also provided by the Company on operational precautions to be taken to avoid excessive damage to mooring wires and minimise wear.

Additionally, where available, the rope manufacturer's guidance should be referred to for maintenance of mooring wires (see appendix D).

Tools and resources required

All Company vessels should be suitably equipped with the correct tools required for maintenance and repairs of mooring wires.

The Company should require all vessels to carry a minimum of two spare mooring wires.

Additionally, the vessel's command will ensure that adequate resources are available for carrying out maintenance of mooring ropes.

See appendix D for a list of tools required for maintenance of wires.

Inspections

Deployment inspections should be carried out by the mooring team prior to every use as described in the Safety Management Manual. Crew members carrying out the deployment inspections should have been trained according to Company requirements and manufacturer's guidance. During the deployment inspection, the working length of the line (outboard of the tension side of the winch) should be inspected for defects which may impair the performance of the line.

Incident reports should be issued in the case of a line failure or significant damage and the manufacturer should then be contacted when needed. Decisions as to whether to go ahead/not go ahead with using lines in mooring operations can then be made and any repairs properly documented.

On completion of each unmooring operation, the Person in Charge of the mooring station should visually inspect the mooring wires and inform the Master if excessive deterioration in the condition of the mooring wires is noticed. With this information, the Master may then consider increasing inspection frequency of the relevant mooring ropes and has the authority to discontinue use of the mooring wires.

Routine inspections should be carried out regularly (frequency depending on berthing frequency and environmental severity) and records of the inspections are maintained. Only qualified and experienced personnel are responsible for inspecting wires in service.

Areas which are regularly inspected include:

- Winch or anchor point and the section of wire close to it.
- Sections of rope in wear zones, particularly sections that run regularly through fairleads and around pedestal rollers.
- The eye, especially at the bend of the eye and its termination.
- Cross-overs on winch drum.
- Terminations, particularly the Talurit type, to identify any looseness, cracks, distortion or corrosion.

	Inspection Criteria	**Discard Criteria**
Visible wire breaks	Number in length of 6d or 30d	Discard if over 4 in length 6d or 8 over 30d
Wire breaks at termination	Evidence of broken wires	Remake termination or discard rope
Fracture of strand	Strand fracture	Discard if present
Reduction of rope diameter	Percentage reduction	Discard if diameter decreased by 10%
Abrasion of outer wires	Degree of deterioration (%)	Discard if over 7%

Summary of criteria for inspection and discard of steel wire ropes in ISO 4309

Detailed inspections should be carried out by the manufacturer's representatives during the vessel's special survey with the entire length of the mooring wire inspected. An inspection report will then be issued containing recommendations for further use, repairs, end-to-end and retirement guidance.

Wear Zone Management

The minimum length required for a mooring line will vary depending on the size of the vessel. Based on standard industry guidelines the length of wire from the fairlead of the vessel to the shore hook will vary between 30-50 metres and the vessel should have sufficient length to meet this criteria. This length will also depend on the distance of the shore hook from the vessel's freeboard during cargo operations, environmental conditions, length of mooring tail, ship movements of the berth and ship/berth compatibility. This information shall be considered during condition-based evaluation on board the vessel.

Wires should be protected when not in use to reduce exposure to the sun and weather conditions. The mooring wires should be adequately greased to prevent wires from corroding. Further guidance on wear zone management should be detailed in the Safety Management Manual.

The mooring wires should be rotated as documented in appendix D and records maintained accordingly. This will ensure that wires, which are exposed to heavy loading conditions, are not exposed for extended periods and therefore, this practice will increase their service life. In order to ensure continuity, the wires should be rotated irrespective of whether they have been replaced.

All mooring wires should be changed end-to-end every five years. Assistance from shore will be required to make an eye in the inboard end and therefore the matter should be discussed with the vessel's Technical Superintendent.

Service Life and Retirement Criteria

Mooring wires are retired when the residual strength of the mooring wire reaches 75% of the ship design MBL. Careful condition assessment is carried out on board considering the criteria provided in the Safety Management Manual and manufacturer's recommendations and any decision to retire the wires is based on the condition assessment. The operator should be consulted as and when required.

When the strength of the mooring wire is reduced due to damage and cannot be used on board for mooring operations, the wire should be retired and replaced.

Wires are replaced if the number of broken strands exceeds 10% of the visible strands in any length of wire equal to eight diameters.

Irrespective of the condition, mooring wires should be replaced every 10 years.

Certificates

Refer to the Mooring and Lifting equipment file for certificates of mooring wires or place them under Appendix D.

Part E – Mooring Tails

Storage
The Safety Management Manual should provide guidance on storage of mooring tails.

New tails not in service, or those removed from mooring lines, should be stored in a rope locker or other suitable covered store location. If stored on an open deck they should be stored on pallets away from direct heat and sunlight and covered under tarpaulins. The pallets should be raised where possible above the level of any standing surface water.

Tails stored with mooring lines on winches or in coils for any length of time should likewise be covered with tarpaulins to protect from sunlight, heat and contaminants.

Maintenance
The Safety Management Manual should contain guidance on maintenance of tails and the vessel's crew comply with these requirements. Further guidance should also be provided by the Company on operational precautions to be taken to avoid excessive damage to mooring tails and minimise wear. Manufacturer's guidance should be referred to for maintenance of mooring tails.

The eyes of the tails which are attached to the connecting shackle as well as any areas of the free length that regularly experience wear or damage should be protected against abrasion, with polyester or a similar type of material used. Leather is not generally recommended as a protection material.

Records for mooring tail time in use records should be kept up to date and should be found in the equipment check file which is filed under **appendix E**.

Tools and resources required
All Company vessels should be suitably equipped with the correct tools required for maintenance and repairs of mooring tails.

The Company should require all vessels to carry a minimum of four spare mooring tails where fitted.

Additionally, the vessel's command should ensure that adequate resources are available for carrying out maintenance of mooring tails.

A list of tools required for maintenance of mooring tails is provided in appendix E.

Inspections
Deployment inspections should be carried out by the mooring team prior to every use as described in the Safety Management Manual. Crew members carrying out the deployment inspections should have been trained according to Company requirements and the manufacturer's guidance. During the deployment inspection, close attention should be paid to the integrity of the connection on the mooring line.

Incident reports should be issued in case of line failure or significant damage and the manufacturer contacted when needed. With this information, decisions whether to go ahead/not go ahead with using lines in mooring operations can then be made; any repairs should be properly documented.

On completion of each unmooring operation, the Person in Charge of the mooring station should visually inspect the mooring tails and inform the Master if excessive deterioration in the condition of the mooring tails is noticed. With this information, the Master may consider increasing the inspection frequency of the relevant mooring tails and has the authority to discontinue use of the mooring tails.

Routine inspections are carried out regularly (frequency depending on berthing frequency and environmental severity) and records of the inspections are maintained. Only qualified and experienced personnel should be responsible for inspecting mooring tails in service.

If physical testing or inspection of retired tails identifies areas that have experienced higher rates of wear, additional detailed and more frequent inspections should be carried out in the same tail positions on in-service lines.

Detailed inspections:
Mooring tails should be replaced when their residual strength reaches 75% of the ship design MBL. The tail follows the same process for determining and managing the service life that is used for mooring lines. This is determined through a combination of destructive testing, historical record keeping and visual examination. Non-destructive condition monitoring techniques should be further taken in to account as available.

The mooring tails fitted to each mooring winch must be of the same type and strength.

Wear Zone Management
The minimum length of a tail will vary; however, the Company should require all tails to be of 11-22 metres in length and have a TDBF (tail design brake force) of 125-130% of the ship design MBL. The TDBF is higher than the LDBF of the mooring line because tails experience more wear in service than lines. The TDBF should be tested and defined in wet condition and any material strength loss when wet should be accounted for. Tails should be protected when not in use to reduce exposure to the sun and weather conditions. Spare tails should be stored away from heat-generating sources and chemicals. Where possible, the space should be adequately ventilated.

Further guidance on wear zone management should be detailed in the Safety Management Manual.

Retirement Criteria
Mooring tails should be retired when the residual strength of the mooring tail reaches 75% of the ship design MBL. Careful condition assessment should be carried out on board considering the criteria provided in the Safety Management Manual and manufacturer's recommendations and any decision to retire mooring tails should be based on the condition assessment.

The Company should be consulted as and when required. Tails should be replaced every 18 months unless experience and time in use with inspection indicates a longer or shorter period is warranted. Irrespective of condition, mooring tails should be replaced every 24 months.

Certificates
Refer to the Mooring and Lifting equipment file for certificates of mooring tails or file them in appendix E.

Part F – Mooring shackles

Maintenance

Mooring shackles are generally maintenance-free. The Safety Management System should contain guidance on maintenance of shackles and the vessel's crew should comply with these requirements. Further guidance should also be provided by the operator on operational precautions to be taken to avoid excessive damage to mooring shackles and minimise wear. Where available, the manufacturer's guidance should be referred to for maintenance of mooring shackles.

Tools and resources required

All Company vessels must be suitably equipped with the correct tools required for maintenance and repairs of mooring shackles.

The vessel's command shall ensure that adequate resources are available for carrying out maintenance of mooring ropes.

The Company should require every vessel to maintain a minimum spare of one mooring shackle.

A list of tools required for maintenance of shackles is provided in **appendix F**.

Inspections

Routine inspections should be carried out by the mooring team prior to every use as described in the Safety Management Manual.

Detailed inspections should be carried out regularly (frequency depending on berthing frequency and environmental severity) and records of the inspections maintained. On completion of each unmooring operation, the Person in Charge of the mooring station shall visually inspect mooring shackles and inform the Master immediately if excessive deterioration or deformation of the mooring shackles is noticed. The Master may consider increasing the inspection frequency of the relevant mooring shackles accordingly.

Storage

The Safety Management Manual should provide guidance on storage of mooring shackles.

Wear zone Management

Shackles are usually robust and encounter minimum wear and tear. However, an inspection carried out by the vessel's crew should identify any wear and/or damages and this must be properly documented. This will further be used to identify any consistent issues with shackles to further enhance wear zone management.

Retirement Criteria

The Company should evaluate the retirement criteria for shackles based on condition assessment and recommendations from the manufacturers.

Certificates

Certificates for mooring shackles should be filed in appendix F.

Appendices

Appendix A. **Mooring Arrangement Plan**

Appendix B. **Mooring Ropes – Conventional Fibre Lines**

- Line installation guidance
- Manufacturer's guidance on number of turns on split drums
- Storage guidance
- Maintenance guidance
- Maintenance records
- Available tools and resources
- Inspection guidances
- Inspection records
- Service life and retirement guidances from manufacturer and operators
- Useage records
- Certificates

Appendix C. **Mooring Ropes – HMSF Lines**

- Line installation guidance
- Manufacturer's guidance on number of turns on split drums
- Storage guidance
- Maintenance guidance
- Maintenance records
- Available tools and resources
- Inspection guidance
- Inspection records
- Service life and retirement guidance from manufacturers and operators
- Useage records
- Certificates

Appendix D. **Mooring Wires**

- Line installation guidance
- Manufacturer's guidance on number of turns on split drums
- Storage guidance
- Maintenance guidance

Appendix D. **Mooring Wires cont...**

- Maintenance records
- Available tools and resources
- Inspection guidance
- Inspection records
- Service life and retirement guidance from manufacturers and operators
- Useage records
- Certificates

Appendix E. **Mooring Tails**

- Line installation guidance
- Storage guidance
- Maintenance guidance
- Maintenance records
- Available tools and resources
- Inspection guidance
- Inspection records
- Service life and retirement guidances from manufacturers and operators
- Useage records
- Certificates

Appendix F. **Mooring shackles**

- Storage guidance
- Maintenance guidance
- Maintenance records
- Available tools and resources
- Inspection guidance
- Inspection records
- Service life and retirement guidances from manufacturers and operators
- Certificates

Appendix G. **Mooring operations – hazards and precautions**

Appendix H. **Mooring procedures – Company guidances and procedures**

Appendix I. **Mooring operations – Company training and competence requirements**

Appendix J. **Mooring operations – Company requirements on Roles and Responsibilities**

ADDENDA

Addendum 1. MEG4 Example Mooring Line Acquisition Form
https://www.OCIMF.org/media/91255/meg4-mooring-line-acquisition-form.pdf
or
https://bit.ly/2TxlODS

Addendum 2. MEG4 Example Mooring Tail Acquisition form
https://www.OCIMF.org/media/91256/meg4-mooring-tail-acquisition-form.pdf
or
https://bit.ly/2X8ENXw

Addendum 3. MEG4 Example Mooring Line Proposal Form
https://www.OCIMF.org/media/87485/MEG4-Mooring-line-proposal-form.pdf
or
https://bit.ly/2BGqrEt

Addendum 4. MEG4 Example Mooring Tail Proposal Form
https://www.OCIMF.org/media/87505/MEG4-Mooring-tail-proposal-form.pdf
or
https://bit.ly/2GxECjd

Addendum 5. MEG4 Example Mooring Line Base Design Certificate
https://www.OCIMF.org/media/87525/MEG4-Mooring-line-base-design-certificate.pdf
or
https://bit.ly/2BHtOuX

Addendum 6. MEG4 Example Mooring Tail Base Design Certificate
https://www.OCIMF.org/media/87495/MEG4-Mooring-tail-base-design-certificate.pdf
or
https://bit.ly/2SUS6vq

Addendum 7. MEG4 Example Mooring Line Certificate
https://www.OCIMF.org/media/91257/meg4-mooring-line-certificate.pdf
or
https://bit.ly/2NdhtTN

Addendum 8. MEG4 Example Mooring Tail Certificate
https://www.OCIMF.org/media/91258/meg4-mooring-tail-certificate.pdf
or
https://bit.ly/2ImgamH

Addendum 9. Sample Mooring Arrangement

Addendum 10. Sample Mooring Diagram

Addendum 11. Sample Mooring Line Log

Addendum 12. Sample Record of Mooring Wires and Tails Useage

Addendum 13. Sample Record of Mooring Wires and Tails Useage (page 2)

Addendum 14. Sample Mooring Ropes & Spare Ropes Verification Record

Addendum 15. Sample Wire Inspection Record

Addendum 16 Sample Wire Inspection Record (page 2)

Addenda 9 to 16 are available to download individually here:
https://www.INTERTANKO.com/Model-Line-Management-Plans-Addenda

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