
**Small craft — Deck safety harness and
safety line — Safety requirements and
test methods**

*Petits navires — Harnais de sécurité de pont et sauvegardes de
harnais — Exigences de sécurité et méthodes d'essai*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 12401 was prepared by Technical Committee ISO/TC 188, *Small craft*.

This second edition cancels and replaces the first edition (ISO 12401:2004), which has been technically revised.

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Introduction

This International Standard has been prepared to meet the needs of persons afloat on recreational craft. Deck safety harnesses and safety lines manufactured according to this International Standard will give reasonable assurance that the wearer will remain attached to the craft.

A deck safety harness and safety line does not provide protection against falls from a height. This International Standard does not cover the requirements of a dinghy "trapeze" harness, a windsurfing harness, or a seat harness for fast motor boats.

This International Standard is intended to serve as a guide to manufacturers, purchasers and users of such safety equipment by ensuring that the equipment provides an effective standard of performance in use.

Equally essential is the need for the designer to encourage the wearing of the equipment by making it comfortable and attractive for continuous wear while afloat, rather than for it to be stowed in a locker for emergency use. The principal reason for the existence of this International Standard is the recognition that comfort and mobility are important factors in determining whether deck safety harnesses are worn.

The primary aims in wearing a deck safety harness are:

- a) to prevent the wearer from falling into the water, and
- b) to assist in recovering the wearer onto the working deck.

Preventing the wearer from actually falling into the water is dependent on the location of the attachment to the craft and the length of the safety line. Because a correctly worn deck safety harness and safety line will, in normal circumstances, prevent the wearer from entering the water, no consideration is given to the towing position after a fall. The importance of ensuring a firm fit cannot be overstressed. Unless the harness is fitted with an automatic tensioner, it remains the responsibility of the wearer to correctly adjust the harness to achieve a firm fit.

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Small craft — Deck safety harness and safety line — Safety requirements and test methods

1 Scope

This International Standard specifies the requirements for performance, sizing, marking and test methods for deck safety harnesses and safety lines on recreational craft.

It is applicable to harnesses and lines in the following sizes of body mass:

- a) size 1: > 50 kg ¹⁾;
- b) size 2: > 20 kg ≤ 50 kg ¹⁾;
- c) size 3: ≤ 20 kg ¹⁾;

which are intended to be worn by all persons when in the exposed cockpit or on the working deck of a craft afloat.

It is not applicable to dinghy “trapeze” harnesses, windsurfing harnesses, seat harnesses for fast motor boats, and harnesses intended to protect against falls from a height.

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 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 12402-7, *Personal flotation devices — Part 7: Materials and components — Safety requirements and test methods*

ISO 12402-8, *Personal flotation devices — Part 8: Accessories — Safety requirements and test methods*

ISO 12402-9:2006, *Personal flotation devices — Part 9: Test methods*

ISO 15027-1, *Immersion suits — Part 1: Constant wear suits, requirements including safety*

ISO 15027-2, *Immersion suits — Part 2: Abandonment suits, requirements including safety*

EN 892:2004, *Mountaineering equipment — Dynamic mountaineering rope — Safety requirements and test methods*

1) Multisizing permitted.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

deck safety harness

device securely fitted to the user and which provides suitable strong point(s) of attachment for the safety line

3.2

safety line

link between the point of attachment on the deck safety harness and a strong point of attachment on the craft

3.3

hook

self-closing means of attachment between the safety line and the strong points on the deck safety harness and the craft on non-integrated safety lines, and between the safety line and the strong points on the deck of the craft on integrated safety lines

3.4

automatic tensioner

device which allows the harness to be worn looser than desirable for safe operation but which automatically tensions the harness to a safe firm fit when strain is placed on the safety line

NOTE The deliberate movement of such a device when tensioning the harness is not considered to be slippage of an adjustment device.

3.5

reference deck safety harness

device used to test a separate safety line

NOTE This is represented in tests by the attachment link between the test mass and the safety line under test.

3.6

reference safety line

device used to test a separate deck safety harness

3.7

integrated deck safety harness and safety line

combination of deck safety harness and safety line that cannot be separated without destruction

3.8

assessment panel

panel consisting of experienced users, responsible for assessing the results of the test

3.9

holding-down device

crotch and thigh straps, integrated or attached to clothing worn between the legs

3.10

integrated combination of deck safety harness and clothing

combination of deck safety harness and clothing that cannot be separated without destruction nor worn without the holding-down device in its intended position

4 Requirements for safety

4.1 General

The original effective maximum length of a safety line, measured with a measuring tape between the attachment points, under a load of 10 kg, shall not exceed 2 m including the length of the hooks.

Design of the safety line and its attachments to the wearer shall preclude accidental incorrect attachment resulting in more than 2 m between the strong point on the craft and the strong point on the deck safety harness.

4.2 Materials and construction

4.2.1 Materials and components shall comply with the relevant requirements in ISO 12402-7. Sewing threads shall be of a contrasting shade or colour in order to facilitate visual inspection.

4.2.2 All machining shall have been carried out on a lockstitching machine and securely finished off by back-sewing for at least 13 mm, except where sewn by an automatic lockstitching machine when the first and last stitches shall have been sewn in such a way as not to provide a natural starting point for a break in the stitching. Sewing shall not have been carried out within 2 mm of any edge of the material. However, ends may be oversewn if not heat-sealed. Sacrificial elements are not required to comply with this method of stitching.

4.2.3 The system of deck safety harness and/or safety line, including all metal components attached at the intended attachment points, shall not deflect a magnetic compass by more than 1°. Testing shall be carried out in accordance with ISO 12402-9:2006, 5.4.

4.2.4 The webbing or equivalent primary elements designed to transfer the shock load to the wearer's body shall have a minimum width of

- a) 45 mm for size 1,
- b) 35 mm for size 2 and
- c) 25 mm for size 3.

NOTE For a definition of sizes, see Clause 1.

4.3 General performance

4.3.1 Donning

Donning of a deck safety harness shall be obvious and simple on the briefest of instructions. This shall be tested in accordance with 5.5.

4.3.2 Attachment point

The point of attachment of a safety line to a deck safety harness shall be positioned within 50 mm of the central axis of the body, front or back, above the lowest point of the ribcage.

If a deck safety harness incorporates more than one point to which the safety line can be attached, it shall either be demonstrated, using the test in 5.2, that attachment to each single point of attachment in turn meets the requirements of this International Standard, or the harness shall be marked as specified in 6 f).

4.3.3 Comfortable wear

A deck safety harness shall

- a) be comfortable to wear for men, women and children as appropriate for the sexes and sizes for which it is intended and when correctly adjusted,
- b) be adjustable to fit the body firmly unless fitted with an automatic tensioner,
- c) not be unduly bulky or heavy,
- d) not restrict the vision, hearing, breathing or movement of the wearer, and
- e) not contain any component nor use any method of component attachment which, in normal use, is likely to cause injury to the user.

Testing shall be carried out in accordance with 5.5.4.2.

4.3.4 Detachability of safety lines

A safety line shall be detachable by the wearer both from the deck safety harness and from the craft when tested in accordance with 5.5.4, except in the case of a deck safety harness intended for size 2 and size 3. In the latter case, the safety line shall be attached in such a way, or the attachment shall be so positioned, that the wearer cannot detach the line from the harness. When tested in accordance with 5.5, the safety line shall be detachable from a size 2 and size 3 deck safety harness or from the craft, or from both, by an adult. Accidental release of a safety line shall not occur when tested in accordance with 5.4.

4.3.5 Hooks

All hooks provided shall be of a self-closing type, with an opening large enough to accept, and fully close on, a cylinder of diameter $(12,5^{+0,1}_0)$ mm. There shall be no tendency for the hooks to open by any action, as tested in 5.4, other than deliberate release, except when a clear and permanent warning label as specified in 5.4 and 6 g) indicates that an attachment bracket is fitted to the craft.

If intermediate hooks are fitted in a safety line, the test specified in 5.4 shall be repeated using each possible combination of points of attachment. Each repetition shall meet the requirements of this International Standard.

The hooks shall be tested in accordance with ISO 9227. When tested for a period of 160 h, the hooks shall not be significantly affected by corrosion.

4.3.6 Holding down device

All safety harnesses shall allow the fitting of a holding-down device, which shall be at least half the width of the flexible elements listed in 4.2.4.

4.3.7 Integrated combinations

Any integrated combination of safety harness and additional items such as lifejackets and immersion suits shall comply with ISO 12402-8, ISO 15027-1 or ISO 15027-2, as applicable, and shall not be rendered inoperative by the dynamic test of the safety harness in accordance with 5.2.

4.4 Inspection requirements for deck safety harness sizes 1 and 2 and safety line

When tested as specified in 5.2, the deck safety harness and safety line shall comply with the following.

- a) Throughout the test, the torso dummy shall be restrained securely in the harness, clear of the ground.
- b) Throughout the test, all components of the deck safety harness and safety line shall remain functional and operate as designed. Sacrificial shock absorbers may rupture, e.g. if stitching breaks. If this occurs, it shall not affect the security of the torso dummy in the deck safety harness.
- c) After the first drop test only, the slipping of any adjustment device shall not exceed 25 mm.
- d) After the first drop test only, and with the load of the torso dummy or test mass relieved from the safety line, the detachability of the safety line shall be checked in accordance with 5.5.4.

4.5 Static loading of deck safety harness size 3

When tested in accordance with 5.3, the total slippage in the safety harness adjustment devices shall not exceed 25 mm.

5 Test methods

5.1 Magnetic properties testing

Place a direct reading magnetic compass in an undisturbed magnetic area (i.e. an area in which magnetic items and d.c. electrical cables are not continually moved or switched). Check the compass to ensure that it has negligible pivot friction. This can be done by deflecting the compass card 10° by means of a magnet and then removing the deflecting force when the card should return to within $0,5^\circ$ of its original position.

Present the metal components (with any hooks closed) individually to the compass on an approximately East-to-West line, to a position where the nearest point of the component is (300 ± 10) mm horizontally from the centre of the compass. Lightly tap the compass to eliminate the effect of friction. Record the angle in degrees of any deflection of the compass from its position before the metal components were brought near the compass.

5.2 Dynamic testing

5.2.1 Principle

Dynamic testing includes two tests. One for testing the strength of the complete harness and one for testing the safety lines. For a deck safety harness and safety line that can be separated, each item is tested separately against a reference counterpart, i.e. reference line and torso dummy for the harness and reference harness and test mass for the safety line.

For an integrated deck safety harness and safety line, the two tests are combined. Unless the harness is part of an integrated combination of deck safety harness and clothing, the holding-down device shall not be fitted during the dynamic test.

NOTE These dynamic tests do not simulate reality on board a craft, but represent a strength test under overload conditions in order to ensure sufficient durability of the components tested.

5.2.2 Apparatus

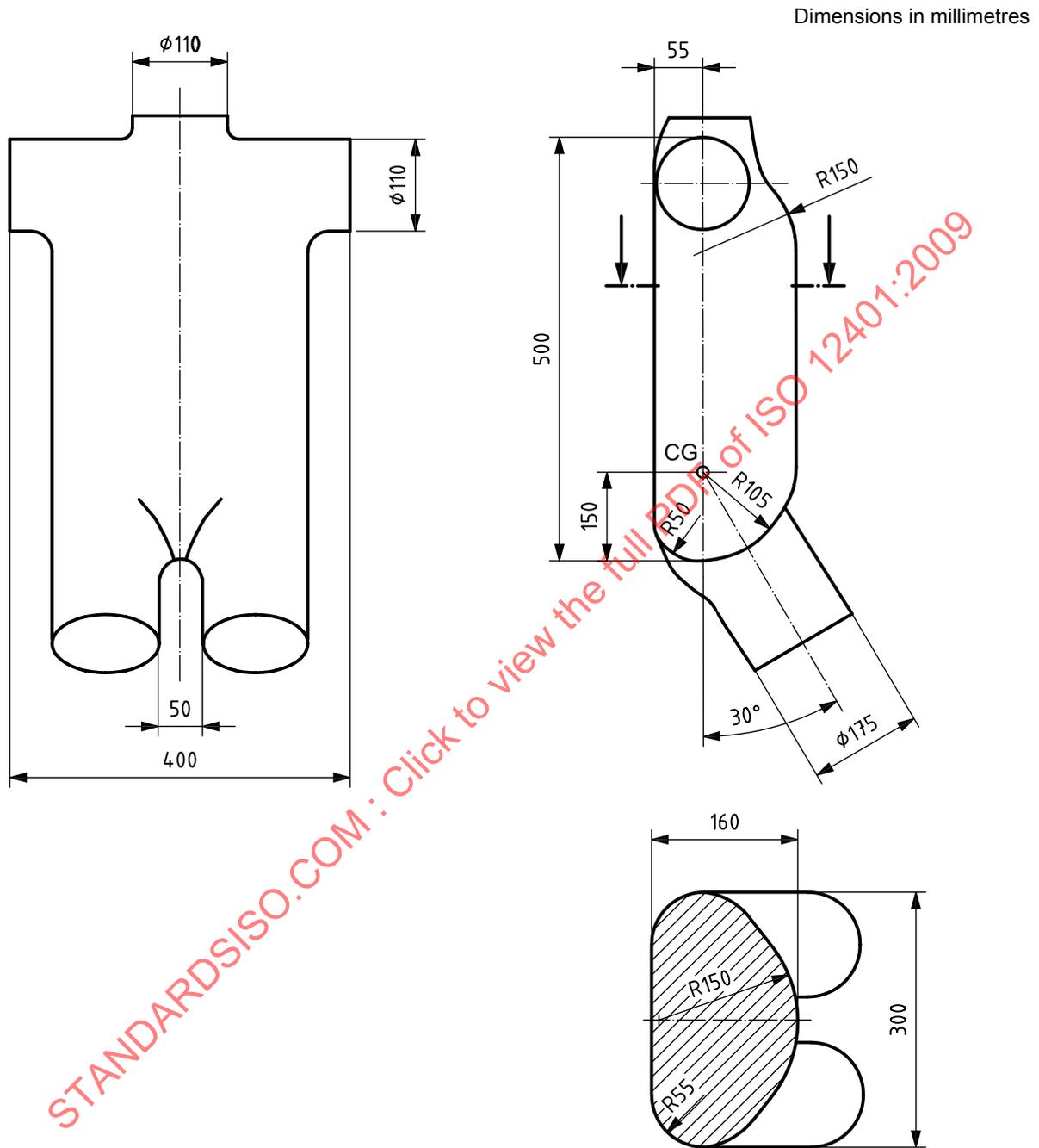
5.2.2.1 Equipment for dynamic testing of deck safety harnesses and safety lines

See Table 1.

Table 1 — Equipment for dynamic testing

Product	Equipment
Deck safety harness size 1	a) Torso dummy with a mass of (100 ± 1) kg in accordance with Figure 1. The centre of gravity shall be (200 ± 25) mm above the perineum. The suspension eyes shall have an inside diameter of 40 mm and maximum cross-section of 15 mm. The surface of the torso dummy should be smooth and, if made of wood, should be shellacked or varnished. b) Single mountaineering rope in accordance with EN 892:2004, 3.2 (see also 5.2.2.3). The mountaineering rope acts as reference line and shall be replaced after each drop (cushioning effect).
Deck safety harness size 2	a) Torso dummy with a mass of (50 ± 1) kg in accordance with Figure 2. This torso dummy shall be made from hard wood or plastics. The centre of gravity shall be in accordance with anthropometrical data. NOTE This torso dummy represents the 99 percentile of a male person with a body height of 155 cm and 10 years of age. The suspension devices shall be equivalent to those used for testing size 1. b) Single mountaineering rope in accordance with EN 892:2004, 3.2 (see also 5.2.2.3).
Safety lines	a) Rigid test mass of (100 ± 1) kg. b) Single mountaineering rope in accordance with EN 892:2004, 3.2 (see also 5.2.2.3). The mountaineering rope acts as reference deck safety harness and shall be replaced after each drop (cushioning effect).
Integrated deck safety harness and safety lines size 1	Torso dummy as used for testing size 1.
Integrated deck safety harness and safety lines size 2	Torso dummy as used for testing size 2.

The dimensions of the torso dummy to be used for testing size 2 are given in Figure 2.



Key

All unspecified radii are 30 mm

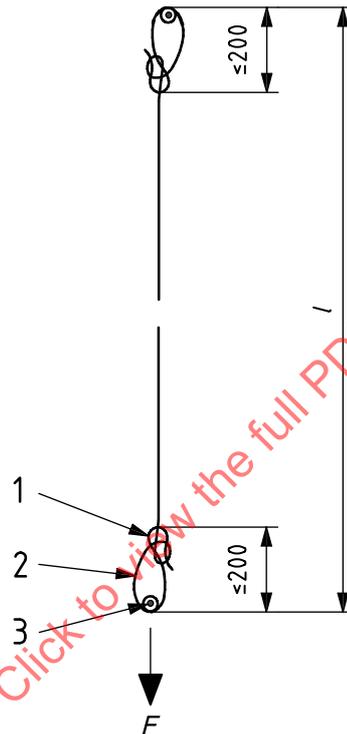
Figure 2 — Dimensions of the torso dummy for testing size 2

5.2.2.3 Reference safety line for dynamic testing

Use a dynamic mountaineering rope in accordance with EN 892:2004, 3.2, with a minimum elasticity of 8 % and an original length of about 4 000 mm, as reference safety line. It shall be used only once per drop test.

Prepare the rope so that, under the load of the torso dummy or a test mass of 100 kg, the test length, l , of the rope, including the eyes to be formed at the two ends, is $(2\ 000 \text{ } ^{+100}_0)$ mm; see Figure 3.

Dimensions in millimetres



Key

- 1 bowline knot
- 2 termination loop
- 3 attachment point

$l = (2\ 000 \text{ } ^{+100}_0)$ mm for reference safety line

$l = (1\ 000 \text{ } ^{+100}_0)$ mm for reference deck safety harness

$F = 1\ \text{kN} \pm 10\ \text{N}$

Figure 3 — Rope for the dynamic test

Terminate the rope in eyes produced by tying bowline knots (see Figure 4), and ensure the length of the termination eyes is a maximum of 200 mm.

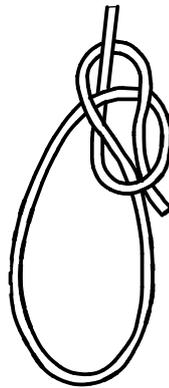


Figure 4 — Bowline knot

5.2.3 Reference deck safety harness

5.2.3.1 General

Use a single mountaineering rope as defined in EN 892:2004, 3.2, with a minimum elasticity of 8 % and an original length of about 3 000 mm, as reference deck safety harness.

Prepare the rope so that, under the load of the test mass of 100 kg, the test length, l , of the rope, including the eyes to be formed at the two ends, is $(1\,000 \begin{smallmatrix} +100 \\ 0 \end{smallmatrix})$ mm; see Figure 3.

5.2.3.2 Anchorage

The anchorage shall be rigid and robust and high enough above the ground so that at no time during the test will the torso dummy or test mass touch the ground.

5.2.4 Conditioning

The conditioning shall be carried out as follows.

- For non-textile products, the samples shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for not less than 24 h prior to the tests.
- For textile products, the samples shall be conditioned in accordance with ISO 139 for not less than 24 h prior to the test.
- If testing under “wet conditions” is specified, the sample shall be soaked for $(6 \begin{smallmatrix} +0,2 \\ -0 \end{smallmatrix})$ h in fresh water, or as specified by the test procedure itself.

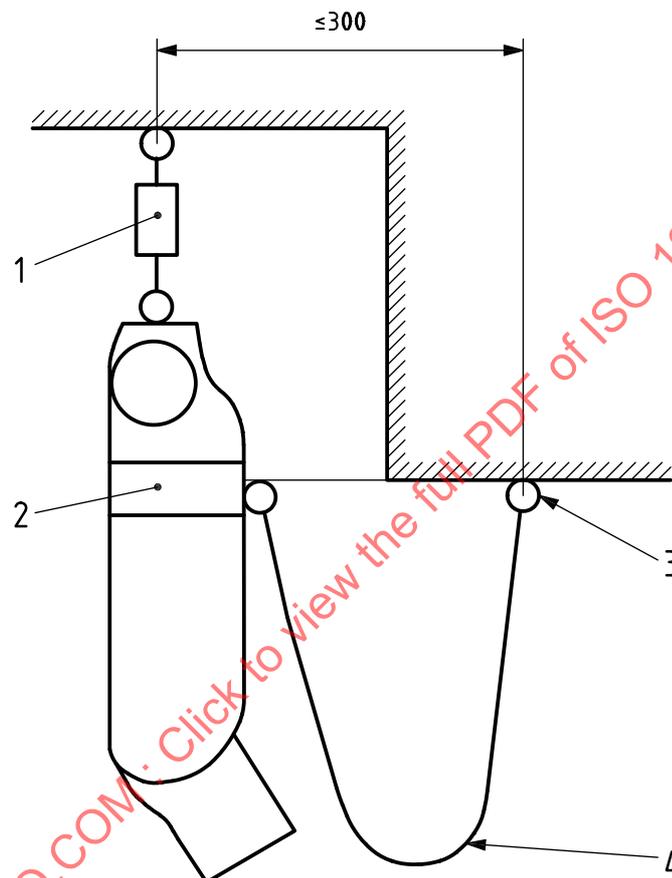
5.2.5 Harness testing

5.2.5.1 Preparation

After conditioning, fit the harness to the torso dummy of the appropriate size in accordance with manufacturer’s instructions. Connect the torso dummy via harness and reference line to the anchorage in accordance with Figure 5. Both ends of the reference safety line shall be on the same horizontal level before releasing and the horizontal distance between the quick-release device and the anchorage shall not exceed 300 mm.

For those deck safety harnesses fitted with an automatic tensioner, before the drop tests are undertaken, the assessment panel shall examine the operation of the device in controlled slow motion to ensure that, in operation, it achieves a firm fit in the intended position on the body. During this investigation, the torso dummy may be lowered in any position. The drop test shall only proceed when the assessment panel is satisfied that the automatic tensioning system achieves the required fit. The tensioner shall be tested in accordance with the manufacturer's instructions.

Dimensions in millimetres



Key

- 1 quick-release device
- 2 deck safety harness to be tested
- 3 anchorage
- 4 reference line

Figure 5 — Test configuration for harnesses

5.2.5.2 First drop, feet first

For the first drop test, raise the torso dummy in an upright posture and hold in a feet-first attitude with a quick-release device in such a way that the anchorage of the reference safety line and the quick-release point are as near as possible in the same vertical plane but separated by a maximum horizontal distance of 300 mm.

Operate the quick-release device and allow the torso dummy to fall freely through a distance of 2 m.

Examine the deck safety harness with regard to 4.4 and note all slippage, breakage or deformation after the drop.

5.2.5.3 Second drop, head first

Take the same harness, readjust it to the same torso dummy. Apply a second drop of 2 m but starting the drop from a head-first position of the torso dummy.

The reference safety line shall be renewed for each test.

Examine the deck safety harness as specified for the first drop.

5.2.6 Safety line testing

Fit the safety line, after conditioning, to the reference deck safety harness as specified in Table 1. Drop test the safety line twice in each configuration of hook attachment with the drop height corresponding to the length of the line currently under test; see Figure 6. Both ends of the safety line shall be on the same level before releasing and no more than 300 mm apart. The reference deck safety harness shall be changed after each drop. The safety line under test shall be changed between each new configuration.

After each drop examine the safety line with regard to 4.4, and note any failure or deformation.

5.2.7 Integrated deck safety harness and safety line testing

For a safety line which cannot be detached from the safety harness without destruction, the integrated deck safety harness and safety line shall be tested in accordance with 5.2.5.2 and 5.2.5.3, with the integrated safety line acting as the reference safety line. The drop height shall equal the length of the integrated safety line, in accordance with 5.2.5. All configurations shall be tested twice and no components may be changed during the test. The assessment panel shall examine the integrated deck safety harness and safety line with regard to 4.4, and record all slippage, breakage and deformation after each drop.

5.3 Static testing of deck safety harnesses of size 3 only

The deck safety harness and safety line are assembled.

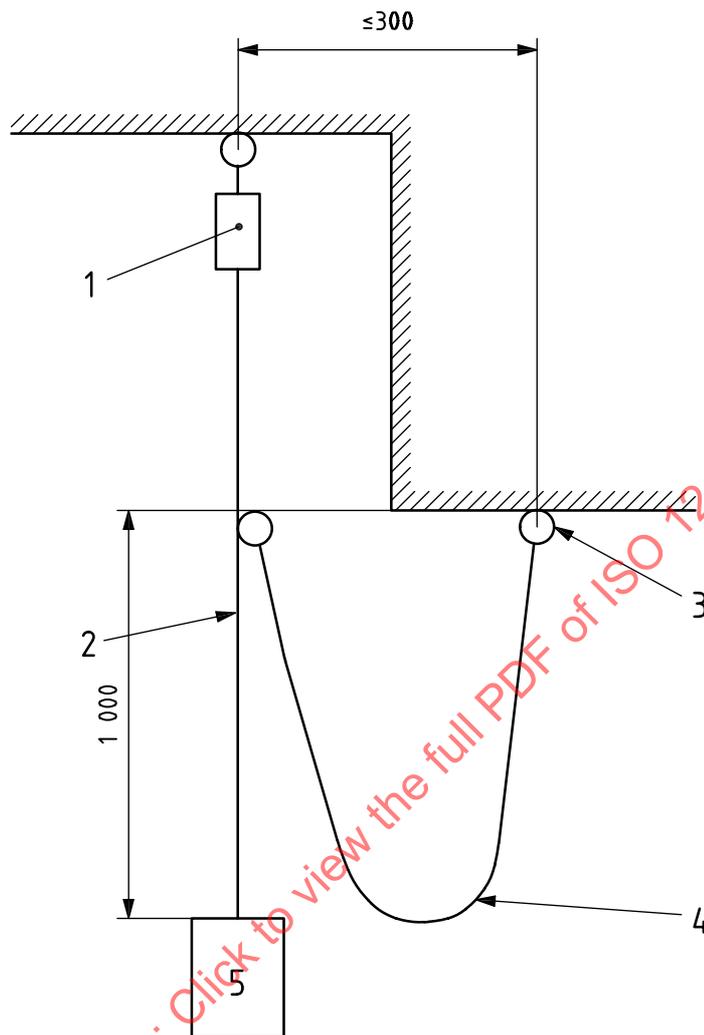
Put the webbing or equivalent primary belt around a test cylinder of (200 ± 10) mm in diameter in accordance with the manufacturer's instructions.

Apply a test load of 1 500 N to the craft hook of the safety line at a rate not exceeding 250 mm/min, with the other end of the safety line fixed to the attachment point at an angle of 90° to the cylinder axis.

Maintain the load for 5 min $\left(5 \text{ min} \begin{smallmatrix} +30 \\ 0 \end{smallmatrix}\right)$ s.

Repeat the test for each configuration of safety line hooks.

Note whether the total slippage of the safety harness adjustment devices exceeds 25 mm.

**Key**

- 1 quick-release device
- 2 reference deck safety harness
- 3 anchorage
- 4 safety line to be tested
- 5 100 kg test mass

Figure 6 — Test configuration for safety lines

5.4 Accidental hook opening testing

5.4.1 The tendency of the hook to accidentally become detached from its attachment point shall be tested using the following three styles of attachment point, made from 8 mm diameter rod:

- a) a straight rod;
- b) an eye bolt of internal radius 10 mm;
- c) U-bolts of internal radius 15 mm and 20 mm.