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**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.

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## 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<sub>SD</sub>) 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.
- (2) Ian. C. Clark BSc, MSc, Master Mariner, MNI, *The Nautical Institute, Mooring and Anchoring Ships Vol.1, Principle and Practice*, ISBN: 9781906915934, 2009.
- (3) Walter Vervloesem AMNI, *The Nautical Institute, Mooring and Anchoring Ships Vol.2, Inspection and Maintenance*, ISBN: 9781870077941, 2009.