BS EN 13374:2013

BSI Standards Publication

Temporary edge protection systems — Product specification — Test methods

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National foreword

This British Standard is the UK implementation of EN 13374:2013. It supersedes BS EN 13374:2004, which is withdrawn.

The title of this standard refers to temporary edge protection systems. In practice this standard has been applied to permanent counter balanced systems, where the structure prevents compliance with BS 6180:2011, *Barriers in and about buildings - Code of practice*.

This standard can also be applied where the protection of only a few persons, in a controlled environment, not subject to panic, crowd control or access by the general public, can be demonstrated (e.g. maintenance of plant and equipment on roofs).

The UK participation in its preparation was entrusted by Technical Committee B/514, Access and support equipment, to Subcommittee B/514/21, Access and working scaffolds and their components (props, tubes and couplers).

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Temporary edge protection systems - Product specification - Test methods

Garde-corps périphériques temporaires - Spécification du produit - Méthodes d'éssai

Temporäre Seitenschutzsysteme - Produktfestlegungen - Prüfverfahren

This European Standard was approved by CEN on 21 March 2013.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN 13374:2013) has been prepared by Technical Committee CEN/TC 53 “Temporary works equipment”, the secretariat of which is held by DIN.

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 November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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

This document supersedes EN 13374:2004.

Temporary edge protection systems are used in construction work, primarily to prevent persons and objects from falling to a lower level from roofs, edges, stairs and other areas where protection is required.

In most European countries temporary edge protection, or other types of fall protection devices, are required when a risk assessment identifies a fall risk regardless of height. In contrast to being secured by a lanyard, greater mobility in the working area is provided when edge protection is in place. The temporary edge protection can in some situations also act as a handrail for people to hold onto when working or walking close to an edge. COUNCIL DIRECTIVE 92/57/EEC was taken into consideration when reviewing this product standard.

While this standard also includes requirements to protect people from falling objects, e.g. by the provision of toeboards, there could be circumstances where this is insufficient and additional measures, which are beyond the scope of this document, will need to be taken.

Classes specified in this standard are intended to cater for the varied requirements appropriate for different uses.

It is important that the structure to which temporary edge protection is attached can support the load that the system is designed for.

This standard is a revised version of the 2004 version. In general, the following changes have been made:

— the normative references have been updated,

— most of the figures have been updated,

— three tables have been added to clarify design and test requirements,

— all testing related information from Clause 5 and 6 have been moved to Clause 7,

— subclause 5.3 has been simplified,

— subclause 6.1.3 has been added,

— subclause 6.3 has been clarified with table and pictures,

— Clause 7 has been rewritten in most parts,

— Annex A has been deleted, the former Annex B is now Annex A;

— editorial changes and clarifications have been done.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the requirements and test methods for temporary edge protection systems for use during construction or maintenance of buildings and other structures.

This standard applies to edge protection systems for flat and inclined surfaces and specifies the requirements for three classes of temporary edge protection.

For edge protection systems with an arrest function (e.g. falling or sliding down a sloping roof) this standard specifies requirements for energy absorption.

This standard includes edge protection systems, some of which are fixed to the structure and others, which rely on gravity and friction on flat surfaces.

This standard does not provide requirements for edge protection systems intended for:

— protection against impact from vehicles or from other mobile equipment,

— protection from sliding down of bulk loose materials, snow etc,

— protection of areas accessible to the public.

This standard does not apply to side protection on scaffolds according to EN 12811-1 and EN 1004.

NOTE This does not prevent these systems to be used on temporary structures.

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 74-1, *Couplers, spigot pins and baseplates for use in falsework and scaffolds — Part 1: Couplers for tubes — Requirements and test procedures*

EN 74-2, *Couplers, spigot pins and baseplates for use in falsework and scaffolds — Part 2: Special couplers — Requirements and test procedures*

EN 74-3, *Couplers, spigot pins and baseplates for use in falsework and scaffolds — Part 3: Plain base plates and spigot pins — Requirements and test procedures*

EN 338, *Structural timber — Strength classes*

EN 596, *Timber structures — Test methods — Soft body impact test of timber framed walls*

EN 1263-1, *Safety nets — Part 1: Safety requirements, test methods*

EN 1990, *Eurocode — Basis of structural design*

EN 1991-1-4, *Eurocode 1: Actions on structures — Part 1-4: General actions — Wind actions*

EN 1993-1-1, *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 1993-1-2, *Eurocode 3: Design of steel structures — Part 1-2: General rules — Structural fire design*

EN 1993-1-3, *Eurocode 3 — Design of steel structures — Part 1-3: General rules — Supplementary rules for cold-formed members and sheeting*

EN 1993-1-4, *Eurocode 3 — Design of steel structures — Part 1-4: General rules — Supplementary rules for stainless steels*

EN 1993-1-5, *Eurocode 3 — Design of steel structures — Part 1-5: Plated structural elements*

EN 1993-1-6, *Eurocode 3 — Design of steel structures — Part 1-6: Strength and Stability of Shell Structures*

EN 1993-1-7, *Eurocode 3 — Design of steel structures — Part 1-7: Plated structures subject to out of plane loading*

EN 1993-1-8, *Eurocode 3: Design of steel structures — Part 1-8: Design of joints*

EN 1993-1-9, *Eurocode 3: Design of steel structures — Part 1-9: Fatigue*

EN 1993-1-10, *Eurocode 3: Design of steel structures — Part 1-10: Material toughness and through-thickness properties*

EN 1993-1-11, *Eurocode 3: Design of steel structures — Part 1-11: Design of structures with tension components*

EN 1993-1-12, *Eurocode 3: Design of steel structures — Part 1-12: Additional rules for the extension of EN 1993 up to steel grades S 700*

EN 1993-2, *Eurocode 3: Design of steel structures — Part 2: Steel bridges*

EN 1993-3-1, *Eurocode 3 - Design of steel structures — Part 3-1: Towers and masts and chimneys- Towers and masts*

EN 1993-3-2, *Eurocode 3: Design of steel structures — Part 3-2: Towers, masts and chimneys – Chimneys*

EN 1993-4-1, *Eurocode 3: Design of steel structures — Part 4-1 : Silos*

EN 1993-4-2, *Eurocode 3: Design of steel structures — Part 4-2: Tanks*

EN 1993-4-3, *Eurocode 3: Design of steel structures — Part 4-3: Pipelines*

EN 1993-5, *Eurocode 3: Design of steel structures — Part 5: Piling*

EN 1993-6, *Eurocode 3: Design of steel structures — Part 6: Crane supporting structures*

EN 1995-1-1, *Eurocode 5 — Design of timber structures — Part 1-1: General - Common rules and rules for buildings*

EN 1995-1-2, *Eurocode 5 — Design of timber structures — Part 1-2: General - Structural fire design*

EN 1995-2, *Eurocode 5: Design of timber structures — Part 2: Bridges*

EN 1999-1-1, *Eurocode 9 — Design of aluminium structures — Part 1-1: General structural rules*

EN 1999-1-2, *Eurocode 9 — Design of aluminium structures — Part 1-2: Structural fire design*

EN 1999-1-3, *Eurocode 9: Design of aluminium structures — Part 1-3: Structures susceptible to fatigue*

EN 1999-1-4, *Eurocode 9 — Design of aluminium structures — Part 1-4: Cold formed structural sheeting*

EN 1999-1-5, *Eurocode 9 — Design of aluminium structures — Part 1-5: Shell structures*

EN 12811-3:2002, *Temporary works equipment — Part 3: Load testing*

3 Terms and definitions

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

3.1
edge protection system
set of components intended to protect people from falling to a lower level and to retain materials

Note 1 to entry: see Figure 1.

3.2
principal guardrail
rail or continuous element forming the top of the edge protection system

3.3
intermediate guardrail
rail or continuous element between the principal guardrail and the working surface

3.4
intermediate protection
protection barrier formed (e.g. as a fencing structure or a safety net) between the principal guardrail and the working surface

Note 1 to entry: see Figure 2.

3.5
toeboard
upstanding element provided specifically to prevent materials or persons from falling or sliding off a surface

3.6
post
principal vertical support of the edge protection system to which the guardrails and toeboards are attached

Note 1 to entry: Components 3.2 to 3.6 can be manufactured in full or part of an integrated edge protection system.

3.7
falling heigt, H_f
vertical distance between the point on which a person may stand and the lowest point on the protection intended to arrest any fall

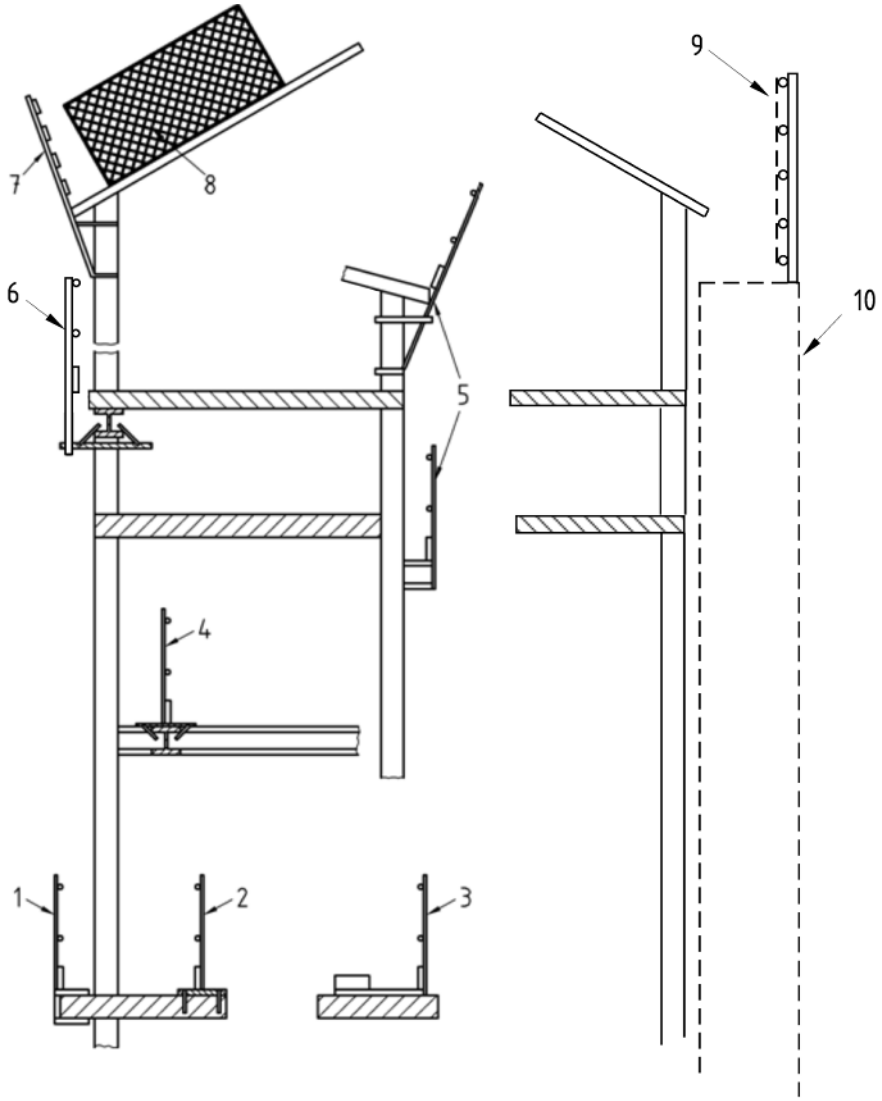
Note 1 to entry: See Figure 3.

3.8
height of the edge protection system
distance between the uppermost point of the principal guardrail and the working surface measured perpendicular to the working surface

3.9
working surface
surface on which persons stand, walk or work

3.10
counterweight
component to (by its own weight) prevent the edge protection system from sliding or from overturning

Note 1 to entry: Figure 1 illustrates some of the various types of edge protection.



Key

1 slab edge clamp system	6 beam bottom flange clamp system
2 fixed to floor type system	7 column clamp system – sloping roof
3 counterweighted system	8 fencing system
4 beam top flange clamp system	9 edge protection on temporary structure
5 column clamp system – slabs and flat/low sloping roofs	10 temporary structure (not defined in this standard)

Figure 1 — Diagrammatic examples of different types of temporary edge protection

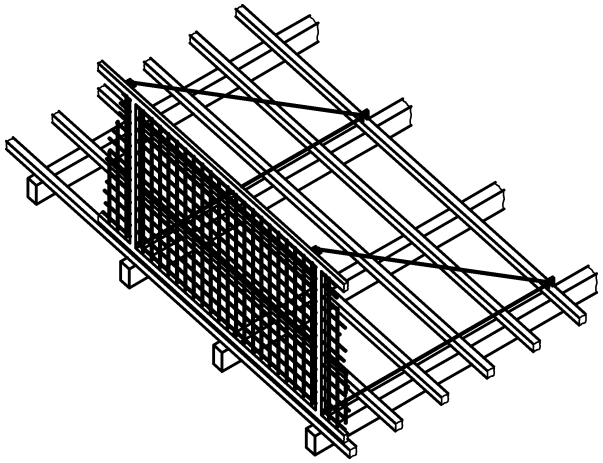
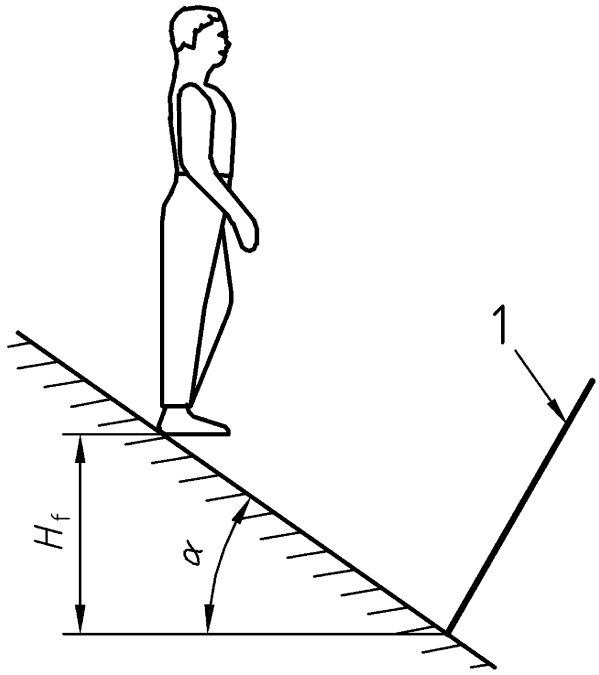


Figure 2 — Example of an edge protection system with a net as intermediate protection on a sloping roof



Key

H_f falling height

α angle of inclination of the working surface

1 edge protection system

Figure 3 — Falling height on an inclined surface

4 Classification of edge protection systems

4.1 Class A

Class A protection provides resistance to static loads only, based on the requirements to:

— support a person leaning on the protection or provide a handhold when walking beside it; and

— collectively stop a person who is walking or falling towards the protection.

4.2 Class B

Class B protection provides resistance to static loads and low dynamic actions only, based on the requirements to:

— support a person leaning on the protection or provide a handhold when walking beside it; and

— collectively stop a person who is walking or falling towards the protection;

— collectively stop a person sliding/falling down a sloping surface.

4.3 Class C

Class C protection provides resistance to high dynamic forces based on the safety requirements to prevent the fall of a person sliding down a steep sloping surface.

— Collectively stop a person sliding/falling down a steep sloping surface.

NOTE More guidance about the use of classes is given in Annex A.

5 Requirements

5.1 General

5.1.1 Basic requirements

An edge protection system shall consist of a principal guardrail and either an intermediate guardrail or an intermediate protection. It shall also be possible to attach a toeboard. All components in the system shall be designed to avoid accidental removal or displacement of any component in any direction during use.

The components shall be designed and manufactured so that injury to persons from puncturing or lacerating of the skin is prevented.

NOTE An edge protection system can be manufactured as an integrated unit.

5.1.2 Nets

Safety nets used in edge protection systems shall be in accordance with EN 1263-1.

The fixing of each net shall satisfy the load requirements of the intended class or classes.

Nets shall be installed in tension to avoid slackness.

5.1.3 Principal guardrail

The distance between the uppermost part of the principal guardrail and the working surface shall be at least 1 000 mm, at any point, measured perpendicular to the working surface, see Figure 4 and 5. The principal guardrails shall be continuous and any horizontal gaps shall be less than 120 mm.

5.1.4 Toeboard

The distance between the uppermost part of the toeboard and the working surface shall be at least 150 mm, at any point, measured perpendicular to the working surface, see Figure 4 and 5.

The toeboard shall be designed to avoid gaps between it and the working surface. If there are gaps, a sphere with a diameter of 20 mm shall not pass through them.

For other situations for example where the working surface is not flat, any gaps should be maintained as small as practicable.

5.2 Additional dimensional requirements for individual classes

Dimensions in millimetres

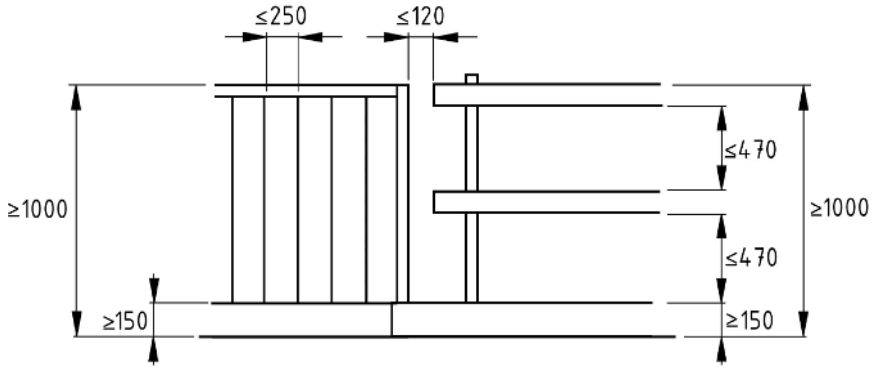


Figure 4 — Dimensional height and spacing of edge protection components

5.2.1 Edge protection system class A

The inclination of edge protection system class A shall not deviate from the perpendicular to the working surface by more than 15°, outwards or inwards.

If an intermediate guardrail is provided, any gap shall be so dimensioned that a sphere of 470 mm diameter will not pass through the protection, see Figure 4. If there is no intermediate guardrail or if it is not continuous, the edge protection system shall be so dimensioned that a sphere with a diameter of 250 mm will not pass through it.

5.2.2 Edge protection system class B

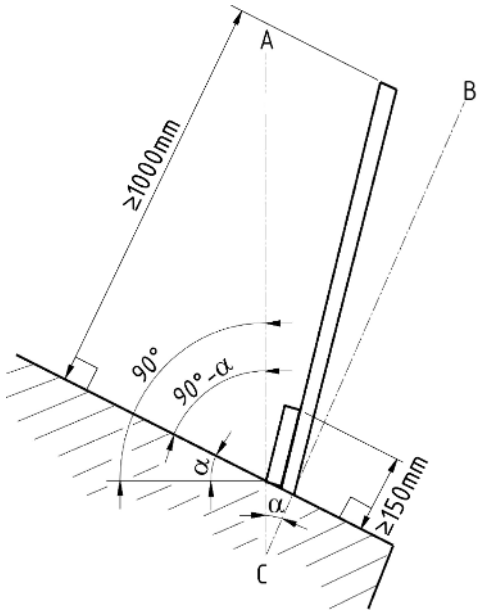
The inclination of edge protection system class B shall not deviate from the perpendicular to the working surface by more than 15°, outwards or inwards.

Any gap in a class B edge protection shall be so dimensioned that a sphere of 250 mm diameter will not pass through the protection.

5.2.3 Edge protection system class C

The inclination of the edge protection shall be between the vertical line AC of Figure 5, and a line perpendicular to the surface, line BC. Gaps in class C edge protection shall be dimensioned so that a sphere with a diameter of 100 mm will not pass through them.

Dimensions in millimetres



Key

AC vertical line

BC line perpendicular to working surface

α angle of inclination of the working surface

Figure 5 — The inclination of the edge protection system

5.3 Material requirements

5.3.1 General

Materials shall fulfil the requirements given in relevant European Standards, where design data is provided. Other materials shall be in accordance with appropriate European Standards. If European Standards do not exist, ISO Standards may be applied.

Materials shall be sufficiently robust and durable to withstand normal working conditions.

Materials shall be free from any impurities and defects, which may affect their satisfactory use.

Information about the most commonly used materials is given in EN 12811-2. Material requirements for nets are given in EN 1263-1. When materials are used, whose properties in relation to the intended application (e.g. temperature, ageing, UV-degradation) are not given in any available standard an adequate assessment is required in order to fulfil the requirements of this standard.

Requirements for couplers are given in EN 74 parts 1 to 3. Couplers and tubes used shall be tested and proven for function and compliance with the standard.

5.3.2 Steel

Steels of deoxidation type FU (rimming steels) shall not be used.

Information on common types of corrosion protection is given in EN 12811-2.

5.3.3 Timber

Timber shall be strength graded in accordance with EN 338 to have a minimum classification of C16.

If a protective coating is used, it shall not impede the visual inspection of the material.

Plywood shall have good durability with regard to climatic conditions.

5.3.4 Material for counterweights

The materials employed shall be solid within the usual range of temperature. Granulated or fluid materials such as sand or water shall not be used. Each counterweight shall be capable of being positively secured against accidental displacement.

5.4 Static and dynamic design requirements for individual classes

5.4.1 General

The classes of edge protection systems shall be subject to load types according to Table 1.

Table 1 — Overview of design requirements

Class	Type of load	
	Static load	Dynamic load
A	X	--
B	X	X
C	--	X

5.4.2 Edge protection system class A

Class A edge protection system shall fulfil the design requirements given in Clause 6.

Class A has no dynamic load requirement.

5.4.3 Edge protection system class B

Class B edge protection system shall fulfil the design requirements given in Clause 6.

Class B edge protection system shall be capable of absorbing a kinetic energy of 1100 J anywhere along the protection up to a height of 200 mm above the working surface and 500 J at all higher parts. For verification of this requirement, the product shall successfully pass the dynamic tests specified in 7.5.1.

5.4.4 Edge protection system class C

Class C has no static load requirement.

Class C edge protection system shall be capable of absorbing 2200 J of kinetic energy anywhere along the protection up to a height of 200 mm above the working surface and 500 J at all higher parts. For verification of this requirement, the product shall successfully pass the dynamic tests specified in 7.5.1 and 7.5.2.

6 Structural design

6.1 General

6.1.1 Introduction

The structural design shall be such that the structure is in accordance with the requirements in the following respects:

1a) ultimate limit state with fundamental loads including load bearing capacity and stability against sliding, overturning and uplift;

1b) ultimate limit state with accidental loads: load bearing capacity for non intended loads, e.g. from people climbing on the edge protection;

2) serviceability limit state: elastic deflection of the edge protection.

6.1.2 Method of design

If not specified otherwise the design shall be carried out following the limit state method. All loads specified in this standard shall be treated as characteristic loads.

The edge protection system as a whole, as well as each component, shall fulfil the individual load requirements separately.

The design shall take into account the combination of the structure, the system and its components and the fixing method.

Where it is not possible to verify the static load requirements by calculation, verification by testing shall be carried out.

Design shall be carried out in accordance with the European Standards for structural engineering. The standards include:

- For steel: EN 1993-series, part 1-1 to 6.
- For aluminium: EN 1999-series, part 1-1 to 1-5.
- For timber: EN 1995-series, part 1-1 to 2.
- For design: EN 1990.

If there are conflicts between provisions in this standard and other standards, then the provisions in this standard shall have precedence.

When using EN 1995-series the following characteristics shall be used.

Load duration:

— instantaneous for accidental load;

— short-term duration for other loads.

Service class:

— class 2.

6.1.3 Ultimate limit state (fundamental and accidental loads)

a) It shall be verified that:

$$E_d \leq R_d \quad (1)$$

where

E_d is the design value of effect of actions, e.g. bending stress, an internal force or moment

R_d is the corresponding design value of resistance.

The value of E_d shall be established from the design values of the actions Q_d.

b) Based on the characteristic value of the action $Q_{k,i}$, the design value of the action $Q_{d,i}$ shall be calculated using:

$$Q_{d,i} = \gamma_{F,i} \times Q_{k,i} \quad (2)$$

where

$Q_{d,i}$ is the design value of the action i

$Q_{k,i}$ is the characteristic value of the action i and shall be taken from Table 2

$\gamma_{F,i}$ is the partial safety factor and shall be taken from Table 2

c) The design value of the resistance $R_{d,i}$ shall be calculated using:

For metal $$R_{d,i} = R_{k,i} / \gamma_{M,i} \quad (3)$$

For timber $$R_{d,i} = R_{k,i} \times k_{mod} / \gamma_{M,i} \quad (4)$$

where

$R_{k,i}$ is the characteristic value of the resistance for material “i”

k_{mod} is modification factor for duration of load and moisture content

$\gamma_{M,i}$ is the partial factor for material “i”

6.1.4 Serviceability limit state

It shall be verified that:

$$\text{elastic deflection} \leq \text{deflection requirement} \quad (5)$$

Regarding the requirements according to Table 2.

6.2 Partial safety factors

6.2.1 Ultimate limit state with fundamental loads

— γ_F = 0,9 for favourable loads, for example counterweight when calculating the stability of counterweighted protection;

— γ_F = 1,5 for all permanent and variable loads;

— γ_M = 1,1 for ductile metallic materials (some ductility limits are given in EN 12811-2);

— γ_M = 1,25 for brittle metallic materials;

— γ_M = 1,3 for timber.

6.2.2 Serviceability limit state

— γ_F = 1,0

— γ_M = 1,0

6.2.3 Ultimate limit state with accidental loads

— γ_F = 1,0

— γ_M = 1,0

6.3 Static loads

6.3.1 General

An edge protection system shall be designed for the following loading criteria.

Point loads can act anywhere along the system, e.g. at the post or between the posts.

Point loads shall be assumed to be distributed upon a maximum area of (100 × 100) mm. For a net or a fencing structure, this load shall be assumed to be uniformly distributed upon a maximum area of (300 × 300) mm.

If nothing else is stated, all loads shall act in the most unfavourable position(s) of the edge protection system including all of its components.

Table 2 — Overview of static load requirements

Line No.	Clause	Load case	Designation	Point Load [N]	Distributed Load q_i [N/m^2]	γ_F	Requirement
1	6.3.2	Serviceability Limit State Toeboard level	F_{T2}	200	-	1,0	max. 55 mm elastic deflection of the system
		Serviceability Limit State Guardrails level	F_{T1}	300			
2	6.3.3	Ultimate Limit State Toeboard level	F_{H2}	200	-	1,5	$E_d \leq R_d$
		Ultimate Limit State All other parts	F_{H1}	300			
3	6.3.4	Ultimate Limit State, Maximum Wind	Q_{MW}	-	600	1,5	$E_d \leq R_d$
4	6.3.5	Ultimate Limit State, Load Combination Toeboard level	$Q_{WW} + F_{H2}$	200	200	1,5	$E_d \leq R_d$
		Ultimate Limit State, Load Combination All other parts	$Q_{WW} + F_{H1}$	300			
5	6.3.6	Ultimate Limit State, Parallel	F_{H3}	200	-	1,5	$E_d \leq R_d$
6	6.3.7	Ultimate Limit State with accidental loads	F_D	1250	-	1,0	$E_d \leq R_d$ max. 300 mm deflection during load

NOTE Lines 2 to 5 specify fundamental loads.

6.3.2 Serviceability limit state

Loads F_{Ti} shall act as follows:

— perpendicular to the edge protection system in the outward direction, and

— downwards parallel to the edge protection system.

The loads shall act separately and on posts, guardrails and toeboards.

See Figures 6 and 7 and line 1 of Table 2.

For posts and guardrails, F_{T1} = 300 N.

For toeboards, F_{T2} = 200 N.

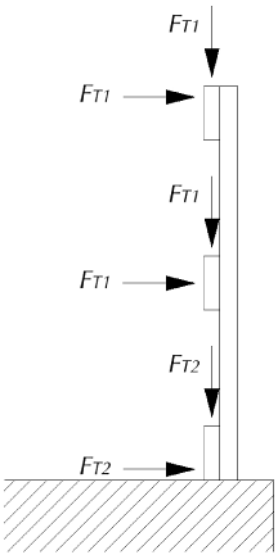


Figure 6 — Serviceability loads, alternative 1 Loads acting separately

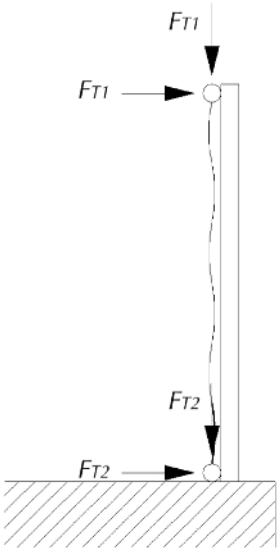


Figure 7 — Serviceability loads, alternative 2 Loads acting separately

6.3.3 Ultimate limit state – Point loads

Loads F_{Hi} shall act perpendicular to the edge protection system in the outward direction. See Figures 8 and 9 and line 2 of Table 2.

For toeboards, F_{H2} = 200 N.

For all other parts (posts, guardrails, nets etc.), F_{H1} = 300 N.

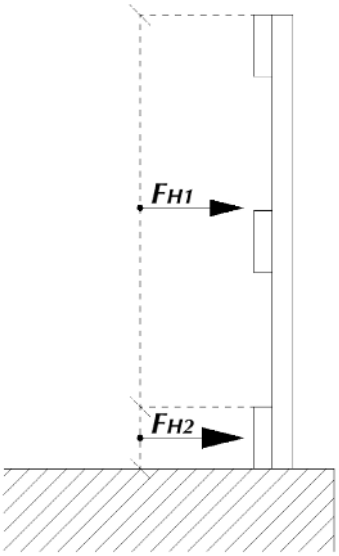


Figure 8 — Ultimate limit load alternative 1 Loads acting separately

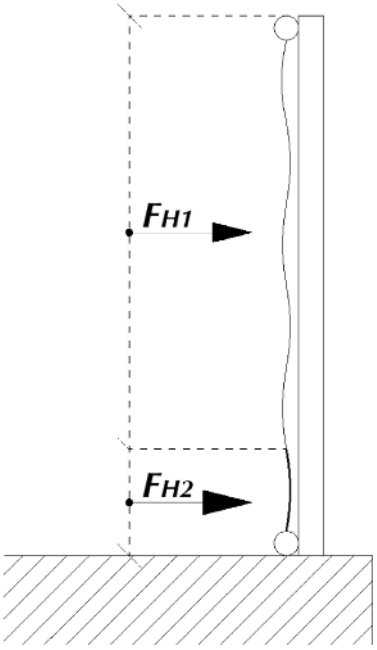


Figure 9 — Ultimate limit load alternative 2 Loads acting separately

6.3.4 Ultimate limit state - Maximum wind load

Load Q_{MW} shall act perpendicular to the edge protection system in the outward and inward direction separately. See Figure 10 and line 3 of Table 2. Q_{MW} is equal to Q_W when q_i = 600 N/m^2.

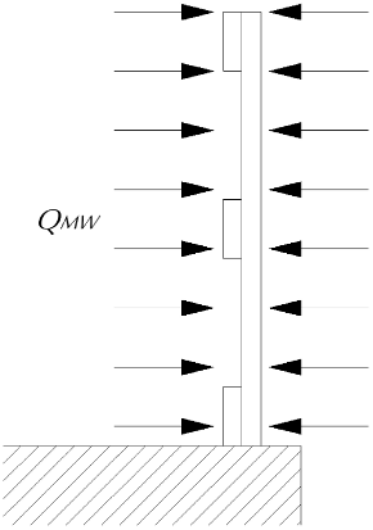


Figure 10 — Ultimate limit load
Maximum wind load – inwards and outwards

Q_W shall be calculated by assuming a wind velocity pressure to be applied on an effective area of the edge protection system, which in general is the projected area in the wind direction, not taking shielding into account. It shall be determined as follows:

$$Q_W = \sum_i (c_{f,i} \cdot q_i \cdot A_i) \quad (6)$$

where

Q_W is the resulting wind force

$c_{f,i}$ is the aerodynamic force coefficient for the edge protection components i (c_{f0} may be used uncorrected)

c_{f0} is the force coefficient of a component with infinite slenderness ratio

q_i is the wind velocity pressure acting on the edge protection components i and shall be taken as 600 N/m^2.

A_i is the reference area of the edge protection components

NOTE 1 The aerodynamic force coefficient $c_{f,i}$ appropriate to the cross section of the edge protection components in question is given in EN 1991-1-4.

For any cross-sections, not included in EN 1991-1-4, the aerodynamic force coefficient may not be assumed to be less than 2,0, unless it has been established by testing.

NOTE 2 600 N/m^2 covers most wind conditions in Europe. More onerous conditions may occur. The wind velocity pressure is based upon 40 m height and an exposure period of 6 months and represents a wind speed of approximately 32 m/s.

6.3.5 Ultimate limit state –Load combination

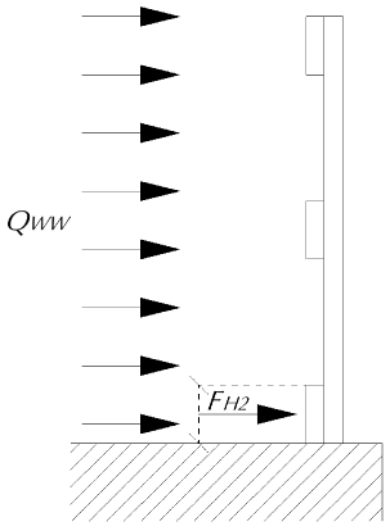


Figure 11 — Load combination Toeboard

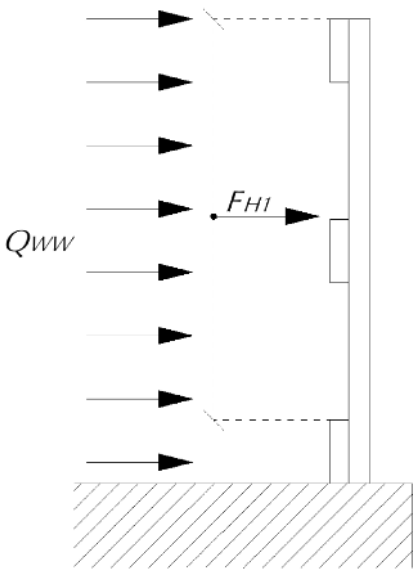


Figure 12 — Load combination All other parts

Loads Q_{WW} and F_{Hi} shall act perpendicular to the edge protection system in the outward direction simultaneously. See Figures 11 and 12 and line 4 of Table 2.

The working wind load Q_{WW} shall be determined according to 6.3.4. Q_{WW} is equal to Q_W when q_i = 200 N/m^2.

For toeboards, F_{H2} = 200 N.

For all other parts (posts, guardrails, nets etc.), F_{H1} = 300 N.

6.3.6 Ultimate limit state - Load parallel to the edge protection system

Load F_{H3} shall act parallel to the edge protection system along its length. This applies to an edge protection system in its smallest configuration e.g. the least number of bays consistent with normal utilisation. See Figure 13 and line 5 of Table 2.

F_{H3} = 200 N

Figure 13 — Parallel load

6.3.7 Ultimate limit state with accidental loads

Load F_D shall act downwards within an angle of ± 10° to the face of the egde protection system, anywhere along the top egde of the guardrails and toeboards. This also applies to any other component of the edge protection system, such as a fencing structure, which has gaps in excess of 100 mm width. See Figure 14 and line 6 of Table 2.

F_D = 1250 N

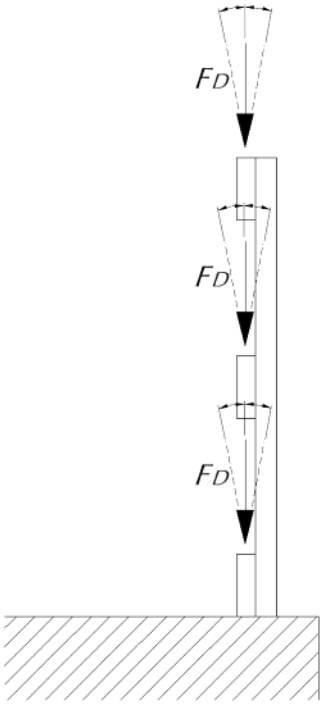


Figure 14 — Accidental load
Loads acting separately

7 Test methods

7.1 General

Tests shall be carried out in accordance with the requirements in this standard and in other relevant European Standards. Unless otherwise indicated in the following, testing shall be conducted by way of visual examination and measurement.

Each testing laboratory which carries out tests according to this standard shall be able to demonstrate competence to carry out the relevant testing requirements of this standard.

NOTE Most countries have systems for national accreditation of testing laboratories.

Table 3 — Overview of testing requirements

Class	Type of loading requirement	Clause (requirement)	Testing required	Clause (testing)
A	Static	6.3	Yes, if design by calculation is not possible	7.4
B	Static			
B	Dynamic	5.4.3	Yes	7.5.1
C	Dynamic	5.4.4	Yes	7.5.2

7.2 Load application

Point loads shall be applied through maximum (100 × 100) mm or, for narrower elements, the width of the element × 100 mm.

When testing nets or fencing structures a distributing plate of maximum (300 × 300) mm (see 6.3.1) may be used.

7.3 Sample to be tested

The test sample shall comprise at least one bay in the most unfavourable length and configuration of the edge protection system. The configuration shall include the fixing or fixing method and base material to which the manufacturer claims conformity with this standard according to their Operation & Maintenance manual. Whichever the case the test sample shall be arranged to represent the way it is intended to be used on site, i.e. in accordance with the manufacturer's Operation & Maintenance manual. For edge protection clamped to a slab edge, see Figure 1, key 1, where the thinnest slab that can be gripped is 100 mm, it shall be fixed to a rigidly fixed concrete slab of thickness (200 $\pm$ 5) mm.

For friction, e.g. counterweighted systems the tests shall be carried out at the maximum inclination, according to Operation & Maintenance manual. The performance of friction systems will vary according to:

— roof pitch;

— base material (wet and dry);

— edge upstand.

The test sample shall be erected on base materials, both wet and dry, and with or without an edge upstand. The manufacturer shall show conformity to this standard through testing at these different permutations.

NOTE It is also allowed to test the components separately and combine the results in the right way to determine the bearing capacity of the whole system.

7.4 Tests for conformity with static load requirements for classes A and B

7.4.1 General

If appropriate according to 6.1.2, the static load requirements, or parts of them, may be verified by testing.

Where the most onerous load case cannot be identified, initial tests may be carried out to identify it. Alternatively, all load cases can be verified.

A minimum of four separate representative samples shall be tested in each type of test.

7.4.2 Tests for serviceability

7.4.2.1 Pre-test procedure

Prior to each test the system shall have a preliminary load, the same as the test load, applied to it. This load is to be held for one minute and then removed. The position of the system after this test shall be the datum for measurements, δ_1, in the full deflection test described in 7.4.2.2.

NOTE The purpose of this load is to ensure that the system is properly bedded and that any looseness is taken out.

7.4.2.2 Test procedure

The loads shall be applied at the most adverse positions.

Establish the datum position of the edge protection, δ_1. The system shall be loaded up to the maximum characteristic load according to 6.3.2. The instantaneous deflection of the edge protection, δ_2 at this maximum load shall then be measured.

7.4.2.3 Evaluation of the recorded test results

The average deflection (δ_2-δ_1) of the performed tests shall be maximum 55 mm, and separate values shall not exceed 60 mm.

7.4.3 Test for strength

7.4.3.1 Test procedure

The loads shall be applied at the most adverse positions.

NOTE Distributed loads can be applied as corresponding resultant point loads.

The system shall be loaded up to the maximum test load, F_{max} = γ_M x γ_F x Q_K, where γ_M and γ_F are partial safety factors, see 6.2.1; and Q_K is the characteristic load for the case being considered, see 6.3.3 to 6.3.7 and lines 2 to 6 in Table 2.

This maximum test load(s) shall be held for one minute. During this period of maximum load there should be no identifiable yielding, fracture or separation of any part of the assembly.

The system should then be loaded up to the ultimate load, R_u, where there is identifiable failure in either the system as a whole or in one of its component parts.

7.4.3.2 Records

Record the following:

a) the ultimate load R_u;

b) any observations relating to yielding, fracture or separation of any part of the test assembly.

7.4.3.3 Evaluation of recorded results

The ultimate load R_u shall be adjusted according to EN 12811-3.

On completion of the test specified in 7.4.3, the adjusted strength R_u shall not be less than the maximum test load, F_{max}.

7.5 Tests for conformity with dynamic load requirements for classes B and C

7.5.1 Test procedure for Class B

7.5.1.1 General

A sphericonical bag shall be released in a controlled fall under gravity and swung towards the edge protection system at the most unfavourable positions, to establish whether the test sample can restrain the bag.

Two types of impact test shall be carried out; Type 1 at the post and Type 2 at the centre point between the posts.

— Type1: The bag shall hit the post at the top, 500 J, and then at the lowest practical part of the post, 1 100 J,

— Type 2: The bag shall first hit the top of the edge protection, 500 J, and then at the lowest practical part of the edge protection, 1 100 J.

No components may be replaced within the type 1 and the type 2 test.

7.5.1.2 Test arrangement

The impact is obtained by the pendular fall of the sphericonical bag which is approximately vertical at the impact point. The bag shall be held back to avoid a second impact.

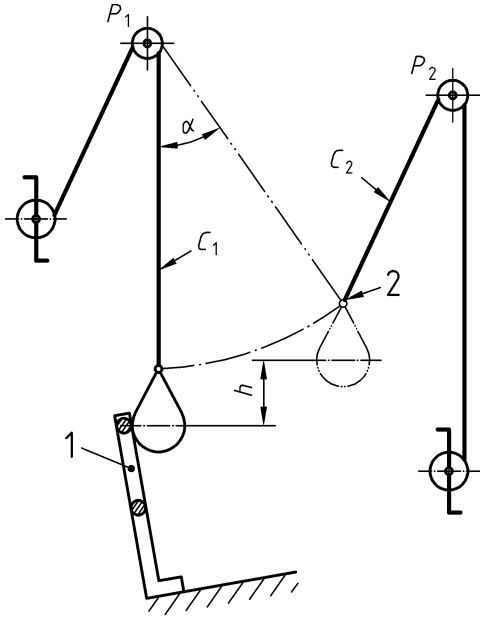
The bag shall be in accordance with EN 596. A typical test apparatus is shown in Figure 15. The bag shall be connected to the rope by a device, 2, which can be released instantaneously from a distance. The bag is suspended by its ring to a rope, C_1, passing over a pulley, P_1. P_1 shall be attached to a frame in the position which ensures that:

— when the bag is offered up to the test specimen its centre touches the specimen at the required point;

— at the point of impact the rope is within $\pm$ 5° from the vertical;

— the angle, α, between the rope, C_1, and the point of impact is less than 65° when the bag is at its starting position.

The drop height, h, see Figure 15, shall be 2,25 m when testing the lowest practical part of the edge protection (1100 J) and 1,0 m when testing other parts (500 J) of the edge protection.



Key

1	test sample
2	snap-hook releasable from a distance
α	angle between the vertical and the pre-released position of the impactor suspension rope $\alpha < 65^\circ$
C_1	rope 1
C_2	rope 2
h	drop height
P_1, P_2	pulleys

Figure 15 — Test apparatus for impact test of class B edge protection

7.5.1.3 Test procedure

Establish the datum for measurement of the deflection, δ, of the edge protection system.

Raise the sphericonical bag to its starting position. Release the bag and allow it to impact at the top of the edge protection system.

Measure and record the instantaneous deflection, δ, at the impact point.

Adjust the test arrangement and continue the procedure by impacting at the lowest practical point of the edge protection system.

Measure and record the instantaneous deflection, δ, at the impact point.

7.5.1.4 Test records

Record the following:

a) The instantaneous deflections, δ, for the two impact points.

b) Whether the impactor is arrested by the edge protection assembly.

7.5.1.5 Requirements

The sphericonical bag shall be stopped by the edge protection.

The minimum deflection of the edge protection system between the posts δ_{min} (at the place where the bag hits the edge protection system) shall be 100 mm, at the moment when this energy has been absorbed.

The system does not need to be serviceable after the test.

The intention is that the deflection requirement of a minimum 100 mm should be applied to every part of the system (at the place where the bag hits the edge protection system), once a satisfactory practical solution is available, i. e. also to apply the requirements to the supports. At the time of writing this standard the state-of-the-art means that it is not practicable to apply the deflection requirement to the posts or within the immediate vicinity.

7.5.2 Test procedure for Class C

7.5.2.1 General

The test impactor shall roll down a ramp towards the edge protection system at two critical points:

— at the post, and

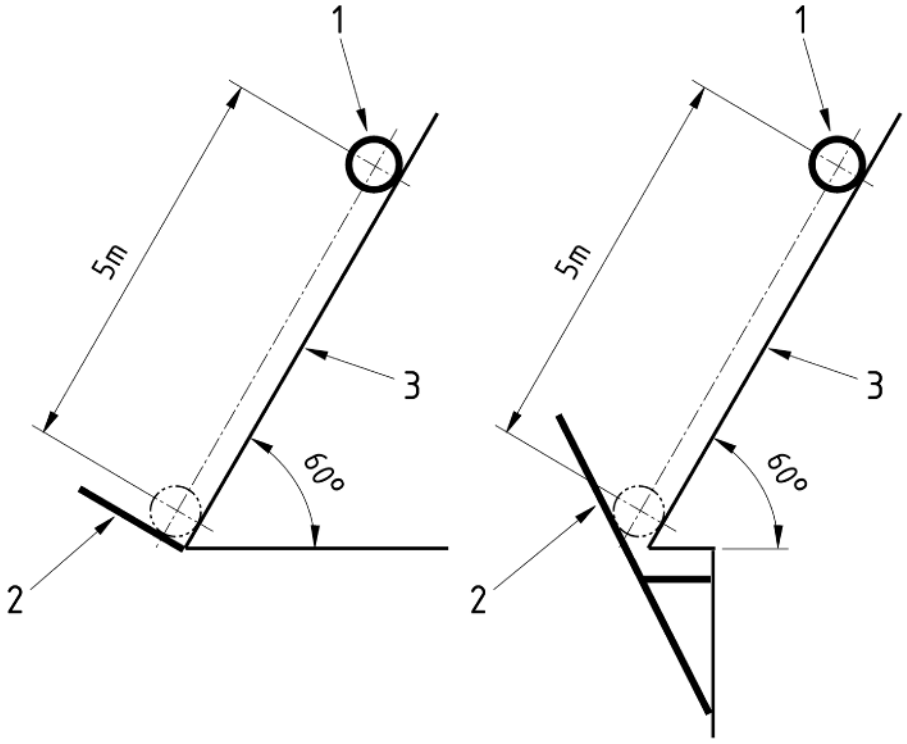
— at the centre between the posts

The test impactor shall be a cylindrical body with a mass of (75,5 $\pm$ 0,5) kg, a length of (1000 $\pm$ 10) mm and a diameter of (300 $\pm$ 5) mm. The cylindrical body shall be made of at least 25 mm rubber with a smooth surface without sharp edges.

The inclined test ramp shall be plain and it shall be inclined by 60° to the horizontal. The inclined test ramp shall have a length of at least 5,0 m. See Figure 16 for the design of the test ramp.

At the base of the test ramp it shall be possible to fix the sample of the edge protection according to the manufacturer's instruction as it would be installed on site.

Provisions shall be made to measure the instantaneous deflection at the centre of the area of contact.



Key

1 impactor
2 edge protection
3 test ramp

Figure 16 — Dynamic strength test method for class C

7.5.2.2 Test procedure

Position the cylindrical impactor so that the centre of gravity travels 5,0 m, as shown in Figure 16. Establish the datum for measuring the deflection of the edge protection.

Allow the cylinder to roll down the slope and impact with the edge protection at the required positions. On the points of impact, measure and record the instantaneous deflections of the edge protection, δ.

Each test sample shall be subjected to two rolling tests at each critical point. No parts whether damaged or not, shall be replaced between the first and second rolling tests.

Parts can be replaced for testing different critical points.

The impactor shall be left in contact with the edge protection for a period not less than three minutes.

7.5.2.3 Test records

Record the following:

a) The maximum instantaneous deflection, δ.

b) Whether the impactor is held for three minutes.

7.5.2.4 Requirements

The cylindrical impactor shall not pass through the edge protection.

The minimum deflection between the posts δ_{min} (at a level 200 mm above the working surface) shall be 200 mm, at the moment when this energy has been absorbed.

The system does not need to be serviceable after the test.

The intention is that the deflection requirement of a minimum 200 mm should be applied to every part of the system (at a level 200 mm above the bottom), once a satisfactory practical solution is available, i. e. also to apply the requirements to the supports. At the time of writing this standard the state-of-the-art means that it is not practicable to apply the deflection requirement to the posts or within the immediate vicinity.

7.6 Test reports

The test reports shall follow the outlines given in Clause 9 of EN 12811-3:2002 but shall include at least the following:

— description of the configuration of the edge protection system;

— number, title and date of issues of this European Standard;

— description of the sample including material specification;

— photographs of and description of the test rig structure;

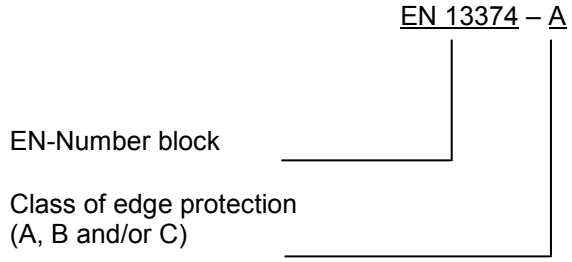
— detailed description of the entire test procedure;

— test result;

— confirmation that the test was carried out in accordance with this standard.

8 Designation

Example of designation for an edge protection system class A



9 Marking

The following purpose made components shall be marked:

— principal guardrails;

— intermediate guardrails;

— intermediate protection (e.g. fencing);

— toe-boards;

— posts;

— counterweights.

The marking shall be clearly visible and shall be so arranged that it will remain legible for the service life of the product, and contain the following:

— EN 13374;

— type of edge protection system: A, B or C;

— name/identification of the manufacturer or supplier;

— year and month, in that order, of manufacture or serial number;

— counterweights shall be marked with their weights in kilogram.

For components specified by the manufacturer but not supplied by him, in addition to any marking specified for the component, there shall be marking to identify the edge protection system to which they relate.

10 Information to be given to the site

10.1 General requirements

A set of instructions forming an Operation & Maintenance manual shall be provided. They will be part of the basis of the assessment and, after successful completion; their content shall be supplied with the components as part of the edge protection system.

10.2 Principal contents

The main instructions in the manual shall include:

— a list giving each component and a description from which it can be identified for example with a drawing;

— instructions for the sequence of assembling;

— requirements regarding fixing to the structure;

— instructions for dismantling the components and how to handle them;

— layouts of configurations allied with their classes and their dimensions;

— a statement of limitations of use with reference to wind velocity pressure, ice loads, snow loads and slippery conditions;

— an explanation of the classification and the range of applications and any limitations of the system described;

— a full specification of the items which are not purpose made components;

— counterweighted edge protection systems shall state the minimum clearance from the edge;

— loads imposed on the structure from which it is supported;

— criteria for rejecting components which are worn or damaged;

— any instructions for storage, maintenance or repair which the manufacturer considers appropriate;

— information about applications for which the edge protection system is suitable, according to relevant national rules.

The instructions shall also state the following:

— after a fall of a person or an object towards or into the edge protection system, and its accessories, the system shall only be re-used after having been inspected by a competent person.

— Openings between edge protections and other structures shall be as small as possible, but no more than 120 mm for the guardrails and 20 mm for the toeboard.

11 Assessment

An assessment of the temporary edge protection system shall be carried out by an appropriate person or organisation that is independent of the designer or organisation that developed the system.

On completion of a successful evaluation, a statement to that effect shall be given. This statement shall identify the reference number of all examinations and the assessor's report shall include:

— identification of the particular set of components examined;

— reference to the standards used.

Annex A
(informative)

Appropriate classes for the use at different inclinations and falling heights

The edge protection specified in this standard is for three different classes. This annex gives advice on which class to use depending on the angle of the working surface from the horizontal and the possible falling height.

Class A may be used if the angle is less than 10°.

Class B may be used if the angle is less than:

— 30° without limitation of the falling height, or;

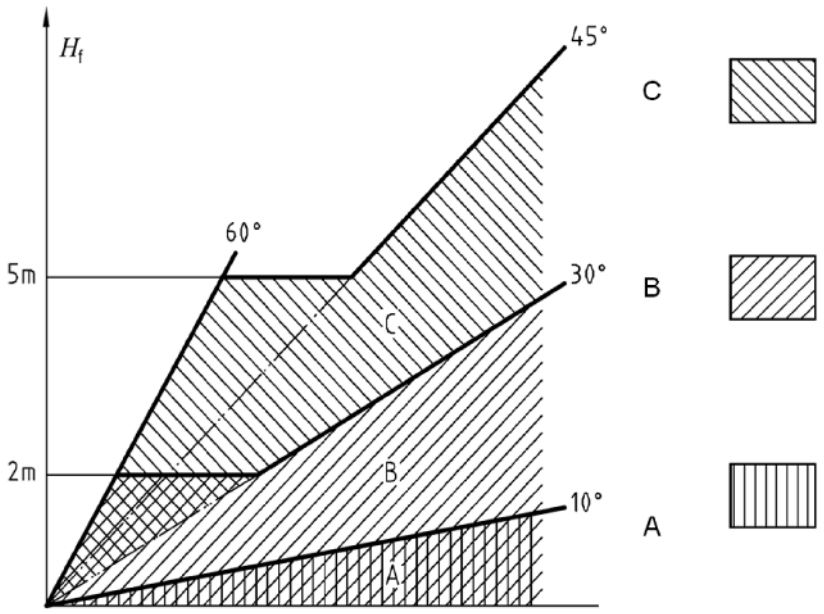
— 60° and the falling height is less than 2 m.

Class C may be used if the angle is between:

— 30° and 45° without limitation of the falling height, or;

— 45° and 60° and the falling height are less than 5 m.

If the angle is more than 60° or more than 45° and the falling height is more than 5 m, edge protection systems are not appropriate as protection. At greater falling heights the system can be placed higher on the sloping area, for example every 2 m and 5 m of falling height for system class B and C respectively (see also Figure 3).



Key

H_f falling height

Figure A.1 — Classes for the use at different angles and falling heights

Bibliography

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[2] EN 12811-1:2003, *Temporary works equipment — Part 1: Scaffolds — Performance requirements and general design*

[3] EN 12811-2:2004, *Temporary works equipment — Part 2: Information on materials*

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