

**U.S. Coast Guard Headquarters**  
**Lifesaving & Fire Safety Standards Division**  
**(CG-5214)**

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**Guidelines for Approval of  
“SOLAS” Embarkation Ladders (USCG approval series 160.117)  
August 1997**

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Coast Guard regulations for embarkation ladders on inspected vessels (46 CFR 199.110(f)) require the use of a “SOLAS” rope embarkation ladder:

- (1) Each embarkation ladder must be approved under approval series 160.117 or be a rope ladder approved under approval series 160.017.
- (2) Each embarkation ladder must extend in a single length from the deck to the waterline with the vessel in its lightest seagoing condition under unfavorable conditions of trim and with the vessel listed not less than 15 degrees either way.

These ladders were formally approved under a chain ladder approval series (160.017), but now are approved under the 160.117 approval designation covered by this guideline. This guideline consists of the approval regulations for rope pilot ladders (46 CFR 163.003), modified for use as an embarkation ladder.

## **1 Scope.**

- (a) This guideline contains standards and approval and production tests for an embarkation ladder used on a merchant vessel to embark survival craft.
- (b) The requirements in this guideline apply to an embarkation ladder designed for use along a vertical portion of a vessel’s hull.

## **3 ASTM standard.**

The following standard of the American Society of Testing and Materials is incorporated by reference into this guideline:

ASTM D 1435 entitled “Standard Recommended Practice for Outdoor Weathering of Plastics.”

## **7 Independent laboratory.**

The approval and production tests in this guideline must be conducted by or under the supervision of an independent laboratory accepted by the Coast Guard under 46 CFR 159.010.

## **9 Approval procedure.**

- (a) General. An embarkation ladder is approved by the Coast Guard under the procedures in 46 CFR 159.005.
- (b) Approval testing. Each approval test must be conducted in accordance with § 21.
- (c) Approval of alternatives. An embarkation ladder that does not meet the materials, construction, or performance requirements of this guideline may be approved if the application and any approval tests prescribed by the Commandant in place of or in addition to the approval tests required by this subpart, show that the alternative materials, construction, or performance is at least as effective as that specified by the requirements of this guideline. The Commandant may also prescribe different production tests if the tests required by this guideline are not appropriate for the alternative ladder configuration.
- ## 11 Materials.
- (a) Suspension members. Each suspension member must be mildew-resistant manila rope or a dacron polyester rope with a polypropylene core of a color that contrasts with the dacron. Each suspension member must have a breaking strength of not less than 24 kN (5,400 lb.) and a nominal circumference of not less than 60 mm (2 ¼ in.).
- (b) Wooden parts. Each wooden part of an embarkation ladder must be hardwood that is free from knots and any other defects affecting its strength or durability.
- (c) Wood preservative. After each wooden part is formed and finished, it must be treated with water-repellant wood preservative that is properly applied.
- (d) Molded steps. Each step made of molded construction must be rubber or resilient plastic.

(e) Metal parts. Each metal fastener must be made of a corrosion resistant metal. Each other metal part must be made of corrosion-resistant metal or of steel galvanized by the hot dip process after the part is formed.

(f) Plastics. Each plastic material must be of a type that retains at least 30 percent of its original tensile strength and at least 80 percent of its original impact strength when subjected to the one year outdoor weathering test described in ASTM D 1435.

## **13 Construction.**

(a) General. Each embarkation ladder must have two suspension members on each side. Each step in the ladder must be supported by each suspension member.

(b) Suspension member. The suspension members of an embarkation ladder must meet the following requirements:

(1) Each suspension member must be continuous from the top of the ladder to the bottom and must not be painted or otherwise coated or covered.

(2) The top and bottom ends of the suspension members on each side of the ladder must have an eye splice or thimble large enough to fit two passes of a suspension member.

(3) *(Reserved)*

(4) Each pair of suspension members must be clamped together both above and below each step. Marline seizing may not be used.

(5) The clear space between the suspension members on one side of a ladder and those on the other side must be at least 400 mm (16 in.), but not more than 480 mm (19 in.).

(c) Steps. Embarkation ladder steps must meet the following requirements:

(1) *(Reserved)*

(2) The top face of each step must have a rectangular surface that is at least 115 mm (4 ½ in.) wide with a non-skid surface that does not retain water. Adhesive non-skid sheets may not be used. (For example, a suitable surface for a step is one that has grooves at least 3 mm (1/8 in.) deep cut in a diamond pattern so that water runs off the edge of the step. Non-skid grit is applied directly to the step surface extending to almost the full width of the step.)

(3) Each step at its thinnest point must be at least 25 mm (1 in.) thick and in determining this thickness, the depth of the grooves in the non-skid surface and the diameter of any hole extending from one side of the step to the other must not be counted.

(4) Each step must be at least 480 mm (19 in.) long.

(5) Each step must be designed so that it can be removed and replaced without unstringing the ladder. If special replacement steps are made to meet this requirement, the replacement steps must meet the requirements of this section.

(6) If a step has grooves for its suspension members, the grooves must be in the sides of the steps.

(7) The spacing from the top of one step to the top of the next step must be uniform and this spacing must be between 300 mm (12 in.) and 350 mm (13 ¾ in.).

(8) *(Reserved)*

(9) The height of each device attached to the step for securing the suspension members must not be more than one-half the width of the step so that the step is not prevented from rolling if the ladder is caught between the hulls of two vessels.

(10) Each replacement step must be of a color different than the color of the original steps, and must have the special marking required in § 25 (b).

(d) *(Reserved)*

(e) Fasteners. Each fastening device securing a part of an embarkation ladder must have a means to prevent the device from loosening.

(f) Workmanship. An embarkation ladder must not have splinters, burrs, sharp edges, corners, projections, or other defects that could injure a person using the ladder.

## **15 Performance.**

(a) Each embarkation ladder must be capable of being rolled up for storage.

(b) Each ladder when rolled up must be able to unroll freely and hang vertically.

(c) Each suspension member must be arranged so that, when the ladder is in use on a vessel, the suspension member cannot come in contact with the vessel's side.

(d) Each step must be arranged so that it can bear on the side of the vessel when the ladder is in use.

## **17 Strength.**

(a) Each embarkation ladder must be designed to pass the approval tests in § 21.

## **21 Approval tests.**

(a) General. Each approval test must be conducted on a ladder of the longest length for which approval has been requested. If the ladder fails one of the tests, the cause of the failure must be identified and any needed design changes made. After a test failure and any design change, the failed test, and any other previously completed tests affected by the change, must be rerun. Any ladder step that has a residual deflection after

testing under this section may not be used thereafter in any ladder represented as Coast Guard approved.

(b) Visual examination. Before starting the approval tests, an assembled embarkation ladder is examined for evidence of noncompliance with the requirements in §§ 11, 13, and 15.

(c) The following approval tests must be conducted:

(1) Step flexibility test. This test is performed on six different steps, one of which must be a replacement step if special replacement steps are made by the manufacturer. Each step is placed on a pair of supports located at the points where the step would ordinarily be attached to the suspension members. A static load must be applied uniformly for a period of at least one minute over a contact surface that is at the center of the step and is approximately 100 mm (4 in.) wide. The load must be 3.14 kN (700 lb.) for each step. The deflection of the step is measured while the step is under load and after the load is removed. The step must not deflect more than 20 mm ( $\frac{3}{4}$  in.) under the load, and there must be no residual deflection after the load is removed.

(2) Strength test #1. An assembled ladder is supported so that a static load, if placed on any of its steps, would exert a force on both the step and each suspension member. A static load of 8.82 kN (2,000 lb.) is then placed on one step for at least one minute. The load must be uniformly distributed over a contact surface that is approximately 100 mm (4 in.) wide. The center of the contact surface must be at the center of the step. This test is performed on six different steps. None of the steps may break or crack. No attachment between any step and a suspension member may loosen or break during this test.

(3) Strength test #2. An assembled ladder is suspended vertically to its full length. A static load of 8.82 kN (2,000 lb.) is then applied to the bottom step of the ladder so that it is distributed equally between the suspension members. The suspension members, and inserts must not break, incur any elongation or deformation that remains after the test load is removed, or be damaged in any other way during this test.

(4) Strength test #3. A rolled up ladder is attached to anchoring fixtures in a location away from any wall or structure that would prevent it from falling freely, and where it can hang to its full length vertically. The ladder when dropped must unroll freely. When unrolling the ladder, its steps and attachments must not become cracked, broken, or loosened. Other similar damage making the ladder unsafe to use must likewise not occur.

(5) Step friction test. One step of each type used on an embarkation ladder must be subjected to this test. This test compares the dry and wet surface friction characteristics of ladder steps with those of a standard oak step.

(i) The standard step must have a surface of clean oak that meets § 11(b) and that is 115 mm (4 ½ in.) wide by 400 mm (16 in.) long. The stepping surface must have grooves that are 3 mm (1/8 in.) deep and 3 mm wide. The grooves must run in two different directions at right angles to each other, and at 45 degree angles with each edge of the stepping surface, so that the grooves form a diamond pattern covering the stepping surface. The centers of all parallel grooves must be 13 mm (½ in.) apart.

(ii) The standard step must be set in a level position. A metal block must be placed on one end of the step so that the block is in contact with the stepping surface. The metal block must have a mass between 1.5 kg (3.3 lb.) and 3.0 kg (6.6 lb.) and must not

be more than 100 mm (4 in.) wide by 135 mm (5 3/8 in.) long. The surface of the block in contact with the step must have leather or composition shoe sole material attached to it.

(iii) The end of the step that has the metal block on it must be slowly raised until the block starts to slide. The angle of the step in this position must be measured and recorded. The step and block must then be placed under water and the procedure repeated.

(iv) The procedure in paragraph (c)(6)(iii) of this section must be repeated using an embarkation ladder step in place of the standard step.

(v) The ladder step must then be secured in a horizontal position with a block resting on its stepping surface. The block must be of a size similar to the one used in the previous tests and have the same shoe sole surface used in the previous tests. The block must be arranged to apply a vertical load of 40 kg (88 lb.) to the step. The block must be then moved back and forth in the same line from one end of the stepping surface to the other. This must be done for a total of 1,500 cycles.

(vi) The step must again be tested as described in paragraph (c)(6)(iii) of this section, except that the initial position of the block must be on a part of the stepping surface that was subjected to the 1,500 cycles of rubbing.

(vii) The angles at which the block starts to slide on a wet and dry ladder step when tested under paragraphs (c)(6)(iv) and (c)(6)(vi) of this section must be equal to or greater than the corresponding angles measured for the standard step when tested under paragraph (c)(6)(iii) of this section.

## **25 Marking.**

- (a) Each embarkation ladder step manufactured under Coast Guard approval must be branded or otherwise permanently and legibly marked on the bottom with—
- (1) The name of the manufacturer;
  - (2) The manufacturer's brand or model designation;
  - (3) The lot number or date of manufacture; and
  - (4) The Coast Guard approval number.
- (b) In addition to the markings required under paragraph (a) of this section each step sold as a replacement step must be branded or otherwise permanently and legibly marked with the words “REPLACEMENT STEP ONLY.”

## **27 Production tests and examination.**

- (a) General. Each ladder produced under Coast Guard approval must be tested in accordance with this section and 46 CFR 159.007. Steps that fail testing may not be marked with the Coast Guard approval number and each assembled ladder that fails testing may not be sold as Coast Guard approved.
- (b) Test No. 1: Steps. Steps must be separated into lots of 100 steps or less. Steps of different types must be placed in separate lots. One step from each lot must be selected at random and tested as described in 21(c)(2) except that supports are placed under the step at the points where it would be attached to suspension members in an assembled ladder. If the step fails the test, ten more steps must be selected at random from the lot and tested. If one or more of the ten steps fails the test, each step in the lot must be tested. No step that has any residual deflection after the test may be used in a ladder represented by the manufacturer as Coast Guard approved.

(c) Test No. 2: Ladders. Assembled ladders must be separated into lots of 20 ladders or less. One ladder must be selected at random from the ladders in each lot. The ladder selected must be at least 3 m (10 ft.) long or, if each ladder in the lot is less than 3 m long, a ladder of the longest length in the lot must be selected. The ladder must be tested as prescribed in 21(c)(3) except that only a 3 m section of the ladder need be subjected to the static load. If the ladder fails the test, each other ladder in the lot must be tested.

(d) Independent laboratory. Each production test must be conducted or supervised by an independent laboratory. However, if a test is performed more than 4 different times per year, laboratory participation is required only 4 times per year. If the laboratory does not participate in all tests, the times of laboratory participation must be as selected by the laboratory. The times selected must provide for effective monitoring throughout the production schedule.

(e) Visual examination. The visual examination described in 21(b) must be conducted as a part of each production test.