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BSI Standards Publication

Personal fall protection equipment — Anchor devices — Recommendations for anchor devices for use by more than one person simultaneously

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PH/5, Personal Fall Protection.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Equipements de protection individuelle contre les chutes - Dispositifs d'ancrage - Recommandations relatives aux dispositifs d'ancrage destinés à être utilisés par plusieurs personnes simultanément

Persönliche Absturzschutzausrüstung - Anschlageinrichtungen - Empfehlungen für die Benutzung von Anschlageinrichtungen gleichzeitig durch mehrere Personen

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Contents

Page

Figures

Foreword

This document (CEN/TS 16415:2013) has been prepared by Technical Committee CEN/TC 160 “Protection against falls from height including working belts”, the secretariat of which is held by DIN.

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Introduction

A reliable anchor device is one of the essential components in a personal fall protection system.

This Technical Specification, which gives minimum performance requirements, is intended to act as a complementary specification for existing European Standards covering components used in personal fall protection systems.

The scope and the requirements are based on the philosophy that anchor devices are rated to sustain the maximum dynamic force generated in a fall from a height by the mass of more than one person, including any equipment carried. The static strength tests are based on a minimum factor of safety of two. To allow for foreseeable misuse of equipment, this Technical Specification provides requirements and test methods for anchor devices, used in personal fall protection equipment in accordance with EN 363, even if their intended use is for restraint.

It is essential that anchor devices are designed and manufactured so that, in the foreseeable conditions of use for which they are intended, the user is able to perform the risk-related activity while being appropriately protected. Manufacturers may wish to bear these points in mind when deciding on the actual performance of their products.

1 Scope

This Technical Specification sets out recommendations for requirements, test apparatus, test methods, marking and information supplied by the manufacturer for anchor devices intended for use by more than one user simultaneously.

This Technical Specification is not applicable to:

— anchor devices intended to allow only one user to be attached at any one time, which are covered by EN 795:2012;

— anchor devices used in any sports or recreational activity;

— equipment designed to conform to EN 516 or EN 517;

— elements or parts of structures which were installed for use other than as anchor points or anchor devices, e.g. beams, girders;

— structural anchors.

NOTE Requirements, test methods, marking and information supplied by the manufacturer for anchor devices intended for use by a single user are covered by European Standard EN 795:2012.

2 Normative references

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

EN 364:1992, *Personal protective equipment against falls from a height — Test methods*

EN 795:2012, *Personal fall protection equipment — Anchor devices*

3 Terms and definitions

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

3.1
anchor system
system intended for use as part of a personal fall protection system that incorporates an anchor point or points and/or an anchor device and/or an element and/or a fixing element and/or a structural anchor (see Figure 1)

Note 1 to entry: Anchor systems that are not intended to be removed from the structure are not covered by this European Technical Specification. See Figure 2.

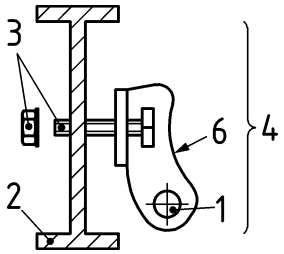


Figure 1a

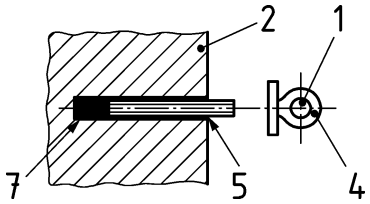


Figure 1b

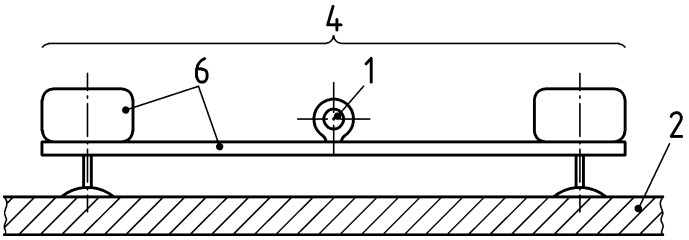


Figure 1c

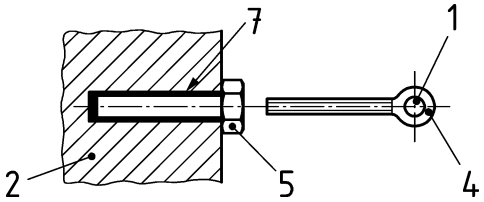


Figure 1d

Figure 1 — Examples of anchor systems that include an anchor device (1 of 2)

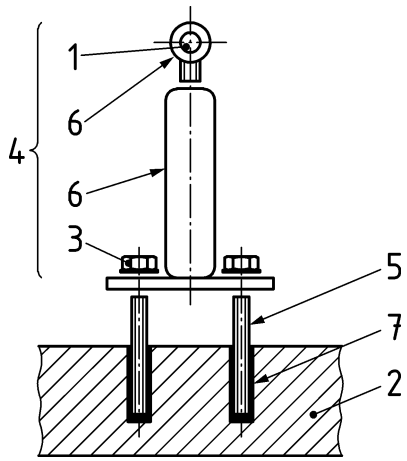
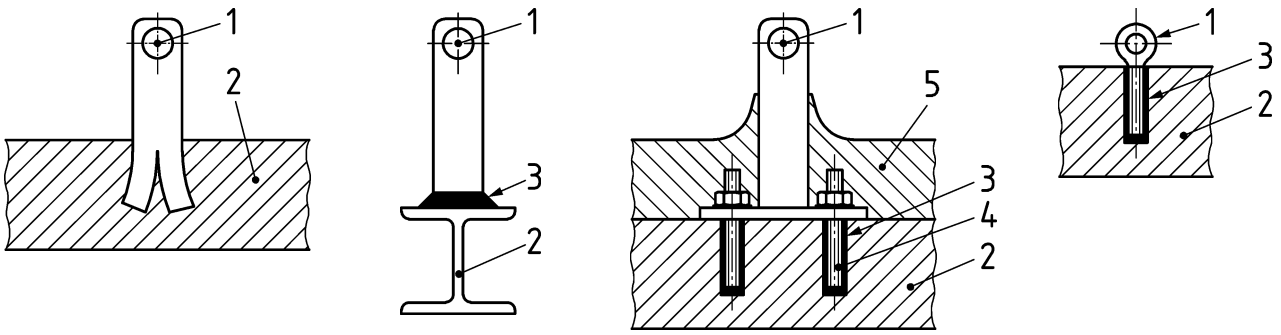


Figure 1e

Key

1	anchor point	4	anchor device
2	structure (not part of the anchor device	5	structural anchor (not part of the anchor device)
3	fixing element	6	element
		7	permanent fixation (e.g. resin bonding)

Figure 1 — Examples of anchor systems that include an anchor device (2 of 2)



Key

1 anchor point

2 structure

3 permanent fixation (e.g. studded, screwed, riveted, welded or resin bonded)

4 structural anchor

5 concrete, insulation or other covering

Figure 2 — Examples of anchor systems that are not covered by this European Technical Specification

3.2
anchor device
assembly of elements which incorporates one or more anchor points or mobile anchor points that can include a fixing element, is intended for use as part of a personal fall protection system, is removable from the structure and is intended to be part of the anchor system

3.2.1
type A anchor device
anchor device with one or more stationary anchor points, while in use, and with the need for a structural anchor(s) or fixing element(s) to fix to the structure (see Figures 3 and 4)

Note 1 to entry: Anchor points may rotate or swivel when in use, where they are designed to do so.

3.2.2
type B anchor device
anchor device with one or more stationary anchor points without the need for a structural anchor(s) or fixing element(s) to fix it to the structure (see Figure 5)

3.2.3
type C anchor device
anchor device employing a flexible anchor line which deviates from the horizontal by not more than 15° (when measured between the extremity and intermediate anchors at any point along its length) (see Figure 6)

3.2.4
type D anchor device
anchor device employing a rigid anchor line which deviates from the horizontal by not more than 15° (when measured between the extremity and intermediate anchors at any point along its length) (see Figure 7)

3.2.5
type E anchor device
anchor device for use on surfaces up to 5° from the horizontal where the performance relies solely on mass and friction between itself and the surface (see Figure 8)

3.3
structural anchor
element or elements which are designed for use in conjunction with a personal fall protection system and to be permanently incorporated into a structure

Note 1 to entry: The structural anchor is not part of the anchor device.

Note 2 to entry: An example of a structural anchor is where an element is welded or resin bonded to the structure.

3.4
fixing element
element or elements used to connect/fix the anchor device to the structure and which is removable from the structure

3.5
element
part of an anchor system or anchor device

3.6
anchor point
point on an anchor system where personal fall protection equipment is intended to be attached

3.7
extremity anchor
element which connects the extremity of a flexible anchor line or rigid anchor line onto the structure

3.8
intermediate anchor
element located between the extremity anchors, which connects a flexible anchor line or rigid anchor line onto the structure

Note 1 to entry: Intermediate supports e.g. a flexible anchor line guide, which are not intended to withstand the load are not intermediate anchors.

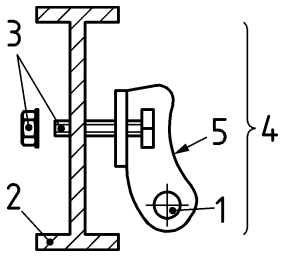
3.9
mobile anchor point
element with an anchor point which is intended to travel along an anchor line

3.10
flexible anchor line
flexible line between extremity anchors to which personal fall protection equipment can be attached either directly by a connector or through a mobile anchor point

Note 1 to entry: A flexible anchor line can be cable (wire rope), fibre rope, or webbing.

3.11
rigid anchor line
rigid line between extremity anchors to which personal fall protection equipment can be attached either directly by a connector or through a mobile anchor point

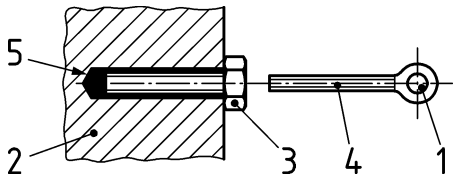
Note 1 to entry: A rigid anchor line can be a rigid profile e.g. a rigid tube or rigid rail.



Key

1	anchor point	4	anchor device
2	structure	5	element
3	fixing element		

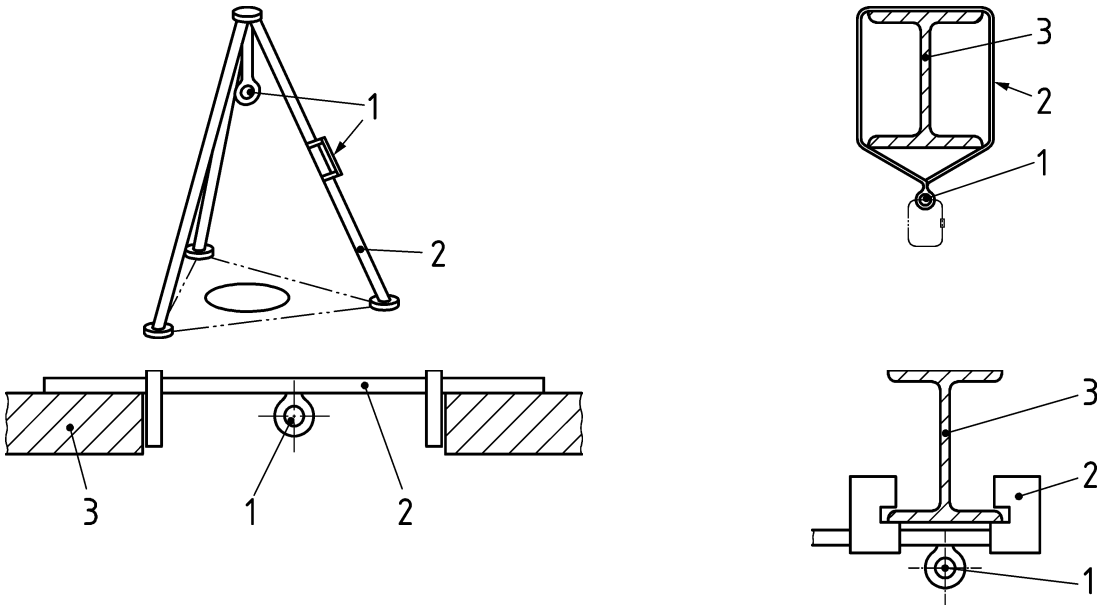
Figure 3 — Example of a type A anchor devices with a fixing element



Key

1	anchor point	4	anchor device
2	structure	5	permanent fixation
3	structural anchor		

Figure 4 — Example of a type A anchor device with a structural anchor



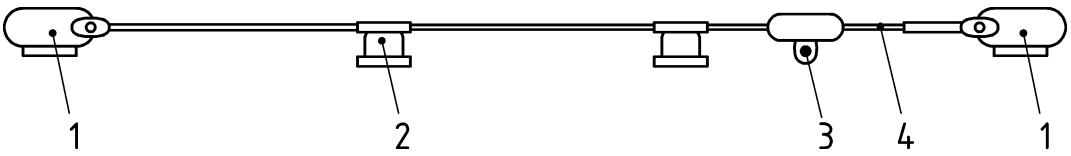
Key

1 anchor point

2 anchor device

3 structure

Figure 5 — Examples of type B anchor devices



Key

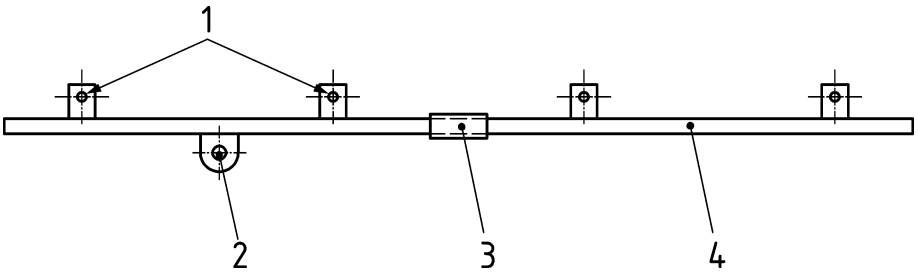
1 extremity anchor

2 intermediate anchor

3 mobile anchor point

4 flexible anchor line

Figure 6 — Example of a type C anchor device



Key

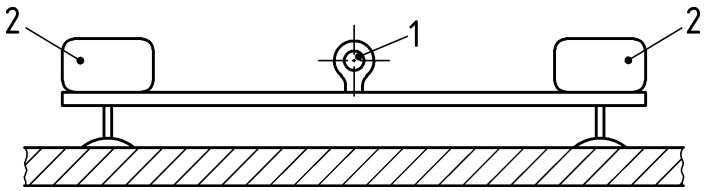
1 extremity or intermediate anchor

2 mobile anchor point

3 rigid anchor line joiner

4 rigid anchor line

Figure 7 — Example of a type D anchor device



Key

1 anchor point

2 mass

Figure 8 — Example of a type E anchor device

4 Requirements

4.1 General

Anchor devices intended for use by more than one person simultaneously shall conform to EN 795:2012.

4.2 Specific

4.2.1 Type A anchor device

4.2.1.1 When tested in accordance with 5.2.2 (dynamic strength and integrity test), the anchor device shall not release the rigid test mass and the rigid test mass shall be held clear of the ground.

4.2.1.2 When tested in accordance with 5.2.3 (static strength test), the anchor device shall hold the load.

4.2.2 Type B anchor device

4.2.2.1 When tested in accordance with 5.3.2 (dynamic strength and integrity test), the anchor device shall not release the rigid test mass and the rigid test mass shall be held clear of the ground.

4.2.2.2 When tested in accordance with 5.3.3 (static strength test), the anchor device shall hold the load.

4.2.3 Type C anchor device – single span

4.2.3.1 When tested in accordance with 5.4.2 (dynamic strength and integrity test), the anchor device shall not release the rigid test mass and the rigid test mass shall be held clear of the ground. No part of the anchor device shall break.

4.2.3.2 When tested in accordance with 5.4.2 (dynamic strength and integrity test), the maximum load measured at the extremity anchor should not exceed 50 % of the minimum breaking strength of the flexible anchor line as specified in the information supplied by the manufacturer (see Clause 7).

4.2.3.3 When tested in accordance with 5.4.2 (dynamic strength and integrity test) the values at the extremities and the maximum dynamic deflection of the flexible anchor line shall not vary by more than ± 20 % from those predicted.

4.2.3.4 When tested in accordance with 5.4.3 (static strength test), the anchor device shall hold the load.

4.2.4 Type C anchor device – multi-span

4.2.4.1 When tested in accordance with 5.4.4 (dynamic strength and integrity test), the anchor device shall not release the rigid test mass and the rigid test mass shall be held clear of the ground. No part of the anchor device shall break.

4.2.4.2 When tested in accordance with 5.4.4 (dynamic strength and integrity test), the maximum load measured at the extremity anchor shall not exceed 50 % of the minimum breaking strength of the flexible anchor line as specified in the information supplied by the manufacturer (see Clause 7).

4.2.4.3 When tested in accordance with 5.4.4 (dynamic strength and integrity test), the values at the extremities and the maximum dynamic deflection of the flexible anchor line shall not vary by more than ± 20 % from those predicted.

4.2.4.4 When tested in accordance with 5.4.5 (static strength test), the anchor device shall hold the load.

4.2.4.5 When tested in accordance with 5.4.5 (static strength test) with the mobile anchor point(s) immediately adjacent to an extremity anchor, on an intermediate anchor, on a corner anchor, on an entry/exit line fitting, and on a joint in the flexible anchor line, where these are part of the anchor device, the anchor device including all load-bearing elements, flexible anchor lines, line fittings and terminations (e.g. swaged connections, sewn loops, spliced terminations) shall hold the load.

4.2.4.6 Where the flexible anchor line is fixed in the intermediate or corner anchor (i.e. the intermediate and corner anchors effectively become extremity anchors), multi-span anchor devices shall be tested as single span anchor devices.

4.2.5 Type D anchor device

4.2.5.1 When tested in accordance with 5.5.2 (dynamic strength and integrity test), the anchor device shall not release the rigid test mass and the rigid test mass shall be held clear of the ground.

4.2.5.2 When tested in accordance with 5.5.3 (static strength test), the anchor device shall hold the load.

4.2.5.3 When tested in accordance with 5.5.3 (static strength test), all load bearing elements including mobile anchor points, rigid anchor lines, rigid anchor line fixings, rigid anchor line joints, junctions and terminations (e.g. welded connections, bolted terminations) shall hold the load.

4.2.5.4 When tested in accordance with 5.5.2 and 5.5.3 the mobile anchor point shall not become detached from the rigid anchor line.

4.2.6 Type E anchor device

4.2.6.1 When tested in accordance with 5.6.2 (dynamic performance test), the anchor device shall not release the rigid test mass and the rigid test mass shall be held clear of the ground. The displacement *L* of the leading edge of the anchor device shall not exceed 1000 mm and the anchor device shall remain stationary. The displacements *L* and *H* shall be recorded (see Figure 19).

4.2.6.2 The test described in 5.6.2 (dynamic performance test) shall be carried out at the maximum angle up to 5° which the manufacturer permits, under each worst-case condition, regarding the type of surface and site conditions.

4.2.6.3 The test described in 5.6.2 (dynamic performance test) shall be repeated for each critical direction in which an arrest force could be applied.

4.2.6.4 When tested in accordance with 5.6.3 (post-arrest suspension test), the leading edge of the anchor device where it is in contact with the surface shall not displace more than 10,0 mm after a period of 3 min and shall remain stationary.

4.2.6.5 When tested in accordance with 5.6.4 (static strength test), the anchor device shall hold the load.

4.3 Marking and information

4.3.1 Marking shall be in accordance with Clause 6.

4.3.2 Information shall be supplied with the anchor device in accordance with Clause 7.

5 Test methods

5.1 Test apparatus

The test apparatus shall be in accordance with EN 795:2012, 5.2.

For the first two simultaneous users, increase the rigid test mass to (200 $\pm$ 1) kg and determine the free fall distance required to generate a fall arrest load of ($12\ ^{+0,5}_{0}$) kN by using a test lanyard with sewn terminations and the overall lanyard length reduced to ($1\ 000\ ^{+50}_{0}$) mm.

Dimensions in millimetres

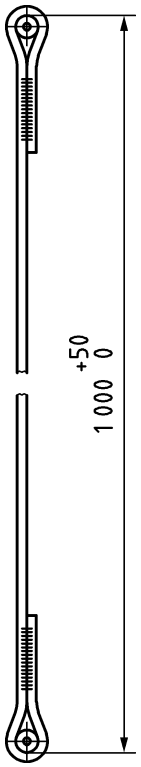


Figure 9 — Test lanyard for 200 kg mass dynamic strength test

5.2 Type A anchor device

5.2.1 General

5.2.1.1 Install the anchor in or on the test apparatus, as appropriate, in accordance with the information supplied by the manufacturer, where relevant using a construction fixing as recommended in the information supplied by the manufacturer, into or onto a sample of construction material(s) also recommended in the information supplied by the manufacturer.

5.2.1.2 Test each anchor point in accordance with 5.2.2 and 5.2.3.

5.2.2 Dynamic strength and integrity

5.2.2.1 Carry out one test using a test lanyard as described in 5.1, connected to a 200 kg rigid test mass.

5.2.2.2 Attach a load cell to the anchor point. Attach one end of the test lanyard to the load cell by means of a connector and the other end of the test lanyard, also by means of a connector, to the rigid test mass.

5.2.2.3 Attach a quick release device to the rigid test mass. Move the rigid test mass downwards until the test lanyard holds the mass. Then raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a maximum of 300 mm horizontally from the anchor point.

5.2.2.4 Release the rigid test mass and observe and record whether the rigid test mass is arrested and is held clear of the ground. Record the peak load at the anchor point.

5.2.2.5 Leaving the 200 kg rigid test mass suspended from the anchor device or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1 and a free fall distance to generate a fall arrest load of ($9\ ^{+0,5}_{0}$) kN. For

each test, leave the mass(es) from the previous test(s) suspended from the anchor device or apply the load statically.

NOTE To prevent collision of the test mass(es) the position of the suspended test mass(es) can be lowered or raised.

5.2.2.6 After the dynamic tests, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for ($3\ ^{+0,25}_{0}$) min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users, the mass would be 900 kg), and hold this or the equivalent load for ($3\ ^{+0,25}_{0}$) min. Check whether the rigid test mass is held clear of the ground.

5.2.3 Static strength

Install the anchor device in or on the static test apparatus specified in 4.1 of EN 364:1992 and apply to the anchor point a static load of ($12\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of durability is not provided by the manufacturer, ($18\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user. Observe whether the anchor device holds the load for a period of ($3\ ^{+0,25}_{0}$) min.

5.3 Type B anchor device

5.3.1 General

5.3.1.1 Install the anchor device in or on the test apparatus, as appropriate, in accordance with the information supplied by the manufacturer, where relevant using a sample of the structure as recommended for use by the manufacturer.

5.3.1.2 Test each anchor point in accordance with 5.3.2 and 5.3.3.

5.3.2 Dynamic strength and integrity

5.3.2.1 Anchor devices without legs

5.3.2.1.1 Attach a load cell to the anchor point. Attach one end of the test lanyard (see 5.1) to the load cell by means of a connector and the other end of the test lanyard, also by means of a connector, to the 200 kg rigid test mass. Attach a quick release device to the rigid test mass.

5.3.2.1.2 Move the rigid test mass downwards until the test lanyard holds the mass. Then raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a maximum of 300 mm horizontally from the anchor point.

5.3.2.1.3 Release the rigid test mass and observe whether the rigid test mass is arrested and is held clear of the ground. Record the peak load at the anchor point, the deflection of the anchor device and the displacement of the anchor point. If the anchor device is equipped with a fall indicator, check whether it indicates that a fall has occurred.

5.3.2.1.4 Leaving the 200 kg rigid test mass suspended from the anchor device or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1 and a free fall distance to generate a fall arrest load of ($9\ ^{+0,5}_{0}$) kN. For each test, leave the mass(es) from the previous test(s) suspended from the anchor device or apply the load statically.

NOTE To prevent collision of the test mass(es) the position of the suspended test mass(es) can be lowered or raised.

5.3.2.1.5 After the dynamic tests, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for ($3\ ^{+0,25}_{0}$) min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users, the mass would be 900 kg), and hold this or the equivalent load for ($3\ ^{+0,25}_{0}$) min. Check whether the rigid test mass is held clear of the ground.

5.3.2.2 Anchor devices with legs and an anchor point(s) not on a leg

5.3.2.2.1 For anchor devices with legs, e.g. tripods or quadpods, where the manufacturer permits an anchor point(s) not on a leg, proceed as described in 5.3.2.2.2 to 5.3.2.2.7.

5.3.2.2.2 Extend the legs of the anchor device to the maximum length permissible. Attach a load cell to the anchor point. Attach the connecting line to the load cell (see Figure 10). Attach one end of the test lanyard (see 5.1) by means of a connector to the free end of the connecting line. Connect the other end of the test lanyard, also by means of a connector, to the 200 kg rigid test mass and attach a quick release device to the rigid test mass.

5.3.2.2.3 Move the rigid test mass downwards until the test lanyard holds the mass. Then raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a minimum of 300 mm horizontally from the anchor point but within the radius of the legs.

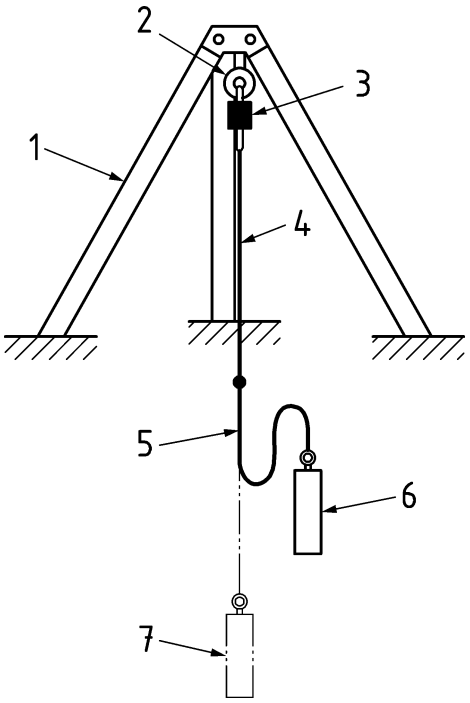
5.3.2.2.4 Release the rigid test mass and observe whether the rigid test mass is arrested and held clear of the ground, and that the anchor device remains stable. Record the peak load at the anchor point, the deflection of the anchor device and the displacement of the anchor point. If the anchor device is equipped with a fall indicator, check whether it indicates that a fall has occurred.

5.3.2.2.5 Leaving the 200 kg rigid test mass suspended from the anchor device or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1 and a free fall distance to generate a fall arrest load of ($9\ ^{+0,5}_{0}$) kN. For each test, leave the mass(es) from the previous test(s) suspended from the anchor device or apply the load statically.

NOTE To prevent collision of the test mass(es) the position of the suspended test mass(es) can be lowered or raised.

5.3.2.2.6 After the dynamic tests, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for ($3\ ^{+0,25}_{0}$) min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users, the mass would be 900 kg), and hold this or the equivalent load for ($3\ ^{+0,25}_{0}$) min. Check whether the rigid test mass is held clear of the ground.

5.3.2.2.7 If the manufacturer permits differential adjustment for uneven surfaces, test the anchor device at the maximum permitted differential adjustment.



Key

1	tripod	5	test lanyard
2	anchor point(s) not on a leg	6	rigid test mass before release
3	load cell	7	rigid test mass after release
4	connecting line		

Figure 10 – Dynamic test for type B anchor devices with legs (e.g. a tripod) and an anchor point(s) not on a leg

5.3.2.3 Anchor devices with legs and an anchor point on a leg

5.3.2.3.1 Where the manufacturer permits an anchor point on a leg, e.g. for attaching a retractable type fall arrester conforming to EN 360, proceed as described in 5.3.2.3.2 to 5.3.2.3.7.

5.3.2.3.2 Extend the legs of the anchor device to the maximum length permissible. Attach the connecting line to the anchor point on the leg of the anchor device (see Figure 11). Pass the connecting line around the apex pulley. Attach a load cell to the free end of the connecting line. Attach one end of the test lanyard (see 5.1) by means of a connector to the load cell. Connect the other end of the test lanyard, also by means of a connector, to the 200 kg rigid test mass and attach a quick release device to the rigid test mass.

5.3.2.3.3 Move the rigid test mass downwards until the test lanyard holds the mass. Then raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a minimum of 300 mm horizontally from the apex pulley but within the radius of the legs.

5.3.2.3.4 Release the rigid test mass and observe whether the rigid test mass is arrested and held clear of the ground, and that the anchor device remains stable. Record the peak load at the anchor point, the deflection of the anchor device and the displacement of the anchor point. If the anchor device is equipped with a fall indicator, check whether it indicates that a fall has occurred.

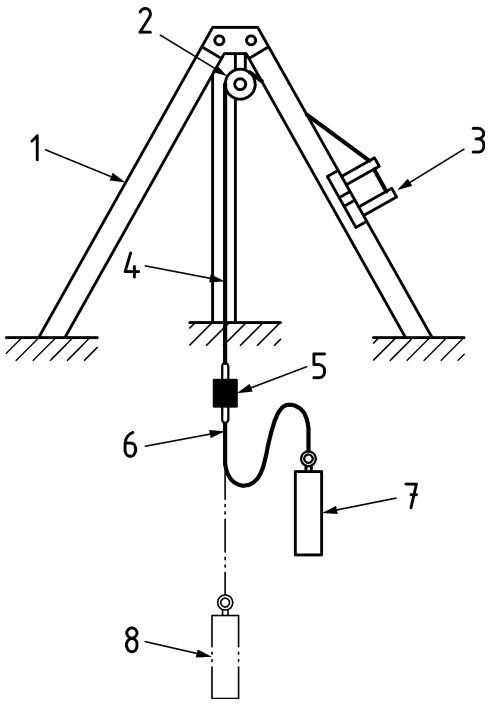
5.3.2.3.5 Leaving the 200 kg rigid test mass suspended from the anchor device or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard

as described in EN 795:2012, 5.2.1 and a free fall distance to generate a fall arrest load of ($9\ ^{+0,5}_{0}$) kN. For each test, leave the mass(es) from the previous test(s) suspended from the anchor device or apply the load statically.

NOTE To prevent collision of the test mass(es) the position of the suspended test mass(es) can be lowered or raised.

5.3.2.3.6 After the dynamic tests, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for ($3\ ^{+0,25}_{0}$) min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users, the mass would be 900 kg), and hold this or the equivalent load for ($3\ ^{+0,25}_{0}$) min. Check whether the rigid test mass is held clear of the ground.

5.3.2.3.7 If the manufacturer permits differential adjustment for uneven surfaces, test the anchor device at the maximum permitted differential adjustment.



Key

1	tripod	5	load cell
2	apex pulley	6	test lanyard
3	anchor point	7	rigid test mass before release
4	connecting line	8	rigid test mass after release

Figure 11 – Dynamic test for type B anchor devices with legs (e.g. a tripod) and an anchor point on a leg

5.3.3 Static strength test

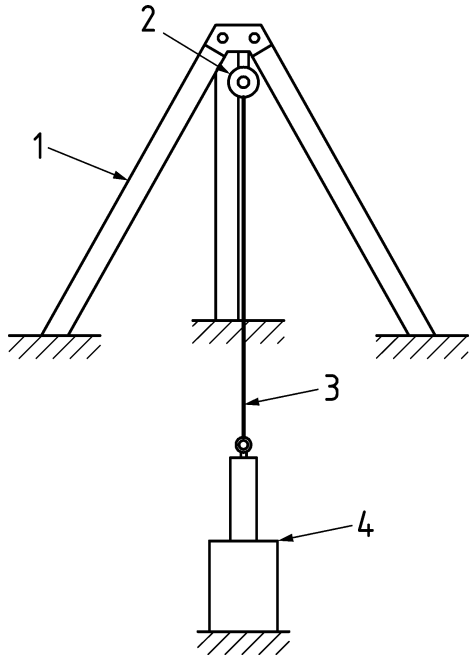
5.3.3.1 Anchor devices without legs

Install the anchor device in or on the static test apparatus specified in 4.1 of EN 364:1992 and apply to the anchor point a static load of ($12\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of

durability is not provided by the manufacturer, $(18\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user. Observe whether the anchor device holds the load for a period of $(3\ ^{+0,25}_{0})$ min.

5.3.3.2 Anchor devices with legs and an anchor point(s) not on a leg

Install the anchor device in or on the static test apparatus specified in 4.1 of EN 364:1992. Extend the legs of the anchor device to the maximum length permissible. Attach a connecting line to the anchor point and connect the connecting line to the static strength apparatus (see Figure 12). Apply to the anchor point a static load of $(12\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of durability is not provided by the manufacturer, $(18\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user. Observe whether the anchor device holds the load for a period of $(3\ ^{+0,25}_{0})$ min.



Key

1 tripod

2 anchor point

3 connecting line

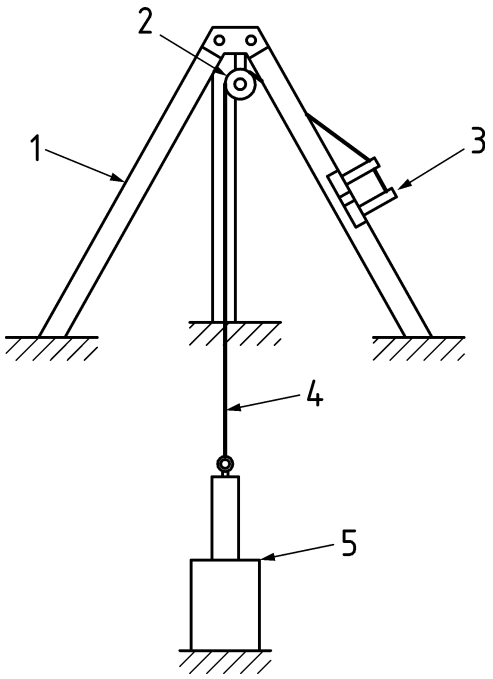
4 static test apparatus

Figure 12 – Static strength test for type B anchor devices with legs (e.g. a tripod) and an anchor point(s) not on a leg

5.3.3.3 Anchor devices with legs and an anchor point(s) on a leg

Install the anchor device in or on the static test apparatus specified in 4.1 of EN 364:1992. Extend the legs of the anchor device to the maximum length permissible. Attach a connecting line to the anchor point on the leg. Pass the connecting line around the apex pulley and connect it to the static strength apparatus (see Figure 13). Apply to the anchor point a static load of $(12\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and

where evidence of durability is not provided by the manufacturer, (18 $^{+1}_{0}$) kN + (1 $^{+0,1}_{0}$) kN for each additional user. Observe whether the anchor device holds the load for a period of (3 $^{+0,25}_{0}$) min.



Key

1 tripod

2 apex pulley

3 anchor point

4 connecting line

5 static test apparatus

Figure 13 – Static strength test for type B anchor device with legs (e.g. a tripod) and an anchor point on a leg

5.4 Type C anchor device

5.4.1 General

5.4.1.1 Performance predictions based on calculations or test results shall be available for configurations of the anchor device applied in 5.4.1.3, including information on:

a) the maximum deflection of the mobile anchor point(s);

b) the maximum load applied to the extremity anchor and those intermediate or corner units that are considered to be in-line fittings. Alternatively, for devices that do not incorporate an extremity anchor, e.g. a circular device, the maximum load in the anchor line;

c) the number of users permitted by the manufacturer.

5.4.1.2 Install the extremity and intermediate anchor(s) in or on the test apparatus, as appropriate, in accordance with the information supplied by the manufacturer, horizontally at an angle of ± 3°, where relevant using a construction fixing as recommended in the information supplied by the manufacturer, into or onto a sample of construction material(s) also recommended in the information supplied by the manufacturer.

5.4.1.3 Arrange the test configuration(s) taking into account the following:

a) the loading directions in use (e.g. intermediate and extremity anchors mounted on a wall, ceiling, roof or ground);

b) the span length;

NOTE A span equals the distance between flexible anchor line fixings, e.g. extremity anchor and intermediate anchor.

c) corners (internal and external corners, maximum deviation);

d) types and combinations of components, e.g. energy absorber(s), terminations, intermediate anchors, mobile anchor points, flexible anchor line(s).

5.4.1.4 If the anchor device does not have a mobile anchor point use a connection as specified in the information supplied by the manufacturer.

5.4.1.5 Where the intermediate anchor and corner anchor of the flexible anchor line do not permit articulation of the mobile anchor point with the direction of loading that could be applied in service, carry out the static strength test described in 5.4.3 or 5.4.5 in directions both in line and perpendicular to the intermediate anchor and corner anchor mounting bolts.

5.4.2 Single span

5.4.2.1 Dynamic strength and integrity test

5.4.2.1.1 Prior to testing, take into account the predictions of maximum dynamic load at the extremity anchor and maximum deflection of the flexible anchor line submitted by the manufacturer in accordance with 5.4.1.1.

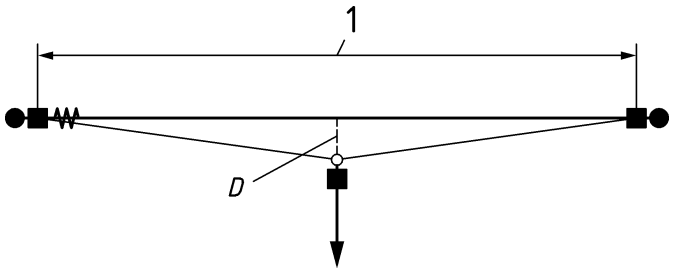
5.4.2.1.2 Install the manufacturer's longest permissible single-span anchor device in accordance with the information supplied by the manufacturer.

5.4.2.1.3 Attach a load cell to each end of the flexible anchor line so that the tension at the extremities can be measured.

5.4.2.1.4 Carry out one test using a test lanyard as described in 5.1, connected to a 200 kg rigid test mass.

5.4.2.1.5 Attach a load cell to a mobile anchor point. Attach one end of the test lanyard to the load cell by means of a connector and the other end of the test lanyard, also by means of a connector, to the rigid test mass. Position the mobile anchor point at the centre of the span. See Figure 14.

5.4.2.1.6 Attach a quick release device to the rigid test mass. Move the rigid test mass downwards until the test lanyard holds the mass. Remove the load until the flexible anchor line returns to its natural position. From this point, raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a maximum of 300 mm horizontally.



Key

1	longest/shortest span	→	direction of load
D	dynamic deflection	⩙	energy absorber (if fitted)
■	load cell	●	extremity anchor

Figure 14 — Example of a single-span type C anchor device test arrangement

5.4.2.1.7 Release the rigid test mass and observe and record whether the rigid test mass is arrested. Measure and record the maximum load at each end of the flexible anchor line and at the mobile anchor point. Also, measure and record the maximum dynamic deflection at the mobile anchor point (e.g. by high speed video, displacement transducer).

5.4.2.1.8 Check that the mobile anchor point does not become detached from the flexible anchor line and/or does not release the rigid test mass and the rigid test mass is held clear of the ground. Record the result.

5.4.2.1.9 Leaving the 200 kg rigid test mass suspended from the flexible anchor line or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1, another mobile anchor point and a free fall distance to generate a fall arrest load of $(9\ ^{+0,5}_{0})$ kN. For each test, leave the mass(es) from the previous test(s) suspended from the flexible anchor line or apply the load statically.

NOTE To prevent collision of the test mass(es) the position of the suspended test mass(es) can be lowered or raised.

5.4.2.1.10 After the dynamic test, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for $(3\ ^{+0,25}_{0})$ min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users the mass would be 900 kg), and hold this or the equivalent load for $(3\ ^{+0,25}_{0})$ min. Check whether the rigid test mass is held clear of the ground.

5.4.2.1.11 Install the manufacturer's shortest permissible single-span anchor device in accordance with the information supplied by the manufacturer and carry out the test described in 5.4.2.1.3 to 5.4.2.1.10.

5.4.3 Static strength test

Using the same test configurations and test positions as those used for the dynamic strength and integrity tests described in 5.4.2.1, apply a static test load of $(12\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of durability is not provided by the manufacturer, $(18\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user. Observe whether the anchor device holds the load for a period of $(3\ ^{+0,25}_{0})$ min.

5.4.4 Multi span

5.4.4.1 Dynamic strength and integrity test

5.4.4.1.1 Prior to testing, take into account the predictions of maximum dynamic load at the extremity anchor and maximum deflection of the flexible anchor line submitted by the manufacturer in accordance with 5.4.1.1.

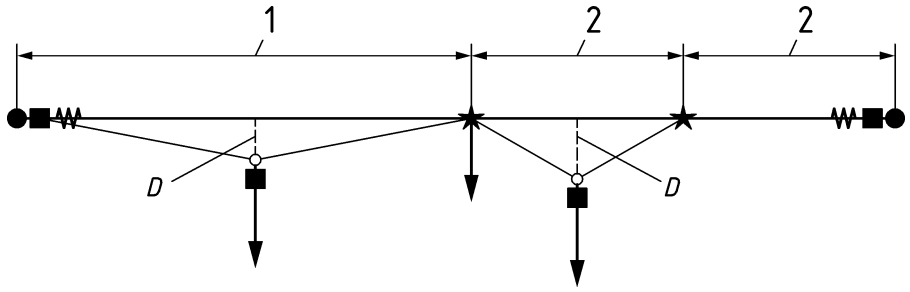
5.4.4.1.2 Install a flexible anchor line, which includes 3 spans, with the longest length permitted at one end of the installed flexible anchor line and where the other two spans are of the shortest length permitted by the manufacturer in accordance with the information supplied by the manufacturer.

5.4.4.1.3 Attach a load cell to each end of the flexible anchor line so that the tension at the extremities can be measured.

5.4.4.1.4 Carry out one test using a test lanyard as described 5.1, connected to a 200 kg rigid test mass.

5.4.4.1.5 Attach a load cell to a mobile anchor point. Attach one end of the test lanyard to the load cell by means of a connector and the other end of the test lanyard, also by means of a connector, to the rigid test mass. Position the mobile anchor point at the centre of the longest span. See Figure 15.

5.4.4.1.6 Attach a quick release device to the rigid test mass. Move the rigid test mass downwards until the test lanyard holds the mass. Remove the load until the flexible anchor line returns to its natural position. From this point, raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a maximum of 300 mm horizontally from the mobile anchor point.



Key

1	longest span	→	direction of load
2	shortest span	⩙	energy absorber (if fitted)
D	dynamic deflection (dependent on span)	●	extremity anchor
■	load cell	○	mobile anchor point
★	intermediate anchor		

Figure 15 — Example of a multi-span type C anchor device test arrangement without a corner anchor

5.4.4.1.7 Release the rigid test mass and observe and record whether the rigid test mass is arrested. Measure and record the maximum load at each end of the flexible anchor line and at the mobile anchor point. Also, measure and record the maximum dynamic deflection at the mobile anchor point (e.g. by high speed video, displacement transducer).

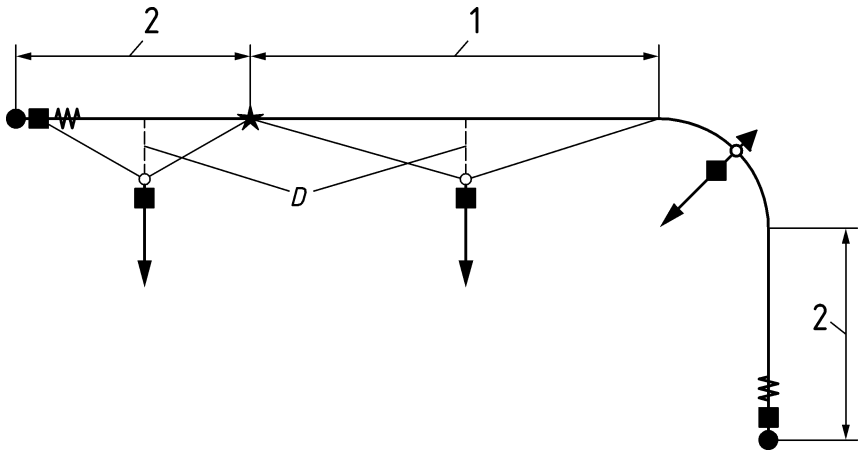
5.4.4.1.8 Check that the mobile anchor point does not become detached from the flexible anchor line and/or does not release the rigid test mass and the rigid test mass is held clear of the ground. Record the result.

5.4.4.1.9 Leaving the 200 kg rigid test mass suspended from the flexible anchor line or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1, another mobile anchor point and a free fall distance to generate a fall arrest load of ($9\ ^{+0,5}_{0}$) kN. For each test, leave the mass(es) from the previous test(s) suspended from the flexible anchor line or apply the load statically.

NOTE To prevent collision of the test masses the position of the suspended test mass(es) can be lowered or raised.

5.4.4.1.10 After the dynamic tests, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for ($3\ ^{+0,25}_{0}$) min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users the mass would be 900 kg), and hold this or the equivalent load for ($3\ ^{+0,25}_{0}$) min. Check that the rigid test mass is held clear of the ground.

5.4.4.1.11 Where there is a corner anchor fitted in the flexible anchor line, carry out the dynamic strength and integrity test with the mobile anchor point positioned at the corner anchor. See Figure 16.



Key

1	longest span	▲	corner anchor
2	shortest span	⟶	direction of load
D	dynamic deflection (dependent on span)	ᴡ	energy absorber (if fitted)
■	load cell	●	extremity anchor
★	intermediate anchor	○	mobile anchor point

Figure 16 — Example of a multi-span type C anchor device test arrangement with a corner anchor

5.4.4.1.12 Where there are entry/exit line fittings or a joint in the line, carry out the dynamic strength and integrity test with the mobile anchor point positioned at these positions.

5.4.4.1.13 Repeat the tests described in 5.4.4.1.3 to 5.4.4.1.12 for the shortest span permitted by the manufacturer at the middle of the shortest span between the intermediate anchors. See Figure 15.

5.4.5 Static strength test

Using the same test configurations as those used in the test described in 5.4.4.1, apply to the mobile anchor point, or a suitable connector attached to the flexible anchor line, a static load of ($12\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of durability is not provided by the manufacturer, ($18\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user. Observe whether the anchor device holds the load for a period of ($3\ ^{+0,25}_{0}$) min.

5.5 Type D anchor device

5.5.1 General test requirements

5.5.1.1 Install the extremity and intermediate anchor(s) in or on the test apparatus, as appropriate, in accordance with the information supplied by the manufacturer, horizontally with a tolerance of ± 3°, where relevant using a construction fixing as recommended in the information supplied by the manufacturer, into or onto a sample of construction material(s) also recommended in the information supplied by the manufacturer.

5.5.1.2 Arrange the test configuration(s) taking into account the following:

a) the loading directions in use (e.g. intermediate and extremity anchors mounted on a wall, ceiling, roof or ground);

b) the longest span length and maximum permitted cantilever distance;

NOTE A span equals the distance between rigid anchor line fixings, e.g. extremity anchor and intermediate anchor.

c) corners (internal and external corners, maximum deviation);

d) types and combinations of components, e.g. end stops, intermediate anchors, mobile anchor point, rigid anchor line joint or junction.

5.5.1.3 If the anchor device does not have a mobile anchor point use a connection as specified in the information supplied by the manufacturer.

5.5.2 Dynamic strength and integrity

5.5.2.1 Install a rigid anchor line with the longest span and the maximum cantilever distance *d* permitted by the manufacturer in accordance with 5.5.1 and the information supplied by the manufacturer.

5.5.2.2 If the manufacturer offers a corner(s) as an option for the device, include a corner with the largest internal corner radius as permitted by the manufacturer between the two spans.

5.5.2.3 Carry out one test using a test lanyard as described in 5.1, connected to a 200 kg rigid test mass.

5.5.2.4 Attach a load cell to a mobile anchor point. Attach one end of the test lanyard to the load cell by means of a connector and the other end of the test lanyard, also by means of a connector, to the rigid test mass. Position the mobile anchor point at the centre of the span. See Figure 17.

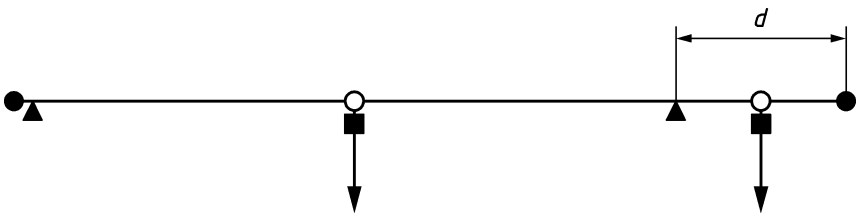
5.5.2.5 Attach a quick release device to the rigid test mass. Move the rigid test mass downwards until the test lanyard holds the mass. Then raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a maximum of 300 mm horizontally from the mobile anchor point.

5.5.2.6 Release the rigid test mass and observe and record whether the rigid test mass is arrested. Record the peak load at the anchor point, the deflection of the anchor device and the displacement of the anchor point measured from its initial position to its point of rest.

5.5.2.7 Check that the mobile anchor point does not become detached from the rigid anchor line and that the rigid test mass is held clear of the ground. Record the result.

5.5.2.8 Leaving the 200 kg rigid test mass suspended from the rigid anchor line or with an equivalent static load applied, repeat the dynamic test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1, another mobile anchor point and a free fall distance to generate a fall arrest load of $(9\ ^{+0,5}_{0})$ kN. For each test leave the mass(es) from the previous test(s) suspended from the rigid anchor line or apply the load statically.

5.5.2.9 After the dynamic test, for two users increase the mass to 600 kg or an equivalent load on the anchor device and hold it for $(3\ ^{+0,25}_{0})$ min. For more than two users, increase the mass by 150 kg per user or an equivalent load (e.g. for 4 users the mass would be 900 kg), and hold this or the equivalent load for $(3\ ^{+0,25}_{0})$ min. Check that the rigid test mass is held clear of the ground.



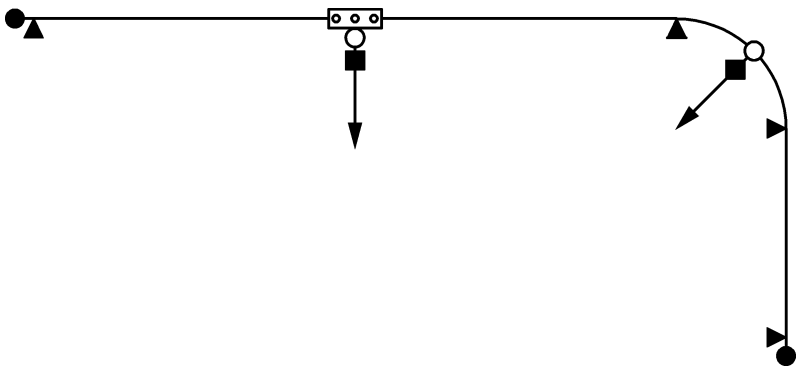
Key

■	load cell	●	end stop
▲	rigid anchor line fixing	○	mobile anchor point
⟶	load direction	*d*	cantilever distance

Figure 17 — Example of a type D anchor device test arrangement including a cantilever

5.5.2.10 If a cantilever is permitted by the manufacturer, repeat the test at the maximum cantilever distance (see Figure 17). Observe and record the maximum deflection of the rail and mobile anchor point. Check that the mobile anchor point does not become detached from the rigid anchor line and that the rigid test mass is held clear of the ground. Record the result.

5.5.2.11 Repeat the dynamic strength and integrity test in all directions the load can be applied in service at different rigid anchor line fixings, e.g. extremity anchor, intermediate anchor, at the middle of a corner, rigid anchor line joint or junction, end stop. See Figure 18.



Key

■	load cell	●	end stop
▲	rigid anchor line fixing	○	mobile anchor point
⟶	load direction	⊡	rigid anchor line joint or junction

Figure 18 — Example of a type D anchor device test arrangement including a rigid anchor line joint or junction and a corner anchor

5.5.3 Static strength test

Using the same test configurations as those used in the test described in 5.5.2 apply to the mobile anchor point a static load of $(12\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of durability is not provided by the manufacturer, $(18\ ^{+1}_{0})$ kN + $(1\ ^{+0,1}_{0})$ kN for each additional user. Observe whether the anchor device holds the load for a period of $(3\ ^{+0,25}_{0})$ min.

5.6 Type E anchor device

5.6.1 General test requirements

5.6.1.1 Install the anchor device on the dynamic performance test apparatus, in accordance with the information supplied by the manufacturer, on typical samples of the surface materials and site conditions (e.g. dry and wet, minimum and maximum ambient temperatures, angle of surface) for which the manufacturer claims suitability.

5.6.1.2 Test each anchor point in accordance with 5.6.2, 5.6.3 and 5.6.4.

5.6.2 Dynamic performance

5.6.2.1 Carry out one test using a test lanyard as described in 5.1, connected to a 200 kg rigid test mass.

5.6.2.2 When testing for wet conditions, before assembling the type E anchor device on the test surface, and no more than 0,5 h before the rigid test mass is released, apply water in the temperature range 10 °C to 25 °C at the rate of 0,5 l/m^2 of the test surface so that the test surface is wet.

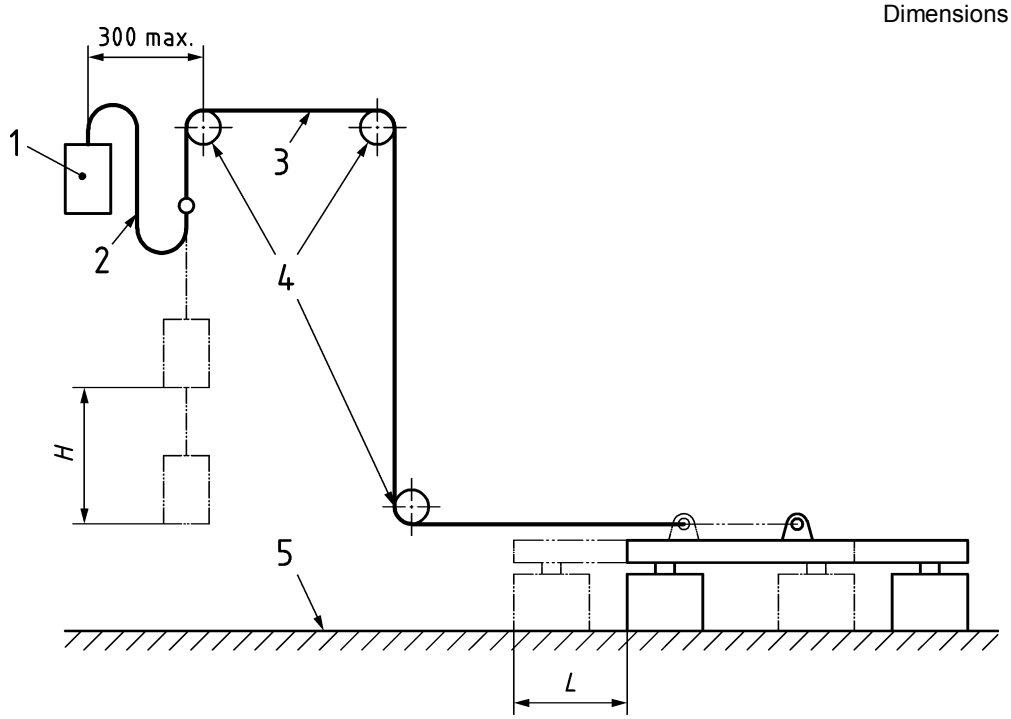
5.6.2.3 Attach a quick release device to the rigid test mass. Move the rigid test mass downwards until the test lanyard holds the mass. Then raise the rigid test mass to the free fall distance determined in 5.1 and hold it at a maximum of 300 mm horizontally from the pulley.

5.6.2.4 Immediately before releasing the rigid test mass, apply more water so the test surface is wet.

5.6.2.5 Release the rigid test mass within 2 min of the second application of water and measure displacements *L* and *H* both immediately following the arrest of the rigid test mass and again after 15 min. Check that the rigid test mass is arrest and held clear of the ground. See Figure 19.

NOTE Displacement *H* can be used to determine ground clearance for the user.

Dimensions in millimetres



Key

1	rigid test mass	4	pulleys
2	test lanyard	5	test surface
3	connecting line	*H, L*	displacement of rigid test mass

Figure 19 — Example of a dynamic performance test apparatus for type E anchor devices

5.6.2.6 Leaving the 200 kg rigid test mass suspended from the anchor device, repeat the dynamic strength and integrity test for each additional user using a rigid test mass of 100 kg, a test lanyard as described in EN 795:2012, 5.2.1 and a free fall distance to generate a fall arrest load of ($9\ ^{+0,5}_{0}$) kN. For each test, leave the mass(es) from the previous test(s) suspended from the anchor device or apply the load statically.

NOTE In order to prevent collision of the test mass(es) the position of the suspended test mass(es) can be lowered or raised.

5.6.3 Post-arrest suspension

5.6.3.1 Carry out the dynamic performance test as described in 5.6.2 with the type E anchor device positioned on the type of surface for which the greatest displacement *L* was recorded in the dynamic performance tests specified in 5.6.2.

5.6.3.2 Without reducing the tension in the wire rope, within 5 min increase the rigid test mass to (600 ± 3) kg + (100 ± 3) kg for each additional user (e.g. 4 users = 800 kg) and apply further water around and

over the anchor device at the rate described in 5.7.2.2 of EN 795:2012, keeping the rigid test mass suspended for a period of ($3\ ^{+0,25}_{0}$) min.

5.6.3.3 Measure the displacement of the anchor device at its leading edge where it is in contact with the surface.

5.6.4 Static strength

Install the anchor device in or on the static test apparatus specified in 5.1 by fixing the anchor device directly to the test apparatus (e.g. by bolting, by constructing a barrier), as appropriate, and apply in each critical direction of use permitted by the information supplied by the manufacturer a static load of ($12\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user (e.g. 4 users = 15 kN) or, where any load bearing element or component is made from non-metallic material(s) and where evidence of durability is not provided by the manufacturer, ($18\ ^{+1}_{0}$) kN + ($1\ ^{+0,1}_{0}$) kN for each additional user. Observe whether the anchor device holds the load for a period of ($3\ ^{+0,25}_{0}$) min.

6 Marking

Marking of the anchor device shall conform to Clause 6 of EN 795:2012, except for 6 a), and, in addition, shall include the maximum number of users permitted simultaneously.

7 Information to be supplied by the manufacturer

Information supplied by the manufacturer shall conform to Clause 7 of EN 795:2012, except for 7 a), and, in addition, shall include the maximum number of users permitted simultaneously and for Type C anchor devices the minimum breaking strength of the flexible anchor line.

Bibliography

[1] EN 360, *Personal protective equipment against falls from a height — Retractable type fall arresters:*

[2] EN 363, *Personal fall protection equipment — Personal fall protection systems*

[3] EN 516, *Prefabricated accessories for roofing — Installations for roof access — Walkways, treads and steps*

[4] EN 517, *Prefabricated accessories for roofing — Roof safety hooks*

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