BRITISH STANDARD

BS EN 364:1993

Personal protective equipment against falls from a height — Test methods

The European Standard EN 364:1992 has the status of a British Standard

UDC 614.895.1:62-783.4:620.17:614.8

Cooperating organizations

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This British Standard, having been prepared under the direction of the Personal Safety Equipment Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 February 1993

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Contents

National foreword

This British Standard has been prepared under the direction of the Personal Safety Equipment Standards Policy Committee and is the English language version of EN 364 *Personal protective equipment against falls from a height — Test methods* published by the European Committee for Standardization (CEN). It partially supersedes BS 1397:1979 and BS 5062-1:1985 which are withdrawn.

EN 364 was produced as a result of international discussions in which the United Kingdom took an active part.

BS 1397:1979, BS 5062-1:1985 and BS 5062-2:1985 are superseded by the following BS EN standards.

BS 1397:1979 is superseded by

BS EN 354
BS EN 355
BS EN 358
BS EN 359
BS EN 361
BS EN 362
BS EN 363
BS EN 364
BS EN 365

BS 5062-1:1985 is superseded by

BS EN 353-1
BS EN 353-2
BS EN 355
BS EN 360
BS EN 362
BS EN 363
BS EN 364
BS EN 365

BS 5062-2:1985 is superseded by BS EN 365.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 364

December 1992

UDC 614.895.1:62-783.4:620.17:614.8

Descriptors: Personal protective equipment, accident prevention, protection against fall, tests, inspection

English version

Personal protective equipment against falls from a height — Test methods

Equipement de protection individuelle contre les chutes de hauteur — Méthodes d'essai

Persönliche Schutzausrüstung gegen Absturz — Prüfverfahren

This European Standard was approved by CEN on 1992-11-30. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 364:1992 E

Foreword

This European Standard was prepared by the Technical Committee CEN/TC 160 “Protection against falls from a height including working belts” of which the secretariat is held by DIN.

This European Standard has been prepared under a mandate given to CEN by the Commission of the European Communities and the European Free Trade Association, and supports essential requirements of the EC Directive(s).

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 1993, and conflicting national standards shall be withdrawn at the latest by June 1993

The standard was approved and in accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This standard specifies test methods for materials, components and systems associated with equipment for protection against falls, as follows:

a) static testing apparatus and static test methods;

b) dynamic testing apparatus, including a torso dummy;

c) test methods for dynamic performance and dynamic strength testing of components and systems;

d) corrosion testing of metal components;

e) test apparatus and test methods for conditioning tests and endurance tests.

The standard also makes recommendations for the scheduling of tests.

2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 354, *Personal protective equipment against falls from a height — Lanyards.*

EN 361, *Personal protective equipment against falls from a height — Full body harnesses.*

prEN 892-1, *Mountaineering equipment — Ropes — Safety requirements, testing, marking.*

EN 10002-1, *Metallic materials — Tensile test — Method of test (at ambient temperature).*

EN 10002-2, *Verification of the force measuring system of tensile testing machines.*

EN 45001, *General criteria for the operation of testing laboratories.*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests.*

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1
force measuring apparatus

apparatus for measuring force including force transducer and analogue or digital display, or chart recorder

3.2
specified static test force

that stated in the requirements of the specification for the particular component or system submitted for test

4 Requirements for test apparatus

4.1 Static testing machines

4.1.1 *Force measurement requirements*

Force measuring apparatus for static testing of components and systems shall conform to EN 10002-2.

The calibration of measuring apparatus should be traceable to an approved physical properties laboratory or approved calibration service in accordance with the accuracy required for the test (consult EN 45001).

4.1.2 *Requirements for rate of stressing*

4.1.2.1 *Metallic materials*

The rate of stressing shall conform to EN 10002-1.

4.1.2.2 *Textile materials*

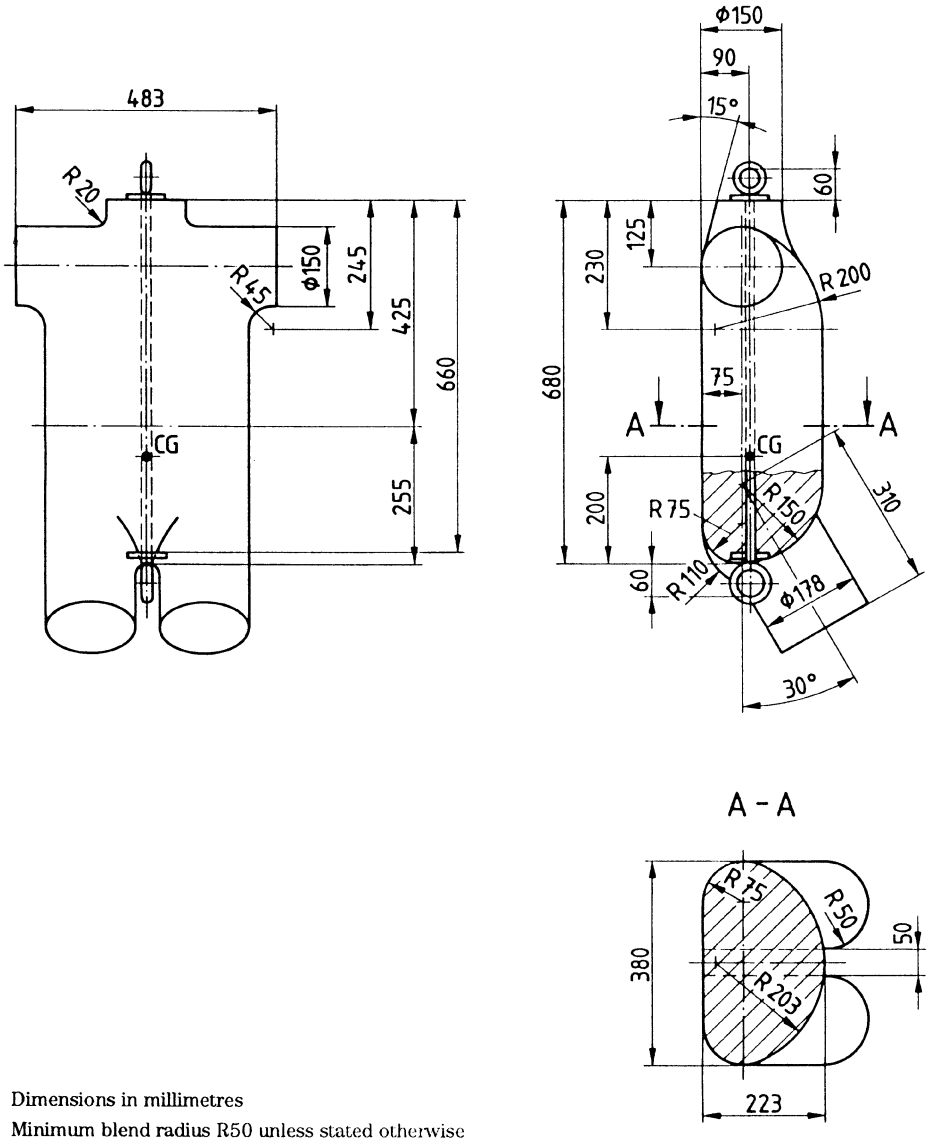
The crosshead velocity for components in the length range 1,0 m to 2,0 m shall be within the range of 50 mm to 150 mm per minute.

Components shorter than 1,0 m shall be tested with a proportionately lower crosshead velocity.

Components longer than 2,0 m may be tested with a proportionately higher crosshead velocity.

4.2 Torso dummy

The torso dummy for static and dynamic testing of relevant components and systems shall conform to the dimensions and requirements described at Figure 1. The mass of 100 kg should have a tolerance of ± 1 kg. The centre of gravity should be (200 ± 25) mm above the perineum. The suspension eyes should have an inside diameter of 40 mm and maximum cross-section diameter of 16 mm. The surface of the dummy should be smooth and, if of timber construction, should be shellacked or varnished.



Dimensions in millimetres
Minimum blend radius R50 unless stated otherwise
Mass 100 kg
Hardwood or plastics
(Minimum shore hardness 90)

Figure 1 — Torso dummy

4.3 Test cylinder

The test cylinder required for static testing of work positioning belts and work positioning restraint belts shall have a diameter of 350 mm with tolerance of ± 10 mm. It should be a rigid structure having a hard and smooth surface.

4.4 Dynamic testing apparatus

4.4.1 *Structure*

The rigid anchorage structure shall be so constructed that its natural frequency (of vibration) in the vertical axis at the anchorage point is not less than 100 Hz and so that the application of a force of 20 kN on the anchorage point does not cause a deflection greater than 1,0 mm.

The rigid anchorage point shall be a ring of (20 ± 1) mm bore and (15 ± 1) mm diameter cross section, or a rod of same diameter cross section.

The height of the rigid anchorage point shall be such as to ensure that no part of the component or system under test, or of the torso dummy or rigid steel mass, shall strike the floor during the test.

4.4.2 *Force measurement apparatus*

The force measuring apparatus shall be capable of measuring forces from 1,2 kN to 20 kN with an accuracy of ± 2 %, a frequency bandwidth of 1 000 Hz, and include a low pass filter which has a passband ripple not greater than $^{+0,5\,dB}_{-1,0\,dB}$ and a – 3 dB frequency bandwidth of 60 Hz. Roll off should be not less than – 12 dB per octave.

If an intermediate amplifier is used, it shall be linear and calibrated to within ± 0,1 % over the operating range.

Where the recorder is of the peak hold type it shall track and hold to an accuracy of ± 1 % over the operating range. Where the recorder is of the force/time history type it should be dynamically or electronically calibrated to within ± 2 % over the operating range.

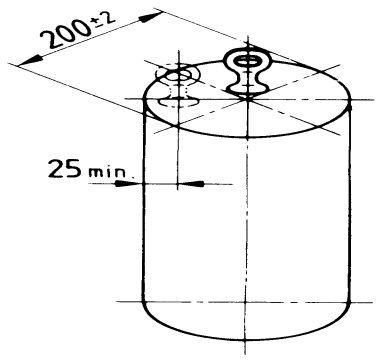
The apparatus shall have a common mode rejection ratio of not less than 60 dB at power frequencies.

For the purposes of this specification, where the force measurement apparatus, amplifier and recorder are in series, an overall error band of ± 2,5 % is accepted.

4.5 Rigid steel masses

The rigid steel mass, either (100 ± 1) kg or (150 ± 1) kg, as appropriate, shall be rigidly connected to an eyebolt which provides secure connection.

The 100 kg mass shall have a nominal diameter of 200 mm. The eyebolt shall be central at one end, but an offset additional eyebolt position is also permissible (see Figure 2) to accomodate horizontal dimensional constraints of relevant testing procedures and equipment.



Dimensions in millimetres

Figure 2 — Rigid steel mass

The 150 kg mass shall have a nominal diameter of 200 mm. The eyebolt shall be central at one end, but an offset additional eyebolt position is also permissible.

4.6 Quick release device

The quick release device shall be compatible with the eyebolts of the **4.2** torso dummy and **4.5** rigid steel masses. It shall ensure release of torso dummy or rigid steel mass with no initial velocity.

4.7 Corrosion test apparatus

The apparatus for testing the corrosion resistance of metals shall be capable of the NSS (neutral salt spray) test procedure described in ISO 9227:1990.

4.8 Apparatus for conditioning tests

4.8.1 *Heat*

The chamber shall be capable of control at (50 ± 2) °C at a relative humidity of (85 ± 5) %.

4.8.2 *Cold*

The refrigerated chamber shall be capable of control at (– 30 ± 2) °C.

4.8.3 *Wet*

The water spray apparatus shall be capable of delivering at the rate of approximately 70 l/h. The water temperature should be in the range 10 °C to 30 °C.

4.8.4 ***Dust***

The chamber should be a box of 1 m cube internally, see Figure 3, with provision for agitating dust with blasts of air from a 6 bar supply. The box shall be provided with a vent and air filter. The chamber shall have provision for a cord to be passed vertically through the top of the box for operation of the mechanism under test.

4.9 Endurance test apparatus

The apparatus shall be capable, under gravitational acceleration of an appropriate mass, of repeated operation of sliding type and retractable type fall arresters.

5 Test methods

Recomendations for the scheduling of tests are described at Annex A.

5.1 Full body harnesses

5.1.1 ***Dynamic performance test apparatus***

The apparatus shall comply with **4.2** and **4.4**.

5.1.2 ***Dynamic performance test procedure***

5.1.2.1 Fit the torso dummy with the harness equipped with a lanyard made from prEN 892-1 approved single mountaineering rope of 11 mm diameter and without an energy absorber, so that the overall length of the lanyard from the harness tie-in point to the end of the knotted loop where it is attached to the test rig is 2 m.

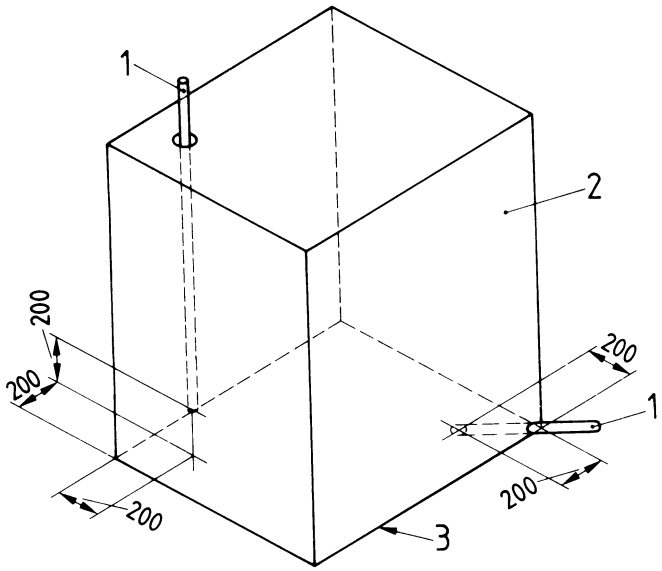
5.1.2.2 Suspend the torso dummy by its upper attachment point and raise this to 2 m above the fixed anchorage point of the lanyard and maximum 300 mm horizontally from the centre line. Hold it with the quick release device.

5.1.2.3 Release the torso dummy without initial velocity, the feet first free fall being about 4 m before the lanyard takes up the tension. Observe whether the harness releases the torso dummy. After the fall observe the orientation of the torso dummy and measure the angle between the longitudinal axis of the dorsal plane of the torso dummy and the vertical.

5.1.2.4 Using the same rope, though re-adjustment is permitted, within (15 ± 1) min repeat the test procedure with the torso dummy suspended from its lower attachment point to achieve a head first free fall of about 4 m.

5.1.2.5 Apply the above feet first and head first procedures to each attachment point designed to be used as part of a complete fall arrest system and marked as such (see EN 361).

5.1.2.6 For those attachment points which are not designed to be used as part of a complete fall arrest system, the above feet first and head first fall procedures shall be repeated but the free fall shall be about 2 m.



Dimensions in millimetres
1 Bore air tube Ø 6 mm
2 1 m^3 (internal dimension) cube
3 Floor level

Figure 3 — Dust conditioning chamber

5.1.3 ***Static strength test apparatus***

The apparatus shall comply with **4.1** and **4.2**.

5.1.4 ***Static strength test procedure***

5.1.4.1 Place the harness on the torso dummy.

5.1.4.2 Install the torso dummy and harness in the test apparatus and apply the specified static test force between the attachment element of the harness and the lower ring of the torso dummy. Maintain the force for a period of 3 min and observe whether the harness releases the torso dummy.

Repeat the procedure for each attachment element of the harness.

5.1.4.3 Repeat the procedure using the upper ring of the torso dummy and at the relevant specified static test force.

NOTE Although this is a strength test, it. also permits the study of behaviour and movement of the various components and some effects on the physical safety of the user.

5.2 Lanyards

5.2.1 ***Static strength test apparatus***

The apparatus shall comply with **4.1**.

5.2.2 ***Static strength test procedure***

Install the lanyard in the test machine and submit it to the specified static test force between its two end points (supplied terminations). Maintain the force for a period of 3 min and observe that the lanyard does not fracture.

NOTE If a textile lanyard is supplied for test with metallic connecters as terminations, the metallic connecters may be replaced by stronger connecters or may be clamped laterally by the jaws of the testing apparatus.

5.2.3 ***Dynamic strength test apparatus***

The apparatus shall comply with **4.4.1**, **4.5** and **4.6**.

5.2.4 ***Dynamic strength test for lanyards incorporating length adjustment device***

Attach a connector to the end point of the lanyard. Adjust the length adjustment device until the length between end points is (2,0 + 0,25) m or, if the overall length is less than 2,0 m, to the full length of the lanyard.

Attach the 100 kg mass to the adjustment device connector and attach the other end to the rigid structural anchorage point.

Raise the mass (4,0 ± 0,1) m or, if the lanyard is less than 2,0 m, as high as the length of lanyard permits and at a maximum of 300 mm horizontally from the structural anchorage. Hold it by the quick release device.

Let the mass fall and observe that the mass is not released.

5.3 Energy absorbers

5.3.1 ***Static preloading test apparatus***

The apparatus shall comply with **4.1**.

Alternatively, the **4.4.1** apparatus can be employed with an auxiliary test mass of 204 kg.

5.3.2 ***Static preloading test procedure***

Install the lanyard in the test machine and submit it to the specified static preloading test force between its two end points (supplied terminations). Maintain the force for a period of 3 min and observe whether permanent extension occurs.

Alternatively, install the lanyard in the test frame and suspend the auxiliary test mass for 3 min from the lower end of the lanyard. Observe whether permanent extension occurs.

5.3.3 ***Dynamic performance test apparatus***

The apparatus shall comply with **4.2**, **4.4**, **4.5** and **4.6**.

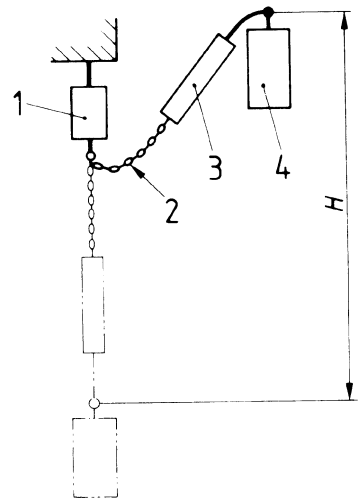
5.3.4 ***Dynamic performance test procedure***

5.3.4.1 *Energy absorber as a component*

5.3.4.1.1 Attach, by connector, to one end of the energy absorber the 100 kg mass and to the other end a length of chain (complying with lanyard specification EN 354) such that the overall length of the connecting system is (2,0 + 0,25) m.

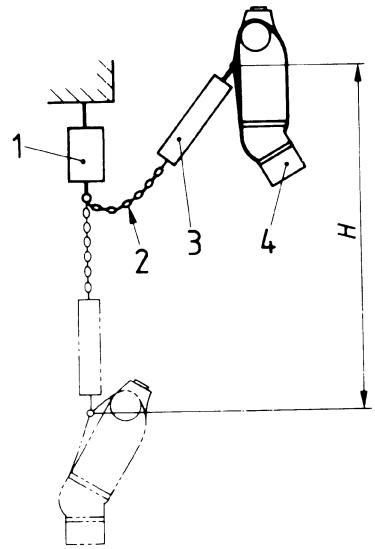
5.3.4.1.2 Suspend the assembled connecting system from the rigid structural anchorage point incorporating the force measuring instrument and raise the mass by 4 m at a maximum of 300 mm horizontally from the structural anchorage. Hold it by the quick release device.

5.3.4.1.3 Let the mass fall and measure the peak force during the arrest stage. After the fall and with the mass at rest, measure the displacement *H* of the point of attachment of the mass to the energy absorber (see Figure 4).



1 Force measurement instrument
2 Chain
3 Energy absorber
4 Mass 100 kg

Figure 4 — Dynamic performance test of energy absorber as component



1 Force measurement instrument
2 Chain
3 Energy absorber
4 Torso dummy

Figure 5 — Dynamic performance test of energy absorber with a harness

5.3.4.2 *Energy absorber integral with a lanyard*

5.3.4.2.1 If the overall length of the energy absorber with lanyard and connectors is 2,0 m, attach the 100 kg mass by connector to one end of the energy absorber and lanyard and attach the other end to the rigid structural anchorage point incorporating the force measuring instrument.

NOTE If the overall length of the energy absorber with lanyard and connectors is less than 2,0 m, the length shall be made up to (2,0 + 0,25) m as described at **5.3.4.1.1**.

5.3.4.2.2 Raise the mass by 4,0 m and at a maximum of 300 mm horizontally from the structural anchorage. Hold it by the quick release device.

5.3.4.2.3 Let the mass fall and measure the peak force during the arrest stage. After the fall and with the mass at rest, measure the displacement *H* of the point of attachment of the mass to the energy absorber.

5.3.4.3 *Energy absorber with a harness*

5.3.4.3.1 If it is not possible to insert a connector at the point of attachment of energy absorber and harness it is permissible to fit the harness to the torso dummy and carry out the further stages of the test as described at **5.3.4.1** (see Figure 5).

5.3.5 ***Static strength test apparatus***

The apparatus shall comply with **4.1**.

5.3.6 ***Static strength test procedure***

Install the energy absorber and submit it, fully developed, to the specified static test force between its two end points. Maintain the force for a period of 3 min and observe that the energy absorber does not fracture.

NOTE Where the energy absorber is integral with a harness and it is not possible to attach the test apparatus to the two end points of the energy absorber, the **5.1.4.2** strength test shall apply.

5.4 Connectors

5.4.1 ***Static strength test apparatus***

The apparatus shall comply with **4.1** and the loading bars shall be 12 mm diameter.

NOTE Where the design and function of a connector make it unsuitable to test with 12 mm diameter loading bars the manufacturer and test house shall agree the design of suitable loading bars.

5.4.2 ***Static strength test procedure***

The connector shall be submitted to the specified static test force between its two end points. The connector shall be allowed to take up its natural position on the loading bars. Maintain the force for a period of 3 min and observe that the connector does not fracture.

If the connector is of the self-closing type, it shall be tested in the unlocked condition.

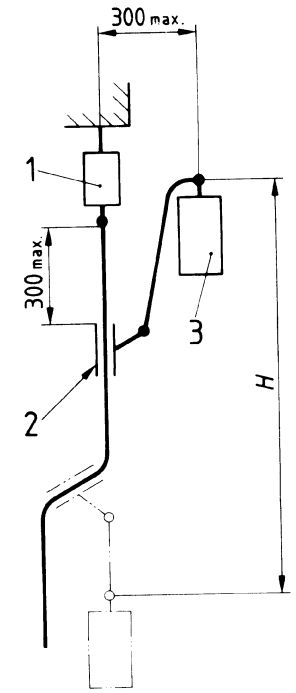
5.5 Guided type fall arresters with a flexible anchorage line

5.5.1 *Dynamic performance test apparatus*

The apparatus shall comply with **4.4**, **4.5** and **4.6**.

5.5.2 *Dynamic performance test procedure*

5.5.2.1 Secure the top of the anchorage line to the rigid structural anchorage point incorporating the force measuring instrument as shown in Figure 6.



Dimensions in millimetres
1 Force measurement instrument
2 Fall arrester
3 Mass 100 kg

Figure 6 — Dynamic performance test of guided type fall arrester with a flexible anchorage rope

5.5.2.2 Hold the fall arrester as in the normal condition of use within 300 mm of the top of the anchorage line. Attach the fall attester to the 100 kg mass by means of its lanyard and connectors.

5.5.2.3 Raise the mass as far above the arrester as the lanyard and connectors permit, and at a maximum of 300 mm horizontally from the structural anchorage. Hold the mass by the quick release device.

5.5.2.4 Let the mass fall and measure the peak force during the arrest stage. After the fall and with the mass at rest, measure the displacement H of the point of attachment of the mass.

5.5.2.5 If the arrester is designed to be attached directly to a harness the system shall be tested in accordance with **5.8**.

5.5.3 *Dynamic strength test apparatus*

The apparatus shall comply with **4.4.1**, **4.5** and **4.6**.

5.5.4 *Dynamic strength test procedure*

The test procedure is as described in **5.5.2** but the test is carried out with the 150 kg mass. Measurement of the arrest force and displacement H is not required. Observe that the mass is not released.

5.5.5 *Static strength test apparatus*

The apparatus shall comply with **4.1**.

5.5.6 *Static strength test procedure for anchorage rope*

From the anchorage rope upper end produce a 2,0 m long specimen with a lower end termination identical to the upper end point. Alternatively, the manufacturer may submit specimens ready for test.

Install the anchorage rope specimen in the test machine and submit it to the specified static test force between its two end points for a period of 3 min. Observe that the lanyard does not fracture.

5.6 Guided type fall arresters with a rigid anchorage line

5.6.1 *Dynamic performance test apparatus*

The apparatus shall comply with **4.4**, **4.5** and **4.6**. In view of the risk of mechanical damage to the rail giving rise to spurious performance results, it is permissible to replace the test mass **4.5** with a sand bag. The sand bag shall have a mass of (100 ± 1) kg and may be fitted with belts (see Figure 7).

5.6.2 *Dynamic performance test procedure*

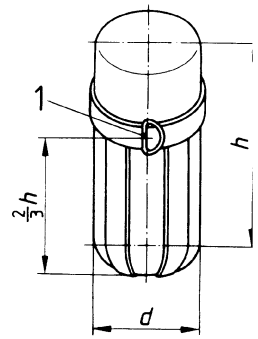
Test method A or test method B shall be employed.

5.6.2.1 *Test method A*

5.6.2.1.1 Secure the rigid anchorage line via the force measurement instrument to the structural anchorage [see Figure 8 a)].

NOTE It is permissible to guide the rigid anchorage line laterally by a method agreed between test house and manufacturer.

5.6.2.1.2 With the attester within 300 mm of the top of the rigid anchorage line, attach the fall attester by means of its supplied lanyard and connectors to the 100 kg mass.



1 'D' ring
d = Ø 300 to 400 mm
h = Height of sand bag

Figure 7 — Sand bag

5.6.2.1.3 Raise the mass as far above the arrester as the lanyard and connectors permit and, at a maximum of 300 mm horizontally from the anchorage line, hold it by the quick release device.

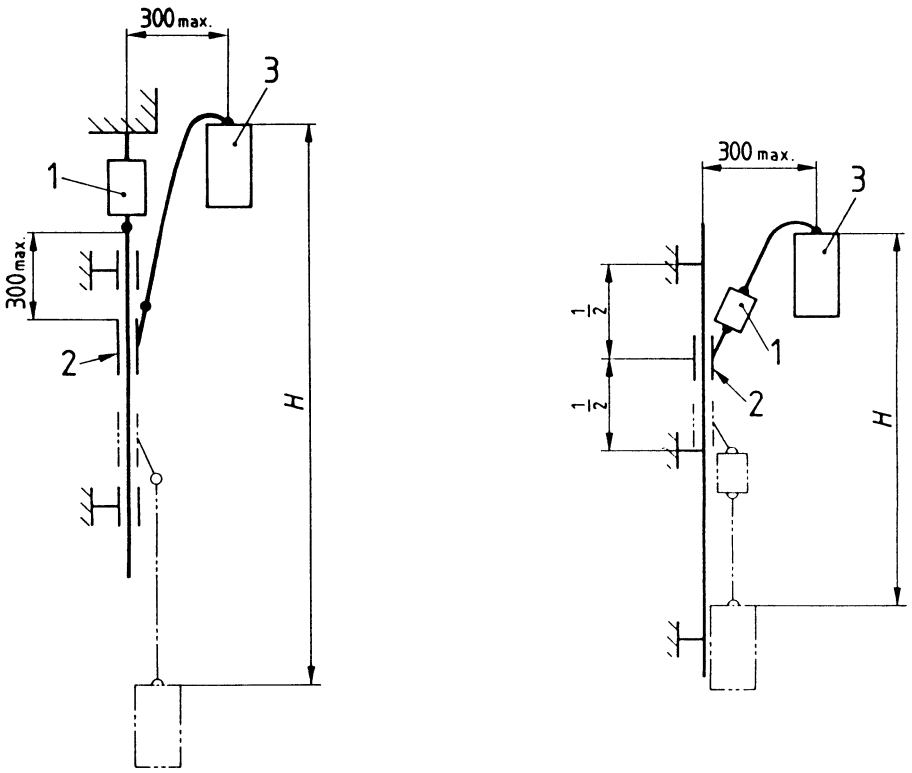
5.6.2.1.4 Let the mass fall and measure the peak arrest force. After the fall, and with the mass at rest, measure the displacement H.

5.6.2.2 *Test method B*

For this test method the maximum overall length of the force measurement instrument shall be 100 mm.

5.6.2.2.1 Secure the rail according to manufacturer's instructions.

5.6.2.2.2 Attach the fall arrester by means of its lanyard and connectors via the force measuring instrument to the 100 kg mass.



a) Test method A

b) Test method B

Dimensions in millimetres

1 Force measurement instrument

2 Arrester

3 Mass 100 kg

Figure 8 — Alternative methods for dynamic performance test of guided type fall arrester on a rigid anchorage line

5.6.2.2.3 With the fall arrester mid-way between the top and an intermediate anchorage [see Figure 8 b)], raise the mass as far above the fall arrester as the lanyard, force measurement instrument and connectors permit. At a maximum horizontal displacement of 300 mm from the anchorage line, hold the mass by the quick release device.

5.6.2.2.4 Let the mass fall and measure the peak force during the arrest stage. After the fall and with the mass at rest, measure the displacement *H* of the point of attachment of the mass.

5.6.3 ***Static strength test apparatus***

The apparatus shall comply with **4.1**.

5.6.4 ***Static strength test procedure for guided type fall arrester on a rigid anchorage line***

Install the specimen of rigid anchorage line (including a joint if the anchorage line is a rail) with fall arrester and supplied lanyard and connectors, in the test machine such that the test force is applied simultaneously to the line (or rail including joint), fall attester, lanyard and connectors. Submit it to the specified static test force between its two end points for a period of 3 min. Observe that no fracture occurs.

5.7 Retractable type fall arresters

5.7.1 ***Dynamic performance test apparatus***

The apparatus shall comply with **4.4**, **4.5** and **4.6**.

5.7.2 ***Dynamic performance test procedure***

5.7.2.1 Secure the top of the arrester to the rigid structural anchorage point incorporating the force measurement instrument as shown in Figure 9.

5.7.2.2 Withdraw the retractable lanyard 600 mm from the fall arrester and attach a clip to prevent retraction. Attach the 100 kg mass. Raise the mass so that its eyebolt is horizontally in line with the clip and, at a maximum of 300 mm horizontally from the centre line, hold it by the quick release device.

5.7.2.3 Let the mass fall and measure the peak arrest force. After the fall and with the mass at rest measure the displacement *H*.

If the arrester includes a fall indicator, confirm that this has operated in accordance with the manufacturer's information.

5.7.3 ***Static strength test apparatus***

The apparatus shall comply with **4.1**.

5.7.4 ***Static strength test procedure***

5.7.4.1 Unreel the retractable lanyard fully, cut it 1 m from the fall arrester and suitably terminate. Alternatively, the manufacturer is permitted to supply test specimens "ready for test" with the manufacturer's termination.

5.7.4.2 Submit the assembly to the specified static test force between its upper anchorage and the retractable line termination. Maintain the force for a period of 3 min and observe that the assembly does not fracture.

5.7.4.3 If the device offers more than one anchorage point, each point is to be tested to **5.7.4.2**.

5.8 Dynamic test for systems with a harness connected direct to a guided type fall arrester on flexible anchorage rope

The purpose of this test is to ensure that when guided type fall arresters are directly connected to a harness the system is operationally compatible.

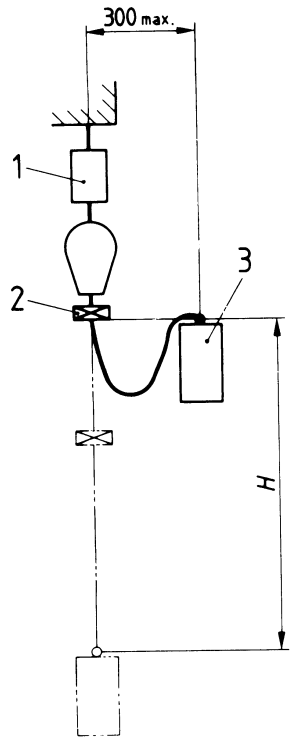
5.8.1 ***Dynamic performance test apparatus***

The apparatus shall comply with **4.2**, **4.4** and **4.6**.

5.8.2 ***Dynamic performance test procedure***

5.8.2.1 Fit the torso dummy with the harness and attach the harness to the fall arrester by means of the direct connector supplied.

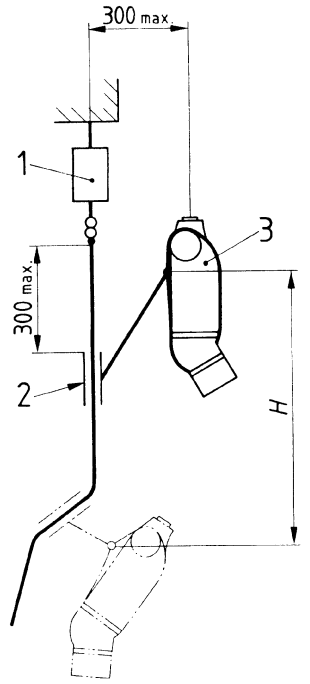
5.8.2.2 Secure the top of the anchorage line to the rigid structural anchorage point incorporating the force measuring instrument as shown in Figure 10.



Dimensions in millimetres

1 Force measurement instrument
2 Clip
3 Mass 100 kg

Figure 9 — Dynamic performance test of retractable type all arrester



Dimensions in millimetres

1 Force measurement instrument
2 Arrester
3 Torso dummy

Figure 10 — Dynamic performance test of system with harness connected direct to guided type fall arrester on flexible anchorage rope

5.8.2.3 Suspend the torso dummy by its upper attachment point and raise this until the arrester is within 300 mm of the top of the anchorage line and the torso dummy no greater than 300 mm horizontally from the structural anchorage. Hold the torso dummy by the quick release device.

5.8.2.4 Let the torso dummy fall and measure the peak force during the arrest stage. After the fall and with the torso dummy at rest, measure the displacement *H* of the point of attachment of the torso dummy.

NOTE The strength tests for a guided type fall arrester with a flexible anchorage rope are described at **5.5.4** and **5.5.6**.

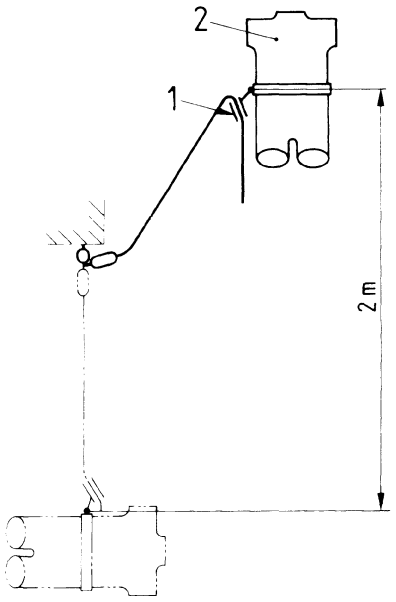
5.9 Work positioning belts and work positioning lanyards

5.9.1 *Dynamic test apparatus*

The apparatus shall comply with **4.2**, **4.4** and **4.6**.

5.9.2 *Dynamic strength test for system of work positioning belt and work positioning lanyard*

5.9.2.1 Fit the torso dummy with the work positioning belt. Attach the work positioning lanyard to one side attachment element only of the work positioning belt. Adjust the length of work positioning lanyard between the attachment element and the length adjuster connector to (1,0 ± 0,05) m. Secure the attachment element to the structural anchorage point as shown in Figure 11.



1 Length adjuster
2 Torso dummy

Figure 11 — Dynamic strength test for system of work positioning belt and work positioning lanyard

5.9.2.2 Suspend the torso dummy by its upper attachment point and raise it so that the work positioning belt side attachment element is about 1,0 m above the work positioning lanyard attachment element and as close as possible to vertically above (but ensure there is sufficient horizontal spacing to avoid impact during the fall). Hold the torso dummy with the quick release device.

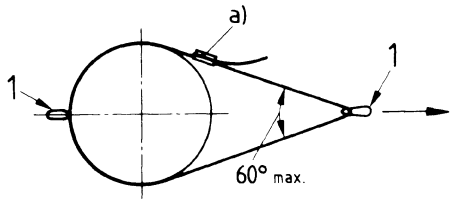
5.9.2.3 Release the torso dummy without initial velocity, the feet first free fall being about 2,0 m before the work positioning strap takes up the tension. Observe whether the torso dummy is released.

5.9.3 *Static strength test apparatus for work positioning belt and work positioning lanyard*

The apparatus shall comply with **4.1** and **4.3**.

5.9.4 ***Static strength test procedure for work positioning belt as a separate component***

Install the work positioning belt and test cylinder in the test apparatus and apply the specified test force between the test cylinder and one of the side attachment elements, as shown in Figure 12. Maintain the force for 3 min and observe whether the work positioning belt releases the cylinder.



a) Buckle must be off cylinder
1 Side attachment element

Figure 12 — Static strength test for work positioning belt as separate component

If the opposite side attachment element differs in design, or the work positioning belt includes other attachment elements, repeat the test procedure for that/those attachment element/s.

5.9.5 ***Static strength test procedure for work positioning belt with integral work positioning lanyard***

Install the work positioning belt with integral work positioning lanyard and test cylinder in the test apparatus. Ensure that the active length of the work positioning lanyard is 300 mm minimum as shown in Figure 13. Apply the specified test force between the test cylinder and the connector at the free end of the work positioning lanyard. Maintain the force for 3 min and observe whether the work positioning belt or lanyard releases the cylinder.

5.9.6 ***Static strength test for separate work positioning lanyard***

Ensure that the work positioning lanyard length adjuster is 300 mm minimum from the free end of the lanyard as shown in Figure 14. Apply the specified test force between the end points of the lanyard. Maintain the force for 3 min and observe that the lanyard does not fracture.

5.10 Restraint belts

5.10.1 ***Static strength test apparatus***

The apparatus shall comply with **4.1** and **4.3**.

5.10.2 ***Static strength test procedure***

5.10.2.1 Install the restraint belt and test cylinder in the test apparatus and apply the specified test force between the test cylinder and the belt attachment element, as shown in Figure 12. Maintain the force for 3 min and observe whether the restraint belt releases the cylinder.

5.10.2.2 If the restraint belt includes other attachment elements of different design, repeat the test for each design.

5.11 Conditioning for fall arresters

A minimum period of 2 h shall be allowed between conditioning tests with the device in ambient conditions and at room temperature.

Retractable arresters shall be conditioned to heat (**5.11.1**), cold (**5.11.2**) and wet (**5.11.3**) with their retractable lanyards fully extended.

5.11.1 ***Conditioning to heat***

5.11.1.1 The conditioning apparatus shall comply with **4.8.1**.

5.11.1.2 Place the fall arrester in a heated chamber for 2 h at a temperature of (50 ± 2) °C and at a relative humidity of 85 %.

Remove the arrester and, before 90 s has elapsed, test as described at **5.11.6**.

5.11.2 ***Conditioning to cold***

5.11.2.1 Conditioning apparatus shall comply with **4.8.2**.

5.11.2.2 Place the fall arrester in a refrigerated chamber for 2 h at a temperature of (– 30 ± 2) °C.

Remove the arrester and, before 90 s has elapsed, test as described at **5.11.6**.

5.11.3 ***Conditioning to wet***

5.11.3.1 The conditioning apparatus shall comply with **4.8.3**.

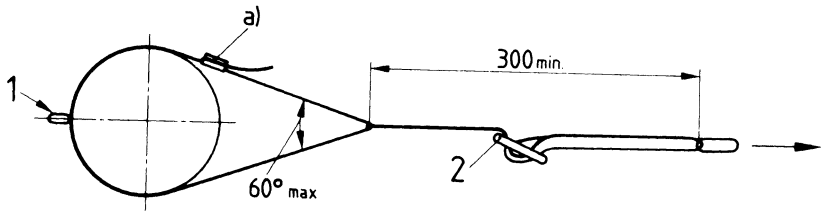
5.11.3.2 Maintain the fall arrester at ambient temperature for 24 h. Arrange the fall arrester vertically in a tank and spray water, within the temperature range (10 to 30) °C, on it for 3 h at a rate of approximately 70 l/h.

Remove the arrester and, before 90 s has elapsed, test as described at **5.11.6**.

5.11.4 ***Conditioning to dust***

5.11.4.1 The conditioning apparatus shall comply with **4.8.4**.

5.11.4.2 Place the fall arrester and its anchorage line, in the operating condition, 150 mm above the base of the box. Take a cord through the top of the box so arranged that the mechanism can be operated.



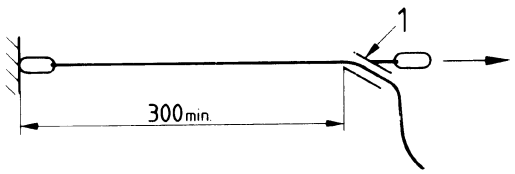
Dimensions in millimetres

a) Buckle must be off cylinder

1 Side attachment element

2 Length adjuster

Figure 13 — Static strength test for work positioning belt with integral work positioning lanyard



Dimensions in millimetres

1 Length adjuster

Figure 14 — Static strength test for work positioning lanyard

5.11.4.3 Introduce 5 kg of dry cement on the floor of the box and, at intervals of 5 min, agitate it by projecting blasts of air for a period of 2 s. After 1 h, beginning coincidentally with air blasts, perform the following movement sequence.

5.11.4.3.1 For guided type fall arresters with flexible rope or rigid anchorage line raise the device as far as the lid of the box will permit, and lower to the original position. Immediately repeat this operation 10 times.

5.11.4.3.2 For retractable type devices, with a drum or other means within the box driven by an external crank, withdraw the retractable lanyard entirely from the device and retract to the initial position.

5.11.4.4 Repeat the movement sequence at intervals of 1 h until five such movement sequences have been completed.

5.11.4.5 After the final movement sequence cease the blasts of air. Allow the dust to settle for 15 min and remove the device and anchorage line, or retractable device, from the box. Test as described at **5.11.6**.

5.11.5 ***Conditioning to oil (guided type with flexible rope)***

5.11.5.1 Immerse the anchorage line in commercial grade diesel oil at a temperature of (20 ± 2) °C for a period of not less than 30 min.

5.11.5.2 Remove the line from the oil and allow to drip for 24 h. Test as described at **5.11.6**.

5.11.6 ***Locking test after conditioning***

5.11.6.1 *Guided type fall arresters*

Suspend the arrester from its upper end point, in the unloaded position, and operate under a falling mass of 5 kg. Observe that the arrester locks and can be unlocked after test.

5.11.6.2 *Retractable type fall arresters*

Suspend the arrester from its upper end point, in the unlocked position, and operate with a suitable mass at a velocity not exceeding 2,5 m/s. Observe that the arrester locks and can be unlocked after test.

The minimum mass shall be 5 kg but this can be increased by 1 kg increments to that mass which operates the device.

5.12 Endurance testing of retractable fall arresters

5.12.1 The apparatus shall comply with **4.9**.

5.12.2 ***Endurance test procedure***

5.12.2.1 Suspend the arrester from its upper end point.

5.12.2.2 Withdraw the line from the arrester for a distance of 1 m and move it over a distance of 300 mm. At the end of the movement cause the arrester to lock by the application of a falling mass at a speed not exceeding 2,5 m/s.

The minimum mass shall be 5 kg but this can be increased by 1 kg increments to that mass which operates the device.

5.12.2.3 Repeat for a total of 1 000 relative movements. Observe that the attester locks on each operation.

5.12.2.4 As a test of function, withdraw the line fully 10 times from the completely retracted position. The velocity of extension and retraction shall not exceed that for which the device is designed.

5.13 Testing for corrosion resistance of metallic components

5.13.1 The apparatus shall comply with **4.7**.

5.13.2 The specimen shall be exposed to the neutral salt spray test for a period of 24 h, and dried for 1 h.

5.13.3 Examine the specimen. Metal parts shall show no evidence of corrosion such as would affect their function (white scaling or tarnishing is acceptable if function is not impaired).

Where necessary to gain visual access to internal components, dismantle the device and examine as described.

Annex A Recommendations for scheduling of tests

To reduce the number of specimens required for a programme of tests it is recommended that the following sequence of events be applied:

A.1 Corrosion resistance test (where applicable).

A.2 Endurance test **5.12** (where applicable).

A.3 Locking tests after conditioning **5.11** (where applicable).

A.4 Static preloading test **5.3.2** for energy absorbers only.

A.5 Dynamic performance test.

A.6 Dynamic strength test (where applicable).

A.7 Static strength test (where applicable).

If this sequence is followed it should be possible in many cases to conduct the necessary tests with as few as 2 test specimens (the changing of anchorage ropes between tests is permissible for sliding type fall arresters), and in extreme cases it is not expected that more than 4 specimens should be required.

National annex NA (informative)

Committees responsible

The United Kingdom participation in the preparation of this European Standard was entrusted by the Personal Safety Equipment Standards Policy Committee (PSM - to Technical Committee PSM/5 upon which the following bodies were represented:

Amalgamated Engineering Union
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Industrial Safety (Protective Equipment) Manufacturers' Association
Institution of Mechanical Engineers
National Federation of Master Steeplejacks and Lightning Conductor Engineers
Suspended Access Equipment Manufacturers' Association

National annex NB (informative)

Cross-references

Publication referred to	Corresponding British Standard
EN 354:1992	BS EN 354:1993 *Personal protective equipment against falls from a height — Lanyards*
EN 361:1992	BS EN 361:1993 *Personal protective equipment gainst falls from a height — Full body harnesses*
EN 10002-1:1990	BS EN 10002-1:1990 *Metallic material — Tensile test — Method of test (at ambient temperature)*
EN 10002-2:1991	BS EN 10002-2:1992 *Verification of the force measuring system of tensile testing machines*
EN 45001:1989	BS 7501:1989 *General criteria for the operation of testing laboratories*
ISO 9227:1990	BS 7479:1991 *Method for salt spray corrosion tests in artificial atmospheres*

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