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THÔNG BÁO KỸ THUẬT TÀU BIỂN
TECHNICAL INFORMATION ON SEA-GOING SHIPS

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Nội dung: Sửa đổi, bổ sung đối với Quy định II-1/3-8 “Trang thiết bị kéo và chằng buộc tàu” của Công ước Quốc tế về an toàn sinh mạng con người trên biển (SOLAS) được thông qua tại khóa họp thứ 102 (tháng 11/2020) của Ủy ban An toàn hàng hải (MSC) thuộc Tổ chức Hàng hải quốc tế (IMO).

Kính gửi: Các chủ tàu/công ty quản lý tàu biển
Các đơn vị đăng kiểm tàu biển

Tại khóa họp thứ 102 (từ ngày 04 đến 11/11/2020), Ủy ban An toàn hàng hải (MSC) của Tổ chức Hàng hải quốc tế (IMO) đã thông qua Sửa đổi, bổ sung đối với Quy định II-1/3-8 “Trang thiết bị kéo và chằng buộc tàu” của Công ước Quốc tế về an toàn sinh mạng con người trên biển (SOLAS). Sửa đổi, bổ sung này dự kiến có hiệu lực thi hành từ ngày 01/01/2024, với nội dung chính được tóm tắt như sau:

1. Đối với các tàu mới (là tàu có hợp đồng đóng mới vào hoặc sau ngày 01/01/2024; hoặc, nếu không có hợp đồng đóng mới, sống chính của tàu được đặt vào hoặc sau ngày 01/7/2024; hoặc tàu được bàn giao vào hoặc sau ngày 01/01/2027):

a) Nếu tàu có tổng dung tích từ 3.000 trở lên: bố trí chằng buộc của tàu phải được thiết kế và các trang thiết bị chằng buộc, bao gồm cả dây buộc tàu, phải được lựa chọn dựa trên hướng dẫn của Thông tư MSC.1/Circ.1619 “*Hướng dẫn về thiết kế bố trí chằng buộc và lựa chọn trang thiết bị chằng buộc thích hợp cho việc chằng buộc tàu an toàn*”.

b) Nếu tàu có tổng dung tích nhỏ hơn 3.000: bố trí chằng buộc của tàu cần phù hợp với hướng dẫn của Thông tư MSC.1/Circ.1619 đến mức tối đa có thể được, hoặc tiêu chuẩn quốc gia của Chính quyền Hàng hải.

2. Tất cả các tàu thuộc phạm vi áp dụng Chương II-1 của Công ước SOLAS: từ ngày 01/01/2024, trang thiết bị chằng buộc bao gồm cả dây buộc tàu phải được kiểm tra và bảo quản đảm bảo tình trạng phù hợp cho mục đích sử dụng dự kiến theo hướng dẫn của Thông tư MSC.1/Circ.1620 “*Hướng dẫn kiểm tra và bảo quản thiết bị chằng buộc bao gồm cả dây buộc tàu*”.

Liên quan đến nội dung nêu trên, xin gửi các Quý Đơn vị Thông tư MSC.1/Circ.1619 và Thông tư MSC.1/Circ.1620.

Thông báo kỹ thuật này được nêu trong mục: *Thông báo/ Thông báo kỹ thuật tàu biển* của Cổng thông tin điện tử Cục ĐKVN: <http://www.vr.org.vn>.

Nếu Quý Đơn vị cần thêm thông tin, đề nghị liên hệ:

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Xin gửi đến các Quý Đơn vị lời chào trân trọng./.

Nơi nhận:

- Như trên;
- Phòng QP, TB, CN, HTQT;
- Trung tâm VRQC, TH;
- Các chi cục đăng kiểm;
- Lưu TB.

Tài liệu gửi kèm: Thông tư MSC.1/Circ.1619 và Thông tư MSC.1/Circ.1620.

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MSC.1/Circ.1619
11 December 2020

**GUIDELINES ON THE DESIGN OF MOORING ARRANGEMENTS
AND THE SELECTION OF APPROPRIATE MOORING EQUIPMENT
AND FITTINGS FOR SAFE MOORING**

1 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), having considered a proposal by the Sub-Committee on Ship Design and Construction, at its sixth session (4 to 8 February 2019), and recognizing the importance of design of mooring arrangements and the selection of appropriate mooring equipment and fittings for safe mooring operations, with a view to ensuring a uniform approach towards the application of the provisions of SOLAS regulation II-1/3-8, as amended by resolution MSC.473(102), which is expected to become effective on 1 January 2024, approved the *Guidelines on the design of mooring arrangements and the selection of appropriate mooring equipment and fittings for safe mooring*, as set out in the annex.

2 Member States are invited to bring the annexed Guidelines to the attention of ship designers, shipyards, shipowners, ship managers, bareboat charterers and other organizations or persons responsible for design of mooring arrangements and the selection of appropriate mooring equipment and fittings.

3 Member States are also invited to bring the annexed Guidelines to the attention of shipmasters, ships' officers and crew, and all other parties concerned.

ANNEX

GUIDELINES ON THE DESIGN OF MOORING ARRANGEMENTS AND THE SELECTION OF APPROPRIATE MOORING EQUIPMENT AND FITTINGS FOR SAFE MOORING

1 Introduction

1.1 Historical evolution in ship designs, especially the design of large ships, has resulted in optimized performance and a greater degree of complexity; this has not been extended to the design of ships' mooring arrangements. These Guidelines support the application of the provisions of SOLAS for mooring arrangements and encourage greater consideration of the occupational safety and safe mooring of the ship when designing new ships. Improving the design of mooring arrangements should enhance usability and safety during towing and mooring operations.

1.2 Regulations II-1/3-8.7 and II-1/3-8.8 of the International Convention for the Safety of Life at Sea (SOLAS), as amended, require that for ships of 3,000 gross tonnage and above constructed on or after 1 January 2024, the mooring arrangement shall be designed, and the mooring equipment including lines shall be selected, in order to ensure occupational safety and safe mooring of the ship; and ships of less than 3,000 gross tonnage constructed on or after 1 January 2024 should comply with these requirements as far as reasonably practicable, or with applicable national standards of the Administration.

1.3 These Guidelines provide an approach to the design of mooring arrangements, and the selection of mooring equipment and fittings, which should be applied in conjunction with principles of ergonomics and usability.

2 Definitions

For the purposes of these Guidelines:

2.1 *Line Design Break Force (LDBF)* means the minimum force that a new, dry, spliced, mooring line will break at. This is for all synthetic cordage materials.

2.2 *Mooring area* refers to the dedicated area on a ship where mooring equipment is installed and line-handling takes place. It also includes areas where there is a risk of personnel injury in event of snap-back or other failure of mooring equipment. There may be multiple mooring areas on a ship.

2.3 *Mooring arrangements* means the configuration of the mooring equipment and fittings and other design features of the ships related to the mooring operation, i.e. lighting and communication equipment.

2.4 *Mooring equipment and fittings* means items such as mooring winches, capstans, bollards, bitts, fairleads, rollers, chocks, etc. and also includes mooring lines.

2.5 *Mooring lines* means ropes, wires and combinations used for mooring operations other than messenger lines but including tails.

2.6 *Mooring operations* means normal mooring and unmooring of the ship, including associated in-harbour towing movements.

2.7 *Mooring personnel* means personnel tasked to assist in the activity of mooring and unmooring ships, either ashore or from mooring boats, carried out within the framework of port marine services.

2.8 *Shipboard personnel* means personnel assigned duties for supervising or working in mooring areas during mooring operations.

2.9 *Ship Design Minimum Breaking Load (MBL_{SD})* means the minimum breaking load of new, dry, mooring lines for which shipboard fittings and supporting hull structures are designed in order to meet mooring restraint requirements.

2.10 *Supervising personnel* means shipboard personnel assigned duties for supervising mooring areas during mooring operations.

2.11 *Towing and mooring arrangements plan* means the plan as described in section 5 of the annex to the *Revised guidance on shipboard towing and mooring equipment* (MSC.1/Circ.1175/Rev.1). This plan presents specific information regarding the towing and mooring fittings aboard the vessel, the mooring lines, as well as the arrangement of mooring lines and the acceptable environmental conditions for mooring.

2.12 *Working Load Limit (WLL)* means the maximum load that a mooring line should be subjected to in operational service, calculated from the relevant environmental mooring restraint requirement.

3 Goals

The equipment selection and mooring arrangement design safety objectives should be to facilitate safe mooring operations and reduce the risk to shipboard personnel and mooring personnel caused by inappropriate selection and arrangement of equipment and fittings.

4 Functional objectives

4.1 A ship should be provided with mooring equipment and fittings appropriate for its type and size. In addition, a ship should be provided with mooring lines appropriate for the equipment and fittings installed on board. In order to achieve the goals for the correct equipment selection and mooring arrangement design safety objectives set out in section 3, the following functional objectives should be applied.

4.2 Mooring equipment and fittings should be:

- .1 arranged to minimize obstructed access to and operation of the mooring equipment;
- .2 arranged to minimize obstructed access to working space and minimize obstructed view of the mooring area;
- .3 arranged to minimize the need for complex mooring line configurations during the normal operation of the ship;
- .4 selected and arranged to minimize the need for manual handling of mooring lines under load; and
- .5 selected and arranged to minimize the exposure of personnel involved in mooring operations to the dynamic loads of mooring lines.

5 Achievement of the functional objectives

To meet the functional objectives, the following design and equipment features should be considered from the earliest stage in the design process.

Selection of equipment, fittings and mooring lines should not be undertaken independently. To facilitate safe mooring operations, it is necessary for mooring equipment, fittings and mooring lines to be considered as a complete system within which all components are compatible.

The guidance on the design of mooring arrangements and the selection of equipment and fittings should be read in conjunction with MSC.1/Circ.1175/Rev.1.

This section should be implemented to the extent permitted by the size and purpose of the ship.

5.1 Design of mooring arrangements

5.1.1 To minimize the need for complex mooring line configurations during the normal operation of the ship, mooring winches and fairleads should be positioned to allow the use of direct, unobstructed leads from the mooring winch to the fairlead for each of the mooring lines described in the towing and mooring arrangements plan. It is preferable to provide a dedicated fairlead for each mooring line.

5.1.2 Where a straight lead is not possible:

- .1 the deviation from a straight lead should be by means of pedestal fairleads, rolling fairleads or similar means that will reduce friction between line/fitting and reduce bend losses. Steel fittings such as horns or bollards without chafe protection should be avoided;
- .2 the line should traverse the mooring area from winch to the fairlead by the shortest route; and
- .3 changes of direction of mooring line should be minimized to prevent reductions in mooring line strength due to bend loss and introduction of complex snap-back areas.

5.1.3 To provide for the oversight and supervision of the mooring operations, the mooring area should be designed to give supervising personnel an unobstructed view of the installed mooring equipment and fittings. This should include the provision for a platform, or other appropriate means, by which supervising personnel can obtain an unobstructed view of the mooring area and berth arrangements planned to be used from a position clear of hazards.

5.1.4 The mooring arrangements should be designed to provide unobstructed views between shipboard personnel, and of lines being worked, within the mooring area.

5.1.5 The winch operator should be provided with mooring winch controls that are positioned so that the winch operator has a direct view of the line in the mooring area being worked without stepping away from the winch controls. Winch controls should be positioned clear of hazards.

5.1.6 Deck illumination should provide a clear view of the mooring area and the equipment and lines being worked during hours of darkness or in conditions of limited visibility.

5.1.7 The design of mooring arrangements and mooring areas should take into account the following constraints:

- .1 anticipated variations in shore-based mooring arrangements and the need to preserve flexibility in mooring line configurations to achieve an appropriate restraining capacity;
- .2 ships' structural elements, including accommodation, ventilation exhausts, cargo equipment or similar obstacles, on access; and
- .3 special requirements for the location and selection of mooring equipment and fittings, for example special requirements for canal transits.

5.1.8 Unless the size and special features of the ship do not permit it, equipment and fittings in mooring areas should be positioned to provide shipboard personnel with unobstructed access to the following during mooring operations:

- .1 mooring winches and winch controls;
- .2 mooring fittings;
- .3 mooring lines and mooring line stowage; and
- .4 the space between shipside fairleads and winches to permit mooring personnel to safely apply stoppers to mooring lines when necessary.

5.1.9 The mooring arrangements should be designed to avoid the exposure of the shipboard personnel to lines under tension through snap-back or sudden movements of mooring lines. In this respect the following measures should be considered:

- .1 locate winches close to shipside fairleads. The position of winches should not result in inappropriate mooring line orientations, or block or otherwise interfere with the use of shipside fairleads for additional mooring lines, connecting up of tugs for towage during mooring operations or the ability to safely moor the ship;
- .2 enclosing the mooring line(s) behind barrier(s) provided that such enclosures do not adversely affect the performance of the mooring system and do not prevent effective inspection and maintenance of equipment, fittings and mooring lines;
- .3 alternative design(s) where crew members do not need to work close to or have to pass mooring lines under tension or potentially under tension;
- .4 use of appropriate, alternative means to moor the ship, including but not limited to automated mooring systems; or
- .5 permanently fix mooring lines to a mooring winch.

5.1.10 Mooring areas should be considered as potential snap-back zones and signage should be provided to indicate that this is the case.

5.1.11 To minimize the need for manual handling of towing and mooring lines, the following measures should be considered:

- .1 equipment and fitting arrangements should minimize the distance over which any mooring line may need to be handled;
- .2 the use of fixed or dedicated mooring lines, taking into account the need to avoid inappropriate mooring line orientations, or block or otherwise interfere with the use of shipside fairleads for additional mooring lines, connecting up of tugs for towage during mooring operations or the ability to safely moor the ship;
- .3 the layout to be designed to prevent manual intervention in transfer of the mooring line from storage drum to mooring winch drum and vice versa;
- .4 use of spooling equipment;
- .5 additional mooring lines should be available for immediate use, provided that their stowage does not interfere with the safe operation of the mooring equipment; and
- .6 a sufficient number of mooring winches so that, during mooring operations, manual use of warping ends, stoppers, capstans and bitts is minimized, as far as possible.

5.1.12 The mooring arrangement design should take into account the principles for effective mooring arrangements included in appropriate industry guidance on mooring equipment and fittings.

5.2 Selection of equipment, fittings and mooring lines

5.2.1 The selection of winches should take into account:

- .1 the availability of winches with alternative drum arrangements, including split drum arrangements, which can reduce the need for manual handling of mooring lines during mooring operations;
- .2 the positioning of winch controls, including the availability of remote controls for winches to improve the line of sight and reduce operator exposure to snap-back;
- .3 the availability of constant tension winches and their appropriateness for the normal operation of the ship; and
- .4 limiting noise levels to ensure proper communication during mooring operations.

5.2.2 The selection of fittings should take into account:

- .1 the type of mooring line with which the fitting is designed to be used. The design or selection of the fitting and the design of its hull supporting structure should be done in accordance with MSC.1/Circ.1175/Rev.1;

- .2 the diameter D of surfaces of mooring fittings that are in contact with the mooring line in relation to the mooring line diameter d (D/d ratio) to reduce or mitigate bend loss of strength; and
- .3 the need for the load-bearing surfaces of fittings to minimize damage from chafing and abrasion.

5.2.3 The selection of mooring lines should take into account:

- .1 the guidance on mooring restraint as per appendix A of MSC.1/Circ.1175/Rev.1;
- .2 the diameter D of surfaces of mooring fittings that are in contact with the mooring line in relation to the mooring line diameter d (D/d ratio) to reduce or mitigate bend loss of strength;
- .3 the compatibility of the MBL_{SD} of mooring lines and the brake capacity of the mooring winches installed on board;
- .4 the Line Design Break Force (LDBF) to be 100% to 105% of the MBL_{SD} ;
- .5 the characteristics and limitations of mooring lines including material properties and environmental operating conditions anticipated during normal operation of the ship;
- .6 the anticipated behaviour of the mooring line in the event of failure;
- .7 the influence on stored energy and the potential for snap-back of high stiffness mooring lines caused by the use of tails; and
- .8 as far as possible, but at least for lines in the same service (e.g. headlines, breast lines or springs), mooring lines of the same diameter and type (i.e. material) should be used.

5.2.4 To avoid overload on mooring winches, fittings and mooring lines, consideration should be given to select mooring winches with brake capacity of less than the ship design minimum breaking load of the mooring line or with adjustable brake capacity.

5.2.5 Fittings, particularly shipside fairleads, should be positioned to minimize the potential for chafing of mooring lines during the normal operation of the ship.

5.2.6 The selection of equipment and fittings including lines should take into account the principles for effective mooring arrangements included in appropriate industry guidance.

5.2.7 The mooring equipment, fittings and the mooring lines should at all times be compatible in design, diameter, strength, suitability, etc. and maintained with the original purpose and concept of the mooring arrangement.

5.2.8 Load limits

5.2.8.1 Notwithstanding the definitions in paragraph 2.1, LDBF of mooring lines made of nylon should be tested under wet and spliced conditions.

5.2.8.2 All components of a ship's mooring system, within defined tolerances, should be selected based on MBL_{SD} .

5.2.8.3 When selecting lines, the LDBF should be 100% to 105% of the MBL_{SD} .

5.2.8.4 The WLL of mooring lines should be used as user operating limiting values, not to be exceeded. The WLL is expressed as a percentage of MBL_{SD} and should be used as a limiting value in operational mooring analyses. Steel wires have a WLL of 55% of MBL_{SD} and all other cordage (synthetic) have a WLL of 50% of the MBL_{SD} .

6 Documentation on deviation

6.1 A supplement to the "Towing and mooring arrangements plan" should record the deviations if any, in relation to the following paragraphs:

- .1 5.1.2 (where a straight lead is not possible);
- .2 5.1.4 (unobstructed views);
- .3 5.1.5 (protection of winch operators);
- .4 5.1.8 (access to mooring equipment and fitting);
- .5 5.1.9 (exposure of the shipboard personnel to lines under tension); and
- .6 5.1.11 (minimize the need for manual handling of towing and mooring lines).

6.2 The documentation should include justification for such deviations and suitable safety measures, if any.

6.3 A reference to the supplement should be included in the towing and mooring arrangement plan so as to make the shipboard personnel aware of the safety measures which need to be considered during mooring operations.

7 References

- (1) Oil Companies International Marine Forum (OCIMF), *Mooring Equipment Guidelines, 4th Edition 2018*, ISBN: 978-1-85609-771-0.
- (2) Ian. C. Clark BSc, MSc, Master Mariner, MNI, *The Nautical Institute, Mooring and Anchoring Ships Vol.1, Principle and Practice*, ISBN: 9781906915934, 2009.

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MSC.1/Circ.1620
24 December 2020

**GUIDELINES FOR INSPECTION AND MAINTENANCE OF
MOORING EQUIPMENT INCLUDING LINES**

- 1 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), having considered a proposal by the Sub-Committee on Ship Design and Construction, at its sixth session, and recognizing the importance of inspection and maintenance of mooring equipment including lines, approved the *Guidelines for inspection and maintenance of mooring equipment including lines*, as set out in the annex.
- 2 Member States are invited to bring the annexed Guidelines to the attention of shipowners, ship managers, bareboat charterers and other organizations or persons responsible for operation of ships.
- 3 Member States are also invited to bring the annexed Guidelines to the attention of shipmasters, ships' officers and crew and all other parties concerned, for providing guidance on inspection and maintenance of mooring equipment including mooring lines.

ANNEX

GUIDELINES FOR INSPECTION AND MAINTENANCE OF MOORING EQUIPMENT INCLUDING LINES

1 General

1.1 Purpose

The purpose of these Guidelines is to provide recommendations and guidance for maintenance and in-service inspections of mooring equipment including lines and tails, criteria for identifying worn-out lines and tails for removal from service before failure, and criteria for selection of replacement mooring lines and tails.

1.2 Application

These Guidelines apply to all ships. Certain provisions are intended for reference by shipboard personnel, and other provisions are intended for Company personnel responsible for selecting and procuring replacement mooring lines.

2 Definitions

For the purpose of these Guidelines:

2.1 *Bend radius (D/d ratio)* means the diameter, D, of a mooring fitting divided by the diameter, d, of a mooring line that is led around or through the fitting. The D/d ratio is used by mooring line manufacturers to specify the minimum radius of a fitting around or through which a mooring line of diameter "d" should be led, in order to reduce or mitigate bend loss of strength of the mooring line.

2.2 *Company* means company, as defined in SOLAS regulation IX/1.2.

2.3 *Line Design Break Force (LDBF)* means the minimum force that a new, dry, spliced, mooring line will break at. This is for all synthetic cordage materials.

2.4 *Mooring arrangement* means the configuration of the mooring equipment and fittings and other design features of the ship related to the mooring operation, i.e. lighting and communication equipment.

2.5 *Mooring boat* means the boat handling mooring lines between the ship and ashore mooring facilities during mooring and unmooring operations and does not include harbour ship assist tugs (see the *Guidelines on minimum training and education of mooring personnel* (FAL.6/Circ.11/Rev.1)).

2.6 *Mooring equipment and fittings* means items such as winches, capstans, bollards, bitts, fairleads, rollers, chocks, etc. and also includes mooring lines.

2.7 *Mooring line configuration* means all components of an individual mooring line, including tails, eye splices, etc. Any change or replacement of a component is a change to the line's configuration, unless a component is replaced by a part having the same specification as in the original configuration.

2.8 *Mooring operations* means normal mooring and unmooring of the ship, including associated in-harbour towing movements.

2.9 *Mooring personnel* means personnel tasked to assist in the activity of mooring and unmooring ships, either ashore or from mooring boats, carried out within the framework of port marine services.

2.10 *Rotation of mooring lines* means periodical change of mooring lines for respective mooring drums to equalize the wear of mooring lines.

2.11 *Ship Design Minimum Breaking Load* (MBL_{SD}) means the minimum breaking load of new, dry, mooring lines for which shipboard fittings and supporting hull structures are designed in order to meet mooring restraint requirements.

2.12 *Towing and mooring arrangements plan* means the plan as described in section 5 of the annex to the *Revised guidance on shipboard towing and mooring equipment* (MSC.1/Circ.1175/Rev.1). This plan presents specific information regarding the towing and mooring fittings aboard the vessel, the mooring lines, as well as the arrangement of mooring lines and the acceptable environmental conditions for mooring.

3 Safe use of mooring equipment

3.1 Safe use of mooring equipment and fittings

Throughout its operational life, mooring equipment should be maintained and operated in accordance with the original design concept, if available, including when replacing parts and lines. In order to ensure all mooring equipment functions as designed, the Company should establish procedures for mooring operations, inspection and maintenance of mooring equipment, including mooring lines, taking into account appropriate references listed in paragraph 7 of these Guidelines.

3.2 Protection and storage of mooring lines

To preserve the design life of mooring lines, the following practices should be followed during mooring operations:

- .1 smooth contacts at turn-off points with large angles and/or eye splices; and
- .2 using covers/mats at ship side to protect against any friction damage.

3.3 Control of mooring lines

3.3.1 The Company should establish procedures to allow the identification and control of mooring lines, tails and associated attachments when on board and to facilitate inspection and maintenance of mooring lines. Such procedures should include:

- .1 providing a means of recording the number, type and location of mooring lines, tails and associated attachments. Such records may be included in either the towing and mooring arrangements plan or with records of inspection and maintenance or an alternative established by the requirements of the Company; and
- .2 providing a means of linking specific mooring lines, tails and associated attachments to the relevant records and a manufacturer's certificate, if available.

3.3.2 Any defect discovered to the mooring lines during mooring operations should be immediately reported to the Master by all parties concerned including shore-based mooring personnel. If no actions are taken as appropriate the competent authorities should be informed, as necessary.

4 Inspection and maintenance of mooring lines

4.1 Inspection of mooring lines

4.1.1 To prevent the deterioration of mooring lines to a condition which may result in the failure of the line during mooring operations, the periodic inspection of mooring lines, mooring line tails and associated attachments should be included in the onboard maintenance plan or equivalent maintenance management system. The maintenance plan may be computer based.

4.1.2 The requirements for inspection of individual mooring lines will be specific to the type of mooring line used on board. In general, onboard inspection of mooring lines will be based on manufacturer recommendations and by visual inspection of the outside of the mooring line to identify excessive wear or damage, e.g. external abrasion, external cut, kink, heat damage such as fusion and slackening or fraying of eye splices. Such visual inspections should be based on:

- .1 the recommendations of the mooring line and/or tail manufacturer, particularly the criteria provided for the assessment of mooring line condition;
- .2 operational experience regarding the performance of the mooring line and/or mooring line tail during previous mooring operations; and
- .3 the environmental conditions to which the mooring lines and/or mooring line tails are routinely exposed.

4.1.3 In the case of jacketed synthetic fibre mooring lines, detailed visual inspection of the condition of the synthetic fibre line may not be possible. The condition of the external jacket is not an accurate indicator of the condition of the load-bearing synthetic fibre material within the mooring line.

4.2 Maintenance of mooring lines

The Company should establish the maintenance procedures as required in paragraph 3.1 of these Guidelines. The maintenance procedures should specify replacement of in-service mooring lines and may include the rotation of mooring lines.

4.3 Criteria for condemning worn-out mooring lines

4.3.1 The replacement of in-service mooring lines which have been assessed as no longer suitable for use should be based on the removal prior to failure and in accordance with criteria provided by the manufacturer.

4.3.2 For visual inspection and replacement of mooring lines, additional advice is provided in industry guidance on mooring line and mooring line tail inspections.

4.4 Inspection and maintenance of equipment and fittings

4.4.1 Equipment and fittings should be properly inspected and maintained, based on the manufacturer's recommendations. Mooring equipment and fittings should be included in the onboard maintenance plan or equivalent maintenance management system. The maintenance plan may be computer based.

4.4.2 Maintenance should include the preservation, by appropriate means, of the clear marking of information on equipment and fittings, including Safe Working Load (SWL) and winch control instructions.

4.4.3 Records of inspection and maintenance of equipment and fittings should be available on board.

4.4.4 Records of the original design concept, equipment, arrangement and specifications should be retained on board through the life cycle of the ship.

4.4.5 To preserve the design life of mooring lines and reduce the potential for failure during mooring operations any storage provided for additional (loose) mooring lines should minimize the exposure to harmful environments (e.g. UV light, water, chemicals, cargo, extreme temperature).

5 Selection of replacement mooring lines

5.1 When replacing mooring lines, compatibility with the mooring equipment and fittings on board, as specified in the mooring arrangement plan, should be taken into account. This should be achieved by selecting a replacement mooring line which meets the designed specifications. In cases where this is not possible, the following properties should be taken into consideration and the towing and mooring arrangement plan updated accordingly:

- .1 breaking strength;
- .2 environmental conditions to be used (e.g. temperature);
- .3 linear density;
- .4 tenacity;
- .5 D/d ratios;
- .6 compression fatigue; and
- .7 stiffness.

5.2 Any increase in LDBF for the mooring lines above the limits specified, i.e. 100% to 105% of the MBL_{SD} , may require a review of the operating parameters and load limits of mooring equipment and fitting as well as of their hull supporting structures.

5.3 It should be noted that, when selecting replacement mooring lines, over time in service their strength will decay due to varying environmental conditions and thus the original service life expectations may not be achieved. Therefore, the Company should ensure that the condition of mooring lines is tracked throughout their service with the objective to replace the line before failure.

5.4 For wire ropes, corrosion protection should be considered.

5.5 For both wire and fibre mooring lines, the acceptable minimum bend radius (D/d ratio) recommended by the manufacturer should be taken into consideration as strength and life expectancy of these lines are directly related to the bend radius they are exposed to in service.

5.6 Where the acceptable minimum bend radius recommendations for a particular mooring line are not achievable, the service life of the line may be less than that stated by the manufacturer and therefore the line may need to be replaced before the end of the service life recommended by the manufacturer. The condition of lines regularly exposed to below the acceptable minimum bend radius should be subject to particular attention during inspections.

5.7 When selecting replacement mooring lines with high stiffness, including wire and high modulus synthetic lines, consideration should be given to the use of synthetic tails in order to reduce peak loading when the ship is secured alongside.

5.8 Consideration of the use of synthetic tails on high stiffness mooring lines should take into account industry and manufacturer guidance and the potential effects of synthetic tails on the stored energy of mooring lines under tension. The use of tails can change the characteristics of a mooring line and its behaviour in the event of failure. High stiffness mooring lines may exert significant dynamic force and have significant snap-back zones when used with synthetic tails that have a low stiffness.

6 Updating of ship documents and record-keeping

6.1 Records of inspection and maintenance of mooring equipment and inspection and replacement of mooring lines should be retained on board. Such records should be kept for a period determined by the Company, but in any event the records should be kept until completion of the next annual survey.

6.2 Consideration should be given to control and certification of mooring lines, wires, tails and associated attachments. Manufacturers' test certificates for mooring lines, joining shackles and synthetic tails should be kept on board and properly linked back to the equipment.

6.3 The items to be recorded during inspection and maintenance should be determined, taking into account the recommendations of the manufacturers of the mooring lines.

6.4 Any change of mooring line configuration requires updating of the towing and mooring arrangements plan.

7 References

- (1) Oil Companies International Marine Forum (OCIMF), *Mooring Equipment Guidelines, 4th Edition 2018*, ISBN: 978-1-85609-771-0.
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- (3) Walter Vervloesem AMNI, *The Nautical Institute, Mooring and Anchoring Ships Vol.2, Inspection and Maintenance*, ISBN: 9781870077941, 2009.