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**Ships and marine technology —
Embarkation ladders**

Navires et technologie marine — Échelles d'embarcation



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5489 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 1, *Lifesaving and fire protection*.

This third edition cancels and replaces the second edition (ISO 5489:1986) of which it constitutes a complete revision in order to take into account new designs and manufacturing methods for embarkation ladders which have entered the market since 1986.

Introduction

This International Standard is intended to supplement existing International Maritime Organization (IMO) requirements for embarkation ladders. Since IMO instruments do not include specific requirements for prototype testing of embarkation ladders for approval, those tests included in this International Standard are in excess of the existing IMO requirements. The inclusion of these tests was considered necessary in order to provide a means of ensuring conformance of embarkation ladders with the performance requirements prescribed in IMO instruments and in this International Standard.

Ships and marine technology — Embarkation ladders

1 Scope

This International Standard specifies requirements for a ship's embarkation ladder that is provided to enable safe embarkation of waterborne survival craft along a vertical portion of the ship's hull. It is applicable to merchant ships required to carry embarkation ladders under Chapter III of the 1974 International Convention for the Safety of Life at Sea (SOLAS), as amended. National maritime safety administrations are urged to accept ladders complying with this International Standard on their ships, as complying fully with the requirements of SOLAS.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 209-1:1989, *Wrought aluminium and aluminium alloys — Chemical composition and forms of products — Part 1: Chemical composition*

ISO 877:1994, *Plastics — Methods of exposure to direct weathering, to weathering using glass-filtered daylight, and to intensified weathering by daylight using Fresnel mirrors*

ISO 1461:1999, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*

3 Materials

3.1 Wooden parts

Each wooden part shall be made of a hardwood (e.g. ash, oak, elm, beech, teak or apitong) free from knots.

3.2 Side ropes

3.2.1 Each side rope shall be mildew-resistant manila rope or a spun thermoset polyester rope with a polypropylene core of a colour that contrasts with the spun polyester. Each side rope shall have a breaking strength of at least 24 kN, and a nominal diameter of 18 mm (57 mm circumference).

3.2.2 Alternative side ropes of synthetic material may be used if they:

- a) meet the breaking strength and size requirements of 3.2.1;
- b) are at least as resistant to elongation under load as the standard ropes described in 3.2.1;
- c) have an exterior surface suitable for grasping with bare hands, similar to manila or spun polyester;
- d) are of a thermosetting polymer, resistant to deterioration from ultraviolet light;
- e) provide a visual indication of excessive wear, similar to the spun polyester/polypropylene construction described in 3.2.1.

3.3 Metallic materials

3.3.1 Each metal fastener shall be made of a material which is inherently corrosion-resistant, or treated to be corrosion-resistant.

3.3.2 Each ferrous metal part that is not of stainless steel, shall be coated in accordance with ISO 1461.

3.3.3 Each stainless steel part shall be of a marine grade alloy with a corrosion resistance at least equal to grade 316¹⁾.

3.3.4 Each aluminium part shall be 5254 or 5652 alloy, or other grade containing not more than 0,06 % copper, in accordance with ISO 209-1:1989.

3.3.5 Metals in contact with each other shall be galvanically compatible or insulated to prevent galvanic corrosion in a marine environment.

3.4 Mechanical fastening devices

Each mechanical fastening device securing a part of a ladder shall have a locking mechanism to prevent the device from loosening.

3.5 Plastic materials

Each plastic material shall be of a type that retains at least 30 % of its original tensile strength and at least 80 % of its original impact strength when subjected to the one year outdoor weathering test described in Method A of ISO 877:1994.

3.6 Quality of materials

Each part of a ladder shall be free of splinters, burrs, sharp edges, corners, projections or other defects that could injure a person using the ladder.

3.7 Rope seizing

Seizing, if used, shall consist of two- or three-ply marline of minimum breaking strength 800 N, or other suitable material of equivalent strength.

4 Construction

4.1 Each ladder shall have two side ropes on each side. Ladders may also be constructed as three-string ladders with a third set of ropes in the middle of the ladder as illustrated in Figure 1. In a three-string ladder, the third set of ropes shall meet the same requirements as the side ropes. Each step in the ladder shall be supported by each side rope.

1) See Iron & Steel Society (ISS) publication *Stainless Steels*, available from Iron & Steel Society, 186 Thorn Hill Road, Warrendale, PA 15090-7528, USA, or <http://www.iss.org>. The publication *Stainless Steels* is the trade name of a product supplied by the Iron & Steel Society. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

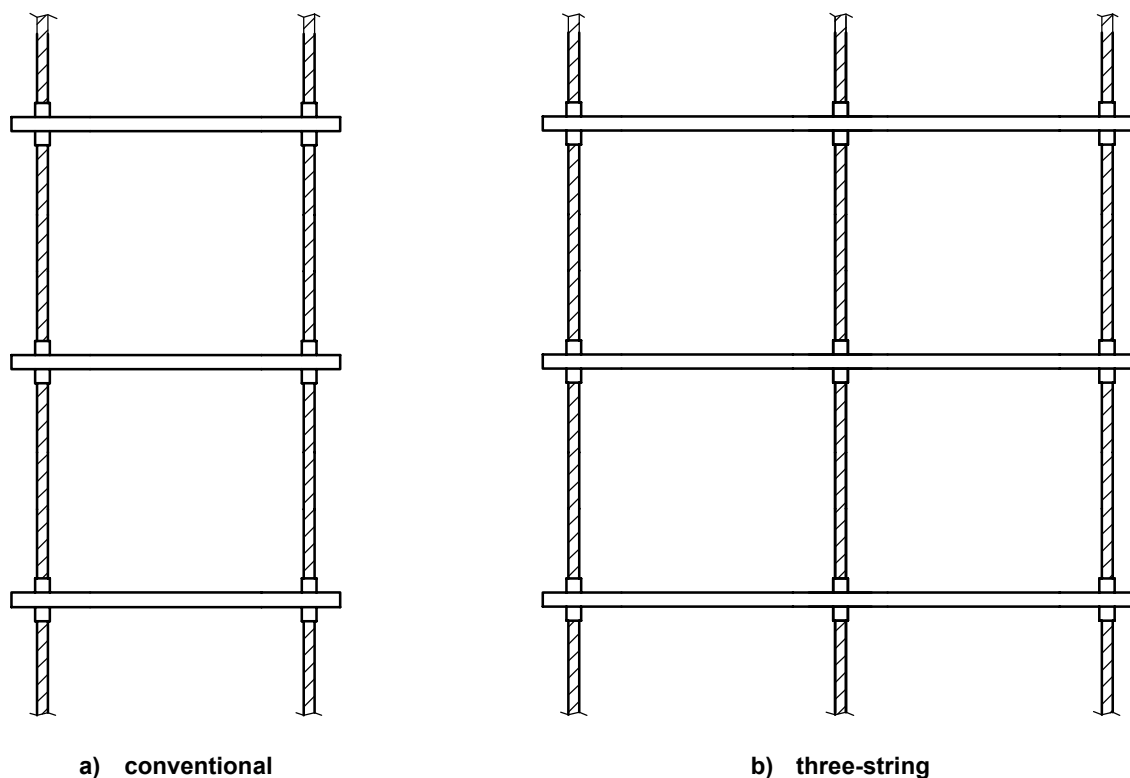


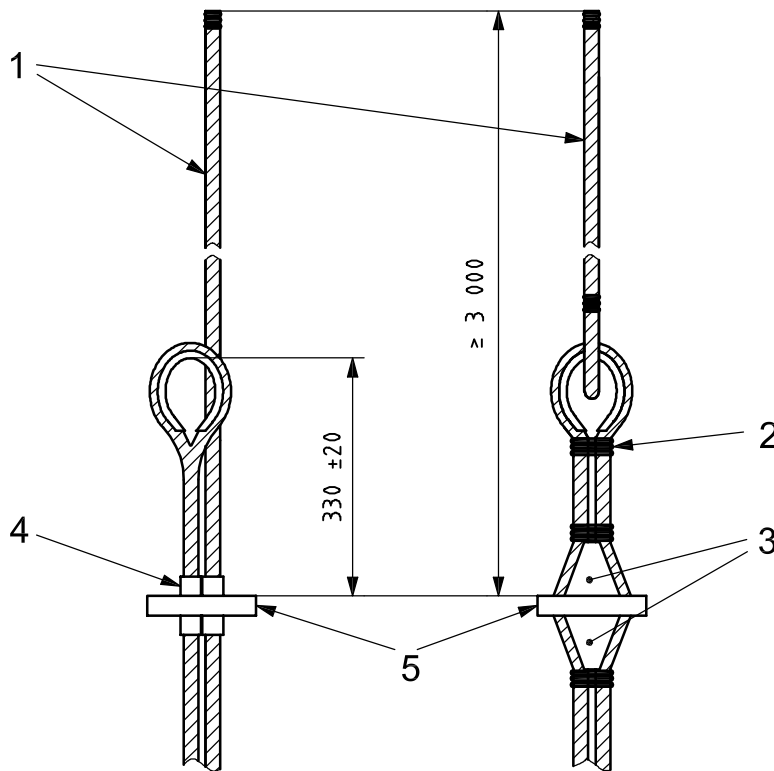
Figure 1 — Embarkation ladders

4.2 The side ropes shall

- a) be continuous from the top of the ladder to the bottom;
- b) not be painted or otherwise coated or covered.

4.3 Unless a special arrangement is needed for a custom installation, the ends of the side ropes shall be finished as follows.

- a) The top end of one or both of the side ropes on each side shall terminate just above the top step in a single eye splice or thimble large enough to accommodate at least two passes of side rope.
- b) The top end of one side rope on each side of the ladder shall extend at least 3 m beyond the top ladder step, or an extension service rope shall be fitted to each side rope eye splice or thimble by means of an eye splice or shackle, as shown in Figure 2. The diameter of an extension service rope shall be at least the diameter of the side ropes.
- c) The side ropes shall not have fittings or form loops at the bottom of the ladder that can be used to attach additional ladder sections or tripping lines.
- d) The ends of each side rope which do not terminate in a splice or fitting, shall be served or otherwise treated to prevent fraying.



Key

- 1 extension service rope
- 2 rope seizing (typical)
- 3 step fixture
- 4 mechanical clamping device
- 5 step

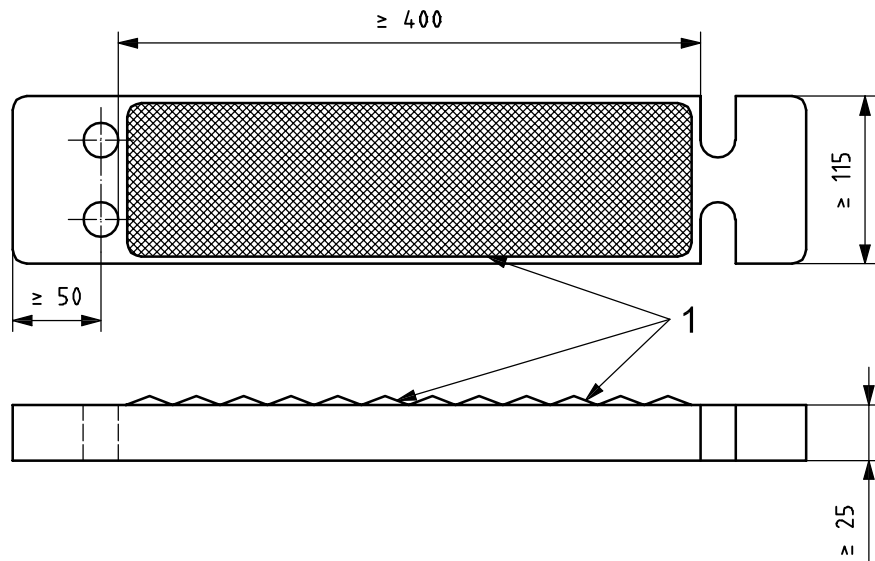
Figure 2 — Alternative extension service rope arrangements at top of ladder

4.4 Each side rope shall pass through a hole in each step. If the hole is in the form of a slot, the slot shall be in the longer edges of the steps. The centre of each hole shall be at least 50 mm from the end of the step. Alternative arrangements are shown in Figure 3.

4.5 Each pair of side ropes shall be secured together both above and below each step with a mechanical clamping device or seizing method which holds each step level when the ladder is hanging freely. Alternative arrangements are shown in Figure 4.

4.6 If a mechanical clamping device is used to secure the side ropes and hold the step in place, the device shall not extend above or below the step surfaces by more than a distance equal to $0,7 \times W$ (where W is the width of the step), so that the step is not prevented from rolling if caught between a boat and the hull of the ship. See Figure 4.

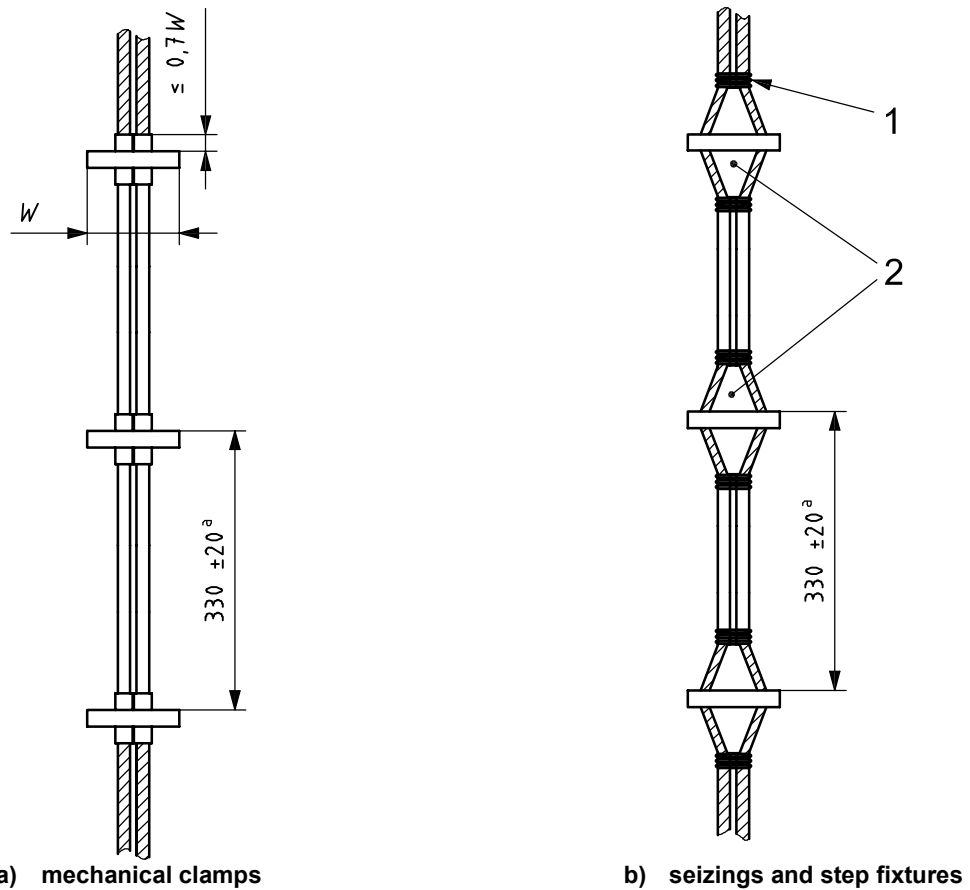
Dimensions in millimetres



Key

- 1 grooved, patterned or textured non-skid surface area

Figure 3 — Typical ladder step showing alternative hole and slot designs for side ropes



Key

- 1 rope seizing (typical)
- 2 step fixture
- ^a Typical value.

Figure 4 — Alternate ladder constructions using mechanical clamps and seizings and step fixtures

- 4.7** If a seizing method is used to secure steps and side ropes, a step fixture shall be used above and below the step. The step fixture shall be designed to lead and support the side ropes from the step to the point above or below the step where the side ropes are seized together. The step fixture shall be designed so that it stays in place when the ladder is rolled or the step is turned.
- 4.8** The clear space between the side ropes on one side of the ladder and those on the other side shall be at least 400 mm. This distance shall be uniform throughout the length of the ladder. See Figure 3.
- 4.9** Each side rope shall be arranged so that, when the ladder is in use along the vertical hull of a ship, the side rope cannot come into contact with the ship's side.
- 4.10** The spacing from the top of one step to the top of the next step shall be $330 \text{ mm} \pm 20 \text{ mm}$, and shall be uniform throughout the length of the ladder. See Figure 4.
- 4.11** Each step shall be of one-piece construction, of either wood or resilient plastic or rubber material complying with the applicable requirements of Clause 3.
- 4.12** The top face of each step shall have a rectangular surface that is at least 115 mm wide with a surface that is grooved, patterned or of a textured non-skid type. The step surface shall be designed so that it does not retain water. A textured non-skid surface shall be moulded into the step or adhered directly to it. Non-skid adhesive sheeting may not be used. See Figure 3.
- 4.13** Each step shall be at least 25 mm thick at its thinnest point. In determining this thickness, the depth of grooves in the top face of the step, the diameter of any hole extending from one side of the step to the other, and the thickness of any non-skid treatment shall not be included. See Figure 3.
- 4.14** Each step shall be arranged so that it can bear on the vertical hull of the ship when the ladder is in use.
- 4.15** The manufacturer shall offer replacement steps for the ladder, which can replace a removed step without the need for unstringing and restringing the ladder. Replacement steps shall meet all of the requirements in this International Standard for steps, and each step shall be supplied with all parts necessary to install the step in the ladder.
- 4.16** Each embarkation ladder shall be capable of being rolled up for storage. Each ladder shall be capable of unrolling freely and hanging vertically.

5 Testing for approval

Before approval of a ladder design by a maritime safety administration as complying with this International Standard, a prototype ladder and its components shall be subjected to the tests and meet the criteria specified in Table 1. Any step or other part of the ladder which is permanently deformed as a result of testing shall not be used in a ladder which is placed in service.

Table 1 — Prototype tests

Test	Item to be tested	Test procedure	Acceptance criteria
Visual examination	Fully assembled ladder.	Compare to construction requirements in Clause 4, and the manufacturer's drawings.	The ladder shall comply with the construction requirements in Clause 4, and be constructed in accordance with the manufacturer's drawings.
Step flexibility	Six steps, which shall include at least one of each different type, including replacement steps, if different from steps used in the ladder's original construction.	Place each step on a pair of supports located where the side ropes would normally pass through the step. Apply a static load uniformly for a period of at least 1 min over a 100 mm wide contact area at the centre of the step. The load shall be 3,0 kN.	Deflection at the centre of the step shall not exceed 25 mm under load. There shall be no residual deflection after the load is removed and the step is allowed to recover.
Step friction	<p>One step of each different material of construction and step surface design.</p> <p>One reference step constructed of clean oak, 115 mm wide and 480 mm long.</p> <p>The step surface shall have grooves 3 mm wide, 3 mm deep and 15 mm apart. The grooves shall run parallel to each other and parallel to the long edge of the step.</p> <p>One metal block of a mass between 1,5 kg and 3,0 kg.</p> <p>The metal block shall have a flat surface no more than 100 mm wide by 135 mm long. The flat surface shall have leather or composition shoe-sole material attached to it.</p>	<p>Set the reference step in a level position. Place the metal block at the centre of the stepping surface on the reference step, with the shoe sole material resting on the stepping surface of the reference step, and with the longer edge of the metal block running across the reference step over both edges. Slowly raise one edge of the step with the metal block on it. Measure the angle at which the block begins to slide.</p> <p>Repeat the procedure with the standard reference step and the block under water.</p> <p>Repeat the procedure in both dry and wet conditions using each different ladder step.</p>	The angles at which the block begins to slide on the dry and wet embarkation ladder step shall be greater than or equal to the corresponding angles measured for the standard reference step.
Step surface durability	<p>One step of each different material of construction and step surface design.</p> <p>A metal block of the type described under the step friction test, arranged to enable a vertical load of 380 N to be applied to it as it slides back and forth over the step under test.</p>	<p>Secure the step in a horizontal position, with the loaded block resting on it. Move the block back and forth from one end of the step surface to the other and back in the same line, for a total of 1 500 cycles.</p> <p>Repeat the step friction test on the worn step in both dry and wet conditions, making sure the sliding block is resting completely on the worn surface of the step.</p>	The angles at which the block begins to slide on the dry and wet embarkation ladder step shall be greater than or equal to the corresponding angles measured for the standard reference step.

Table 1 (continued)

Test	Item to be tested	Test procedure	Acceptance criteria
Ladder and step attachment strength	Fully assembled ladder of longest length to be approved.	Suspend the ladder vertically, hanging to its full length or extend the ladder to its full length on a horizontal surface, with the top end of the ladder secured using its own attachments. Apply a static load of 8,8 kN widely distributed over the bottom step for a period of at least 1 min, so that the load is applied evenly between the side ropes through the step attachment fittings. Repeat the procedure at five different steps, except that the ladder is not required to be hanging at full length and only the step under test, its side rope attachments and the side ropes immediately above the step attachment fittings are required to be subjected to the load.	Steps shall not break or crack. Attachments between any step and a side rope shall not loosen or break. Side ropes shall not sustain any observable damage, elongation, or deformation that remains after the test load is removed.
Unrolling	Fully assembled ladder of longest length to be approved.	Attach the rolled-up ladder to anchoring fixtures in a place away from any wall or structure that would prevent it from falling freely, and where it can hang vertically. Allow the ladder to unroll freely.	The steps and attachments shall not be cracked, broken, or loosened. The ladder shall not sustain damage that would make it unsafe to use.

6 Designation

6.1 Ladders conforming to this International Standard shall be designated by the following indications, in the order given:

- a) "Embarkation ladder ISO 5489";
- b) "S" followed by the number of steps;
- c) "L" followed by the length, in metres.

EXAMPLE A 5 m embarkation ladder consisting of 15 steps, conforming to this International Standard, is designated as follows:

Embarkation ladder ISO 5489-S15-L5

6.2 Spare or additional components for ladders conforming to this International Standard shall be designated by reference to this International Standard.

EXAMPLE A replacement step for a ladder conforming to this International Standard is designated as follows:

Step ISO 5489

7 Marking

7.1 The bottom of at least two steps of the ladder shall be marked with:

- a) the name and address of the manufacturer;
- b) the manufacturer's model designation;
- c) "ISO 5489" and "SOLAS";
- d) the year of assembly or reassembly of the ladder;
- e) identification of the approving maritime safety administration, along with any approval indications required by that administration;
- f) where used, identification of a recognized organization acting on behalf of the maritime safety administration.

7.2 The bottom of each replacement step shall be marked with:

- a) the name and address of the manufacturer;
- b) the manufacturer's model designation;
- c) the words "REPLACEMENT STEP ONLY";
- d) "ISO 5489" and "SOLAS";
- e) the year of production of the step;
- f) identification of the approving maritime safety administration, along with any approval indications required by that administration;
- g) where used, identification of a recognized organization acting on behalf of the maritime safety administration.

8 Production tests and inspections

Production tests and inspections of embarkation ladders approved as conforming to this International Standard should be carried out as described in informative Annex A.

9 Maintenance

9.1 Damaged steps shall be replaced with replacement steps meeting the requirements of 4.15 and of the type supplied or specified by the ladder manufacturer. A ladder shall not include more than two replacement steps.

9.2 If a ladder requires a third replacement step, it shall be rebuilt. A ladder constructed with spun polyester side ropes, with the inner core showing at any place throughout the length of the ladder is no longer serviceable. Such ladders shall be rebuilt to the original manufacturer's standard, using new side ropes, and using undamaged steps in place of all damaged steps and replacement steps.

9.3 Each ladder shall be subjected to the ladder and step attachment strength test listed in Table 1 at approximately 30-month intervals. Each ladder which fails the test shall be rebuilt according to 9.2, or scrapped. The ladder shall be stamped or tagged near the bottom of the ladder with the date of the test and the identification of the person or company performing the test. The person or company performing the test shall also provide a test certificate for the owner of the ladder, indicating the details of the test, including the date, and the identification of the person or company performing the test.

Annex A (informative)

Recommended production tests and inspections

A.1 General

The manufacturer should have a quality assurance system in place, which is acceptable to the approving maritime safety administration, to ensure that production ladders are produced to the same standard as the original prototype ladder tested for approval.

A.2 Sample selection and testing of steps

Steps should be separated into lots of 100 steps or less. Steps of different types should be in separate lots. One step selected at random from each lot should be subjected to the step strength test described in Table A.1. If the step fails the test, ten more steps should be selected at random from the lot and tested as described in Table A.1. If any of the ten steps fails the test, each step in the lot should be tested before it is used in a ladder.

Table A.1 — Production tests

Test	Item to be tested	Test procedure	Acceptance criteria
Step strength	Ladder step.	Place supports under each end of the step where the side ropes pass through the step. Apply a static load of 8,8 kN widely distributed over a 100 mm wide area at the centre of the step.	The step shall not break or crack. There shall be no residual deflection after the load is removed and the step is allowed to recover.
Ladder and step attachment strength	Fully assembled ladder at least 3 m long.	Suspend the ladder vertically, hanging to its full length or extend the ladder to its full length on a horizontal surface, with the top end of the ladder secured using its own attachments. Apply a static load of 8,8 kN widely distributed over the bottom step for a period of at least 1 min, so that the load is applied evenly between the side ropes through the step attachment fittings.	Steps shall not break or crack. Attachments between any step and a side rope shall not loosen or break. Side ropes shall not sustain any observable damage, elongation, or deformation that remains after the test load is removed.

A.3 Sample selection and testing of ladders

A visual examination as described in Table 1, and the tests in Table A.1, should be conducted by the maritime safety administration that approved the ladder, or a recognized organization acting on its behalf, at least annually on a ladder taken from the production line to ensure that it complies with the requirements of Clauses 4 and 5.

