BS EN 15567-1:2015

BSI Standards Publication

Sports and recreational facilities — Ropes courses

Part 1: Construction and safety requirements

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National foreword

This British Standard is the UK implementation of EN 15567-1:2015. It supersedes BS EN 15567-1:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SW/136/15, Sports, playground and other recreational equipment - Adventure courses.

A list of organizations represented on this committee 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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Foreword

This document (EN 15567-1:2015) has been prepared by Technical Committee CEN/TC 136 “Sports, playground and other recreational facilities and 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of an identical text or by endorsement, at the latest by November 2015, and conflicting national standards shall be withdrawn at the latest by November 2015.

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 15567-1:2007.

EN 15567 consists of the following parts, under the general title, *Sports- and recreational facilities — Ropes courses*:

— *Part 1: Construction and safety requirements*;

— *Part 2: Operation requirements*.

The main changes to EN 15567-1:2007 are:

a) terms and definitions revised (Clause 3);

b) requirements for wire ropes revised (4.2.4);

c) new clause for synthetic ropes included (4.2.5);

d) influence of loads revised (4.3.2);

e) requirements for trees revised (4.3.3.3);

f) requirements for zip lines revised (4.3.4.2);

g) requirements for safety systems revised (4.3.5);

h) requirements for personal protective equipment revised in accordance with existing standards (4.4);

i) requirements for inspection and maintenance revised (Clause 7);

j) Annex A revised;

k) Annex B deleted;

l) new Annex C “Relevance of ISO 4309:2010 to EN 15567-1 for ropes courses” added;

m) correction of editorial errors.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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.

Introduction

Ropes courses vary considerably and may be used for educational, recreational, training or therapeutic purposes.

Ropes course activities involve risks that should be managed by the manufacturers and operators. This is achieved through careful design, manufacture, supervision, training, instruction, information etc.

Ropes course activities should only be undertaken by those who are physically and mentally able to comply with the safety requirements specified by the operator.

The various safety devices (for protection against falling from a height and collisions) consist of equipment designed to limit the consequences of falls or collisions. There are inherent risks associated with ropes courses. These risks should, however, be appropriately managed and reduced to an acceptable level by the ropes course operator. However, it should be understood that such risks cannot be eliminated altogether. It should be noted that no safety system can prevent deliberate misuse.

On the basis of a risk assessment, that takes into account the manufacturer's manual, operators should take reasonably practicable measures to ensure the safety of participants and staff. This means that the degree of risks in a particular job/work place/facility need to be balanced against the time, trouble, cost, benefits and physical difficulty of taking measures to avoid or reduce the risk.

Ropes course operators should also consider EN 15567-2, when carrying out risk assessments.

1 Scope

This European Standard applies to permanent and mobile ropes courses and their components.

This European Standard specifies safety requirements for the design, construction, inspection and maintenance of ropes courses and their components.

This European Standard does not apply to temporary ropes courses (see 3.3) and children's play grounds (see EN 1176 all parts).

For the use of ropes courses EN 15567-2 applies.

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 335, *Durability of wood and wood-based products — Use classes: definitions, application to solid wood and wood-based products*

EN 350-2:1994, *Durability of wood and wood-based products — Natural durability of solid wood — Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe*

EN 351-1:2007, *Durability of wood and wood-based products — Preservative-treated solid wood — Part 1: Classification of preservative penetration and retention*

EN 358, *Personal protective equipment for work positioning and prevention of falls from a height — Belts for work positioning and restraint and work positioning lanyards*

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

EN 636, *Plywood — Specifications*

EN 813, *Personal fall protection equipment — Sit harnesses*

EN 1176-1, *Playground equipment and surfacing — Part 1: General safety requirements and test methods*

EN 12277, *Mountaineering equipment — Harnesses — Safety requirements and test methods*

EN 12927-6, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 6: Discard criteria*

EN 13411-1, *Terminations for steel wire ropes — Safety — Part 1: Thimbles for steel wire rope slings*

EN 13411-2, *Terminations for steel wire ropes — Safety — Part 2: Splicing of eyes for wire rope slings*

EN 13411-3:2004+A1:2008, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule-securing*

EN 13411-4, *Terminations for steel wire ropes — Safety — Part 4: Metal and resin socketing*

EN 13411-5, *Terminations for steel wire ropes — Safety — Part 5: U-bolt wire rope grips*

EN 13411-6, *Terminations for steel wire ropes — Safety — Part 6: Asymmetric wedge socket*

EN 13411-7, *Terminations for steel wire ropes — Safety — Part 7: Symmetric wedge socket*

EN 15567-2:2015, *Sports- and recreational facilities — Ropes courses — Part 2: Operation requirements*

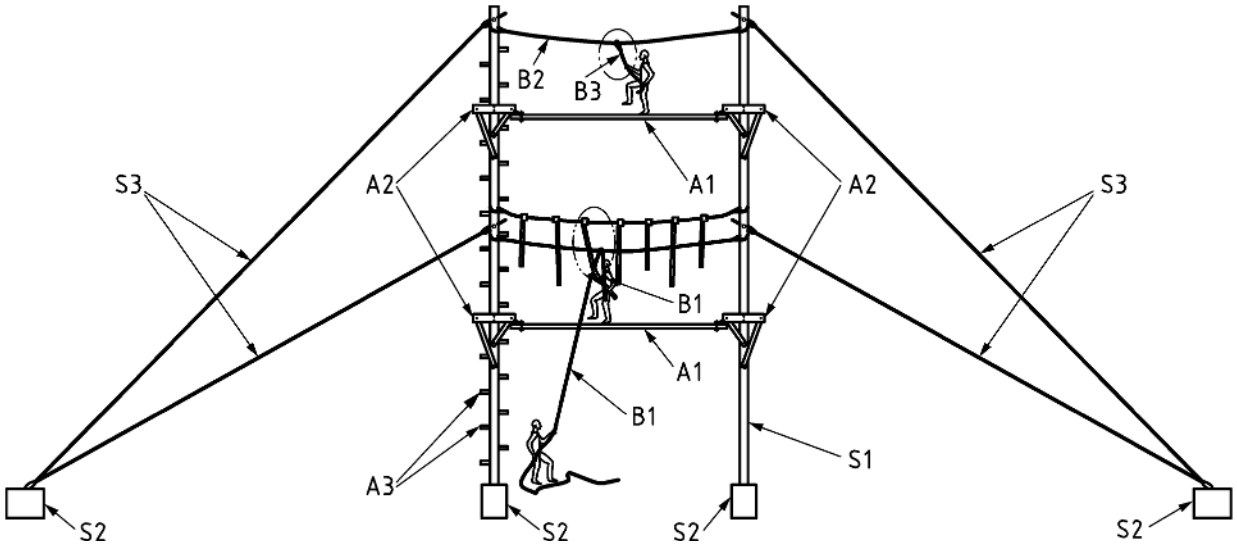
ISO 4309:2010, *Cranes — Wire ropes — Care and maintenance, inspection and discard*

3 Terms and definitions

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

3.1
ropes course
constructed facility consisting of one or more activity systems, support systems and, if needed, an appropriate safety system with restricted access and requiring supervision

Note 1 to entry: See Figure 1.



Key

Activity systems A		Support systems S		Belaying systems B	
A1	Elements	S1	Poles trees buildings, rock, other supporting structures	B1	Assisted belaying system
A2	Platforms	S2	Foundations, anchors	B2	Safety line
A3	Access	S3	Guy lines	B3	Safety system (categories A to E)

Figure 1 — Example of a ropes course

3.2
permanent ropes course
facility installed for more than seven days on the same site

3.3
temporary ropes course
facility that is not a mobile ropes course and is installed for a maximum of seven days

3.4
mobile ropes course
facility constructed in such a way that the support system is transportable from site to site

3.5
support system
artificial and/or natural structure intended for installation of activity and safety systems

Note 1 to entry: See Figure 1 for examples.

3.6
activity system
facility that permits the progression of the participant

EXAMPLE Examples are elements, platforms and access structures, see Figure 1.

3.7
element
activity unit in a ropes course

3.8
platform
raised area usually before or after an element on which participants can stand

3.9
giant swing
activity system where the participant performs guided pendulums (to- and-fro movements)

3.10
zip line
activity system in which the participant glides under gravity in a sloping direction

3.11
landing area
area in which a participant exiting an element can land

3.12
change-over
manual transfer from one part of a safety system to another

3.13
safety line
flexible or rigid, horizontal, vertical or sloping, continuous or discontinuous device used as a protection against falling from a height

3.14
interlocking device
device with at least two gates whereby an action on the one gate results in an effect on another gate

EXAMPLE The opening of one gate causes the locking of another gate.

3.15
safety system
system used either to prevent, to arrest or cushion a participant's fall

Note 1 to entry: Examples of fall safety systems are guard rails, safety line, landing mat, net, retractable lifeline.

3.16
individual safety system
component(s) connecting the harness to the safety line

Note 1 to entry: Each of the following systems A to E provide adequate levels of safety when used in combination with appropriate supervision, training, instruction and information. See also EN 15567–2.

3.16.1
individual safety system category A
self-closing device which is not automatically self-locking

EXAMPLE Self-closing or screw gate connector.

3.16.2
individual safety system category B
self-locking device

EXAMPLE Self-locking connector.

3.16.3
individual safety system category C
interlocking device designed to reduce the likelihood of unintentional detaching from the safety system

3.16.4
individual safety system category D
interlocking device designed to prevent unintentional detaching from the safety system

3.16.5
individual safety system category E
device that is permanently attached during operation and can only be opened with a tool

3.17
collective safety system
system which can protect at least one person and, once properly installed or erected, does not require any action by the user to make sure it will work

Note 1 to entry: Examples include scaffolds, towers, nets, airbags, etc.

3.18
assisted belay system
belaying system where the participant is secured by at least one person

3.19
spotting
one or more persons working to catch, hold or give physical support to other participants

3.20
critical application
application where the consequences of a failure are likely to lead to a serious injury or death

3.21
serious injury <ropes courses>
any of the following injuries:

— fractures, other than to fingers, thumbs and toes;

— amputations;

— any injury likely to lead to permanent loss of sight or reduction in sight;

— any crush injury to the head or torso causing damage to the brain or internal organs;

— serious burns (including scalding) which:

  — covers more than 10 % of the body;

  — causes significant damage to the eyes, respiratory system or other vital organs;

— any scalping requiring hospital treatment;

— any loss of consciousness caused by head injury or asphyxia;

— any other injury arising from working in an enclosed space which:

  — leads to hypothermia or heat-induced illness;

  — requires resuscitation or admittance to hospital for more than 24 h

3.22
primary brake
braking system engaged during normal operation to arrest the participant which can be either active or passive

3.22.1
active braking system
braking system operated by the participant or another person

3.22.2
passive braking system
braking system operating without manual intervention

EXAMPLE Examples are bungee, gravity, net, water, impact absorbers, impact absorbent floors, landing mats, etc.

3.23
emergency brake
passive braking system that controls participant deceleration upon failure of the primary brake without causing serious injury or death

3.24
level 1 supervision
situation whereby an instructor can physically intervene to prevent a misuse of the individual safety system that would otherwise lead to a significant risk of serious injury or death

3.25
level 2 supervision
situation whereby an instructor is able to see the participant and intervene verbally

3.26
level 3 supervision
situation whereby a participant is in a position to alert an instructor of their need for assistance, who is able to respond promptly to the alert and provide adequate assistance

Note 1 to entry: It is intended that the role of the instructor is to be available to provide adequate assistance to a participant if called upon to do so. This is a largely reactive, rather than proactive, role.

3.27
fall factor
the height of the fall or distance fallen divided by the length of the lanyard or rope that is used

3.28
falling space
any space into which a participant may enter during a fall stopped by the safety system

3.29
free space
space in, on or around an element that can accommodate a participant whilst attached to the safety system

EXAMPLE Examples are oscillating space for a zip line or for a giant swing.

3.30
free height of fall
greatest vertical distance from the clearly intended structure supporting the body to the impact area below

3.31
dead load
weight of the element when unloaded

3.32
characteristic load
maximum (un-factored) load that can be generated in normal use

3.33
imposed load
load corresponding to the average weight of a participant multiplied by the number of participants simultaneously authorized on the element

3.34
dynamic load
vertical impact force imposed on the safety system generated by a falling participant

3.35
routine visual check
inspection intended to identify obvious hazards that can result from vandalism, use or weather conditions

3.36
operational inspection
inspection, more detailed than routine visual inspection, to check the operation and condition of the equipment

3.37
periodical inspection
verification carried out by an inspection body at least once per calendar year and within a maximum interval of 15 months intended to establish the level of safety of the ropes course

3.38
functional test
practical test of elements to ensure they are fit for purpose

3.39
inspection body
body that performs inspections

Note 1 to entry: A body can be an organization or part of an organization.

[SOURCE: EN ISO/IEC 17020:2012, 3.5]

Note 2 to entry: EN ISO/IEC 17020 defines inspection bodies of type A, type B and type C, covered by appropriate professional civil liability insurance.

3.40
arboricultural expert
competent person able to undertake arboreal assessments

Note 1 to entry: Expert covered by appropriate professional civil liability insurance.

3.41
competent person
someone who has the necessary technical expertise, training and experience to carry out the task

3.42
arboreal assessment report
report of a periodical inspection comparing the condition of the trees in relation to the last assessment

4 Safety requirements

4.1 Choice of site

The site of the ropes course shall be chosen to ensure that it is located in an area of reasonable operating safety. It shall be possible to evacuate participants from any part of the ropes course.

The immediate surrounding area shall not impair the safety of the structure and the activities taking place on the site.

Local factors (e.g. lightning, humidity, corrosion, flooding, avalanches, soil conditions, weather patterns and evidence of previous tree failures, etc.) shall be taken into consideration in both the design and the operation of the facility, see EN 15567-2. Local land managers and foresters may need to be consulted.

Unauthorized access to the ropes course shall be taken into account referring to national regulations.

NOTE In general, the installation and use of ropes courses will cause changes to the environment which are covered by national legislation in force.

4.2 Material

4.2.1 General

Materials shall conform to 4.2.2, 4.2.3, 4.2.4 and 4.2.5.

Materials shall be fit for purpose.

NOTE 1 The provisions relating to certain materials in this standard do not imply that other equivalent materials are unsuitable in the manufacture of ropes courses.

The selection of materials and their use should be in accordance with appropriate European Standards.

Materials shall be selected and protected so that the structural integrity of the equipment manufactured from these materials should not be rendered unserviceable before the next relevant inspection.

NOTE 2 EN 15567–2 gives recommendations on inspections.

Particular care should be taken in the choice of materials where equipment is to be used in extreme climatic or atmospheric conditions.

In the choice of materials or substances for ropes courses, consideration should be given to the eventual disposal of the material or substance having regard to any possible environmental toxic hazard.

For all Materials used in critical applications, a competent person shall determine an inspection procedure or comply with the manufacturer's recommendations.

Consideration should also be given to degradation of structural components through ultraviolet influences.

4.2.2 Timber and associated products

Timber parts should be designed in such a way that precipitation can drain off freely and water accumulation is avoided.

In cases of ground contact, one or more of the following methods shall be used to minimize the risk of rot:

a) use of timber species with sufficient natural resistance in accordance with Classes 1 and 2 of the natural resistance classification given in EN 350-2:1994, 4.2.2.

b) construction methods, e.g. post shoe;

c) use of timber treated with wood preservatives in accordance with EN 351-1:2007, Figure A.1 and in accordance with hazard Class 4 of EN 335.

Consideration should also be given to other factors which can be hazardous, such as splintering, poisoning etc.

All components made of timber and associated products, other than those species conforming to a), that affect the stability of the structure and are in constant contact with the ground shall be treated in accordance with c).

When selecting metal fastenings, consideration should be given to the species of timber and chemical treatments used as some will accelerate corrosion of metals if there is contact.

Plywood used for outdoor installations shall conform to EN 636.

EN 14229 may be used for ropes courses where timber poles are used for the support system.

4.2.3 Metals

Consideration shall be given to the corrosion of metal components.

Metals that produce toxic oxides shall be protected by a non-toxic coating.

4.2.4 Wire ropes

The choice of the wire rope shall be appropriate for the application. For wire safety lines only galvanized or stainless steel wire ropes shall be used. Synthetic core wire ropes may also be appropriate.

Wire ropes with natural fibre core shall not be used in critical applications.

A wire rope discard criteria shall be in accordance with the relevant sections of ISO 4309:2010. For guidance see Annex C. For cables which are not covered by ISO 4309:2010, EN 12927-6 applies.

All wire rope terminations shall conform to EN 13411-1, EN 13411-2, EN 13411-3, EN 13411-4, EN 13411-5, EN 13411-6 and EN 13411-7 or an appropriate documented test shall be carried out.

Only the following conditions are considered to be acceptable variations from EN 13411-3 in relation to the use of ferrules on wire rope termination used on ropes courses.

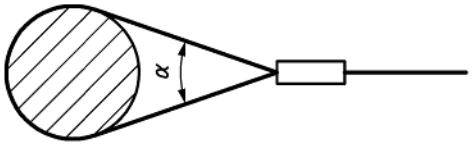
a) The fatigue test (EN 13411-3:2004+A1:2008, 5.1.2.3) is not required if a second ferrule-secured termination is applied. In such cases, the second ferrule shall be applied in such a way that the end of the cable is at least flush with the end of the compressed ferrule-secured termination and in a manner that is consistent with the design provided by the ferrule-secured system designer.

b) All ferrules used for wire rope termination on ropes courses shall display (legibly) the ferrule- secured termination manufacturer's mark/identity. A mark for individual traceability, as would normally be required by EN 13411-3:2004+A1:2008, 7.1 b), is waived.

c) A record shall be kept by the ropes course owner of the ferrule-secured termination manufacturer's details. There shall be no requirement to certificate the ferrule-secured termination as is required by EN 13411-3:2004+A1:2008, 7.2.

If other types of wire rope terminations are used they shall be used in accordance with the manufacturer's guidelines.

Terminations shall consider the effects of the closure angle. An angle $\alpha \leq 60$ ° is recommended (see Figure 2, e.g. trees and poles).



Key

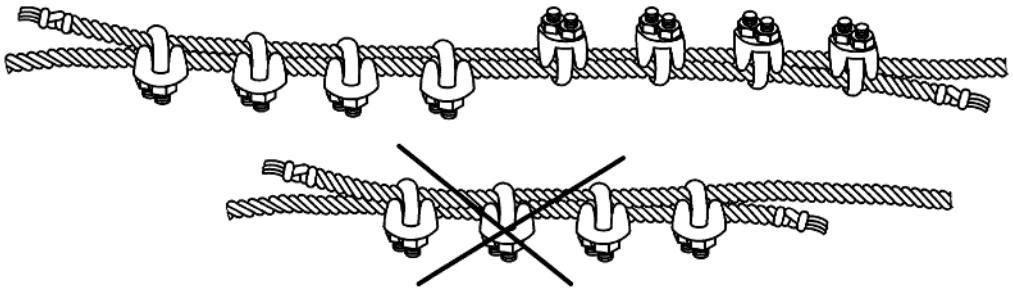
α = angle of termination

Figure 2 — Angle of termination

If angles $\alpha > 60$ °are applied, sufficient measures shall be taken to protect the termination from inappropriate radial loading.

If the angle α is > 120 °, particular care shall be taken to ensure the strength of the wire rope is sufficient.

If it is necessary to use rope clamps to make an in line connection of two separate wire rope terminations, Figure 3 provides an example of an inline connection.



a) Correct and wrong placement of rope grips when connecting parallel rope ends

b) Double-lug head fittings

Figure 3 — Placement of wire rope grips

NOTE Figure 3 indicates only the position of wire rope grips. The number of wire rope grips according to EN 13411–5 will depend on the nature and the diameter of the wire rope and the types of wire ropes and grips used.

Plastic covered wire ropes shall not be used for zip lines.

If plastic covered wire ropes are used for a critical application they shall be constructed of galvanized or stainless steel and an appropriate inspection process shall be applied to take account of difficulties in their visual inspection. If during an inspection damage to the coating is observed (except for the dead ends) sufficient to allow water ingress the wire rope shall be discarded.

Either of the following test methods for plastic covered ropes shall be undertaken every two years with 2 samples of the oldest or most subject to fatigue wire ropes used in the course:

1) breaking test, in which the minimum design calculation shall be reached;

2) interior wire rope inspection.

Points of attachment on wire ropes are liable to create changes in local curvature of wire rope and might therefore create local fatigue, therefore these points shall be given special attention during inspection and examination.

Care shall be taken to ensure that the torque settings of wire rope grips comply with EN 13411-5.

4.2.5 Synthetic ropes

The choice of the synthetic rope shall be appropriate for the application.

4.2.6 Synthetics and composites

If, in maintenance, it is difficult to determine at what point material becomes brittle, manufacturers shall give an indication of the time period after which the part or equipment should be replaced.

It should be possible to identify excessive wear of the gelcoat of GRP (glass-reinforced plastics) products intended for sliding before the participant becomes exposed to the glass fibres. (This can be achieved for example by the use of different coloured layers in the sliding surface.)

4.2.7 Dangerous substances

Dangerous substances shall not be used in ropes courses in such a way that they can cause adverse health effects to the user of the equipment.

NOTE Attention is drawn to the provisions of Directive 76/769/EEC. Such materials include, for example, asbestos, lead, formaldehyde, coal tar oils, carbolineums and polychlorinated biphenyls (PCB).

4.3 Design and manufacture

4.3.1 General safety requirements

Ropes Courses shall be designed with consideration for the size and the body weight of the participants.

Moving parts shall be designed to limit the risk of injury.

There shall be no sharp edges or burrs on the facility within reach of the user.

The installation shall be constructed and the equipment shall be chosen so that any openings that can be reached in normal use do not create hidden entrapment hazards.

The free and falling space shall not contain any unprotected obstacles that a person manoeuvring or falling might crash into, other than the constituent parts of the activity system.

If there is a likelihood of a participant sustaining injury from collision with an obstacle located in the vicinity of the element (for example a tree), an appropriate safety device should be installed (for example a pad should be fitted over part of the tree).

On safety system categories A to C a clear distinction between the safety line and the activity system (hauling system, handlines) shall be made.

It shall be impossible to connect to the dead end of any wire rope.

Ropes courses shall be designed with regard for course evacuation and the rescue of individual participants (access, anchor location, egress).

Elements located one above the other shall be designed so that lowering of a person who has to be rescued is not prevented.

It shall not be possible to undo critical components without a tool.

4.3.2 Influence of loads

4.3.2.1 General

The influence of loads needs to be taken into account during design and manufacture of ropes courses. Such loads can be permanent or variable.

4.3.2.2 Permanent loads

The permanent loads consist of the dead load of the built structure.

4.3.2.3 Variable loads

4.3.2.3.1 General

The variable loads consist of:

a) user loads (static and dynamic);

b) snow loads;

c) wind loads;

d) effects of temperature;

e) special loads.

4.3.2.3.2 User loads

Empirical evidence suggests that it is impossible to have two or more users/participants create a peak impact force simultaneously due to a fall. The user loads are given in Table 1.

Table 1 — User loads

Description	Characteristic Vertical Load (component) F	Characteristic Vertical Load (component) q_v	Characteristic Horizontal Load (component, only if needed) q_h
Weight of user	0,8 kN	—	0,08 kN (1/10 F)
User Load on platforms and elements where an independent, individual, or collective safety system exists	—	1,6 kN/m^2	0,16 kN/m^2 (1/10 q_v)
User load on zip lines where the fall factor is less than 0,5	3,0 kN	—	0,6 kN (1/5 F)
User load for all other types of safety systems	6,0 kN	—	1,2 kN (1/5 F)
User load on elements where a fall factor cannot occur e.g. when participant is enclosed within a net	3,0 kN	—	0,6 kN (1/5 F)

4.3.2.3.3 Snow loads, wind loads and effects of temperature

Data for snow loads, wind loads and effects of temperature can be found in the Eurocodes for actions on structures (EN 1991-1-1, EN 1991-1-2, EN 1991-1-3, EN 1991-1-4 and EN 1991-1-5) or appropriate national standard.

4.3.2.3.4 Special loads

These may include earthquakes or unusual emergency procedures.

NOTE User Loads are not special loads.

4.3.2.3.5 Calculations

The calculation of artificial supporting structures shall be in accordance with relevant Eurocodes.

Design calculations shall be provided for all artificial supporting structures.

Loads provided in Table 1 are characteristic loads (un-factored) and therefore relevant factors of safety shall be applied (i.e. dependent on the materials used).

For the purposes of design a safety factor of 3 of the minimum breaking load shall be applied to wire ropes. For a belaying system this shall be in accordance with the loads defined in Table 1. The calculation shall take into account the weakness coefficient caused by wire rope termination (see EN 13411 all parts).

For the assessment of natural supporting structures (e.g. trees and rock) see 4.3.3.3.

4.3.3 Support system

4.3.3.1 General

The support system shall have the stability and resistance appropriate for the loads given in 4.3.2.3.

The support system may include:

a) Artificial elements like:

   1) framework with foundation;

   2) guys;

   3) foundations;

   4) tension bars and compression bars;

   5) mounting parts on or in buildings.

b) Natural elements like:

   1) trees;

   2) rocks.

4.3.3.2 Safety requirements for artificial components

4.3.3.2.1 General

Hauling systems, retrieval systems and guys shall either be inaccessible for participants or clearly identified as not being a safe connection point.

4.3.3.2.2 Guys

Careful attention shall be given to the position of guys.

When they are accessible from the ground they shall be clearly visible or protected to avoid injury.

Guys shall either be made inaccessible to participants or, when guys are accessible on a belaying system or from the ground, they shall have a device that discourages misuse.

4.3.3.2.3 Existing supporting structures

Before attaching elements to an existing supporting structure, it shall be evaluated for structural strength, hazards (e.g. electrical) and accessibility.

In instances where the ropes course transmits loads to the existing supporting structure (e.g. a host building) care shall be exercised to ensure that the existing supporting structure can bear the loads created by the ropes course.

Design calculations shall confirm that the existing supporting structure is fit for purpose.

The manufacturer of the ropes course shall provide the owner of the existing supporting structure (or their agent) with all the relevant information relating to the loads and forces that the ropes course and associated equipment may apply to the existing supporting structure.

4.3.3.3 Safety requirements for natural supporting structures

4.3.3.3.1 Trees

4.3.3.3.1.1 Tree strength assessment

A tree strength assessment shall be undertaken to consider the suitability of each tree in relation to its intended use and loads applied. The use of additional supports (e.g. guys) shall be considered.

4.3.3.3.1.2 Arboreal assessment

An assessment shall be undertaken of each intended site to consider its general suitability. The general condition of other trees in the vicinity of the course shall be considered, in order that a reasonably safe environment can be achieved.

Following initial selection by the course designer, all trees used should be subject to inspection by a competent arboriculturist to assess their physiological condition and suitability for the intended use. The assessment shall be carried out post course design and preferably before construction commences. In any event, the inspection should take place before the course is inaugurated.

Tree selection shall be based primarily on visual assessment of external features to determine each tree’s physiological and structural condition. Initial assessment may prompt further investigation using simple tools (such as soft-headed hammers and rigid probes) or more complex methods (such as micro drilling and sonic tomography) to evaluate internal stem condition.

The inspection shall include an assessment of each tree's diameter, estimated height, vitality and form.

Consideration should also be given to the effect on tree roots from compaction, erosion and physical damage during the construction phase and continued use. Suitable remedial action should be taken where necessary. Where assessment identifies work required to trees on site, to improve their suitability or to remove a danger, this should be carried out by competent arboriculturists before inauguration.

4.3.3.3.1.3 Periodic arboreal assessment and inspection

For periodic arboreal assessment and inspection Annex A applies.

4.3.3.3.1.4 Tree and root system protection

The systems used to fix the platforms, safety lines and elements shall be designed to minimize any damage to the trees.

Measures should be taken to protect the root system, particularly against compaction.

4.3.3.3.2 Rocks

When rocks are used as supporting structures the anchor pull out strength shall be at least 4 times the applied load. The choice of anchor should take into account the environmental conditions of the site.

4.3.4 Activity system

4.3.4.1 General

The activity systems shall be designed to accommodate the imposed loads.

The activity system may include for example:

a) ropes, chains and straps;

b) beams, ladders, bridges;

c) landings and platforms;

d) nets; and

e) descending devices.

4.3.4.2 Zip lines

4.3.4.2.1 General

Zip lines shall have no exposed broken wire ends within the reach of the participants.

If any part of the zip line or the landing area is not visible from the starting point, a departure regulation system shall be used.

Appropriate training and equipment shall be provided if participants are required to brake actively during the descent.

A passive braking system shall always be in place.

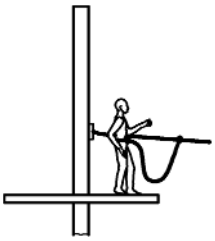
4.3.4.2.2 Special case: zip line with safety line

If a zip line is designed with a supporting cable for the trolley and another cable for the belay then each cable shall be calculated according to 4.3.2.3.2.

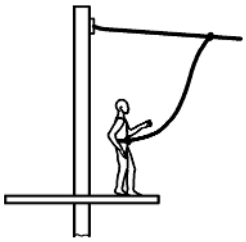
4.3.4.2.3 Single rope zip lines

If a zip line consists of a single rope that is used both as a progression rope and a safety line, the safety line calculation rules shall be applied, see 4.3.2.3.2.

For single rope zip lines different fall factors and user loads shall be considered (see Figure 4).



a) fall factor > 0,5, user load = 6 kN



b) fall factor ≤ 0,5, user load = 3 kN

Figure 4 — Fall factors and user loads for single ropes zip lines

4.3.4.2.4 Protection at zip line arrival areas

A primary brake shall be in place to control the rate of deceleration in the arrival area thereby reducing the risk of injury to an acceptable level.

An emergency brake shall be in place where failure of the primary brake would result in a significant risk of serious injury or death.

4.3.4.3 Platform

The characteristics of the platforms used for an activity system shall:

a) ensure a stable position of balance;

b) withstand the load for which they are designed.

4.3.5 Safety system

4.3.5.1 General

Each safety system and its constituent equipment shall be fit for purpose when combined with the appropriate levels of design, manufacture, information, instruction, training and supervision as set out in EN 15567-2.

Evidence of appropriate welding shall be provided when welding forms part of a critical application.

Evidence of suitability shall be supplied for any non-certified component, e.g. type examinations, design calculations, etc.

Specific attention should be given to the frequency of use. When equipment is provided to participants, the manufacturer's instructions and the requirements specified in this document shall be observed on all the used safety systems.

EXAMPLE A device conforming to EN 341 may be suitable for a rescue of a fall from a tower. However, it may not be fit for purpose for everyday use in a ropes course.

Safety systems can be:

a) collective:

   1) guard rails and railings;

   2) nets, landing mats and impact absorbent floors appropriate to the potential fall height;

b) individual:

1) safety systems categories A to E: in this case, participants shall wear a harness attached to a safety line;

2) safety systems categories A to E shall conform to the relevant clauses of European PPE standards;

c) assisted belaying system: in this case participants shall wear a harness attached to a rope, belayed by one or more persons using appropriate techniques. assisted belaying systems shall conform to the relevant clauses of European PPE standards;

d) spotting.

4.3.5.2 Requirements

When participants' feet are more than 1,0 m above the ground, a safety system shall be in place. When not protected by an individual, collective safety system or an assisted belaying system (see 4.3.5.1 a), b) and c)), the ground covering and falling space shall conform to EN 1176-1.

4.3.5.3 Specifications for devices used as a protection against falling from a height

4.3.5.3.1 Use of connectors for attachment to the safety line

The use of individual safety systems categories A to D is restricted to the action of change over. All other connectors in the individual safety system shall only be openable with a tool. The only exception is when the connector is out of reach of the participants when a triple action connector may be used.

The use of individual safety systems category A is only allowed when all change-overs take place from a stable position of balance (e.g. on a platform) or, a collective safety system (see 4.3.5.1 a)) is in place.

4.3.5.3.2 Permissible deceleration

The devices used to protect participants against falling from a height shall be designed to ensure that the maximum deceleration to which a person is subjected is 6 g.

4.3.5.3.3 Horizontal or sloping progression

4.3.5.3.3.1 General

Systems, in particular with trolleys, shall be designed in such a way as to reduce entrapment of body parts or clothing.

4.3.5.3.3.2 Safety line identification and continuity

On safety systems categories A to C the safety line shall be clearly distinguishable from other ropes (for example by means of a colour code). Changing over from one safety line to another shall be an easy operation and ensure the continuity of the belay.

4.3.5.3.3.3 Safety line slope

The slope of the safety line is not specified. A person who falls shall be able to slide forward or backward along the safety line, within the falling space, without colliding with another person.

A person sliding along the safety line after falling may collide with the element or platform components. A device shall be installed to reduce the risk of injury should such a fall occur.

4.3.5.3.4 Vertical progression

For this type of progression, various methods of preventing falls from a height and complying with deceleration of 6 g as required in 4.3.5.3.1 can be used.

The belay points or participants themselves may be fitted with an impact absorbing system or any other system that is equally effective.

4.4 Personal protective equipment (PPE)

The PPE shall be appropriate to the morphology of the participants. A full body harness (or a combination of sit and chest harness) shall be worn where appropriate, e.g. when a sit harness is ill fitting around the waist.

Harnesses shall be in accordance with EN 361, EN 358, EN 813 or EN 12277. The choice of the PPE shall be in accordance with the ropes course design.

For operational use sport climbing equipment can be used.

All persons undertaking any construction, maintenance or inspection work on the ropes course shall use PPE in accordance with the PPE Directive 89/686/EEC.

5 Test methods

There are no specific test methods required.

6 Marking

6.1 Element identification

The elements shall be identified and documented in a site plan for assistance and rescue purposes.

6.2 Element marking

6.2.1 Notices

For ropes courses where the participants are under level 3 supervision, the following information should be given at the beginning of each element:

a) element identification;

b) maximum number of persons allowed on this element if different from the general instructions;

c) any special instructions (standing, sitting, kneeling, etc.);

d) any special safety instructions (where and how to attach oneself, and so on).

Participants shall be able to see the notices before negotiating an element and the notices should be positioned as far as possible at the same place at the starting point of each element.

Where possible, pictograms shall be used in place of written instructions to ensure that the instructions are more easily understood.

For all safety signs the symbols of EN ISO 7010 and ISO 22727 should be used.

6.2.2 Ropes course difficulty

For ropes courses where the participants are not under level 1 or level 2 supervision, the difficulty of the ropes courses or elements shall be clearly identified (colour code, numerical code, etc.). Where participants are faced with a choice of routes the route difficulty shall be at least that of the most difficult element that participants will have to negotiate.

When a ropes course bypasses one or more of the more difficult elements, the minimum difficulty shall be indicated at the beginning of the ropes course. The more difficult element(s) shall then be identified at the bypass, according to the difficulty code used.

If the ropes course difficulties are colour coded, the following colours shall be used in ascending order of difficulty:

— green (easy);

— blue;

— red;

— black (very difficult).

Other colours can be used to denote additional levels of difficulty.

7 Inspection and maintenance

7.1 Inspection

7.1.1 General

Inspection bodies shall be competent in the specific field of ropes course inspection.

7.1.2 Inaugural inspection

Before the site is inaugurated, it is recommended that a type A inspection body (see 3.43) according to EN ISO/IEC 17020:2012, 4.1 certify that the site is in compliance with EN 15567-1.

The following shall be carried out by an inspection body:

a) visual inspection;

b) functional test (see 3.42) carried out at height by an inspector;

c) verification that the course has been constructed in accordance with the design drawings (e.g. guy angles);

d) checking that design calculation and/or tree strength assessment exist;

e) check the current arboreal assessment to ensure that all trees used as a support system have been judged safe to use.

7.1.3 Modification inspection

Like for like replacement shall be documented but requires no inaugural or modification inspection if undertaken by a competent person.

In instances where a modification to critical applications is made that has already had an inaugural inspection, a further inspection by a Type A, B or C inspection body will be required. A modification inspection shall fulfil the requirements in 7.1.2, including documentation.

Modifications shall be documented by the operator and a risk assessment shall determine the appropriate inspection body (Type A, B or C) and date by which an inspection shall be undertaken in accordance with 7.2.

7.1.4 Periodical inspection

Periodical inspections should be carried out at least each calendar year and with a maximum interval of 15 months by an inspection body (type A, type B or type C in accordance with EN ISO/IEC 17020:2012, Annex A).

The following shall be carried out:

a) routine visual check (3.39);

b) operational inspection (3.40);

c) functional test (see 3.42) carried out at height by an inspector;

d) assessment of worn components and requirements for their replacement;

e) verify that all manufacturer's/supplier's instructions for maintenance have been carried out;

f) verify that plastic covered wire ropes have been tested in accordance with 4.2.4;

g) check the current arboreal assessment to ensure that all trees used as a support system have been judged safe to use;

h) verify that a PPE inspection report exists.

Specific consideration shall be given to the potential effects of fatigue on wire ropes used in a critical application.

Typical checks include the effects of weather, evidence of rotting or corrosion and any change in the level of safety of the equipment as a result of repairs made, or components added or replaced. The periodical inspection may require excavation or dismantling of certain parts (see EN 15567-2:2015, 10.4).

7.1.5 Inspection reports

A report containing the following information shall be prepared as part of the inaugural or periodical inspections:

a) identification of the issuing body;

b) place(s) and date(s) of inspection;

c) identification of the item(s) inspected;

d) name, address and signature of the inspector;

e) a statement of conformity where applicable;

f) a record of all defects found. Any safety defects which are found shall be resolved to the satisfaction of the inspection body before the course is used;

g) Information on what has been omitted from the original scope of the inspection;

h) a statement that the inspection report should not be reproduced, except in full.

NOTE Optional elements that can be included in inspection reports or certificates are listed in EN ISO/IEC 17020:2012, Annex B.

All inspection reports shall be included in the operational documentation of the ropes course.

7.2 Maintenance manual

The manufacturer/supplier shall provide drawings and diagrams necessary for maintenance, inspection and checking of correct operation and, when appropriate, repair of the equipment.

The manufacturer/supplier shall provide instructions for maintenance (marked with the number of this standard), which shall include a statement on the frequency of inspection which will vary with the type of construction and design, environmental conditions and the intensity of use, and shall include guidance on the following:

a) routine visual check (3.39). A routine visual check shall be carried out by a competent person before each opening (see EN 15567-2:2015, 10.2).

b) operational inspection (3.40). An operational inspection shall be carried out by a competent person every 1 month to 3 months, or as indicated by the manufacturer's instruction (see EN 15567-2:2015, 10.3).

NOTE Examples of visual and operational inspection points are cleanliness, equipment ground clearances, ground surface finishes, exposed foundations, sharp edges, missing parts, excessive wear (of moving parts) and the structural integrity of the safety system.

c) periodical inspection (3.41). Periodical inspections should be carried out at least each calendar year and with a maximum interval of 15 months by an inspection body (type A, type B or type C in accordance with EN ISO/IEC 17020:2012). See 7.1.4.

The maintenance manual shall specify the results and dates of the inspection and the maintenance operations undertaken, for example:

1) where necessary, the servicing points and methods of servicing, e.g. lubrication, tightening of bolts, re-tensioning of ropes;

2) replacement parts shall comply with manufacturer's specifications;

3) if special disposal treatment is required for some equipment or parts;

4) identification of spare parts;

5) any additional measures to be taken during the run-in period, e.g. tightening of fastenings;

6) tensioning of ropes;

7) need to keep drainage holes clear;

8) surfacing shall be maintained: in particular, the levels of loose fill materials;

9) GRP (glass-reinforced plastics) should be replaced or repaired before the glass fibres become exposed through wear or damage. This particularly applies to slides.

8 Documents

8.1 General

The following documents shall be retained by the operator.

8.2 User manual for operators

The manufacturer or the installer of a ropes course shall provide a product manual containing at least the following information together with the main product. This shall include:

a) a technical description of the facility and its individual components (material certificates etc.);

b) instructions relating to the correct use of the course, see Annex B;

c) a certificate of conformity to EN 15567-1;

d) a manufacturer's declaration, containing at least:

   1) design calculations;

   2) normative references;

   3) exclusions of liability, if any;

e) instructions for maintenance which specify the frequency and method by which equipment shall be inspected and maintained.

8.3 Arboreal assessment report

For requirements regarding arboreal assessment reports see Annex A.

Annex A
(normative)

Minimum information to be included in an arboreal assessment report

A.1 General site description

General description of the woodland or forest, including species mix, age class, soil type, topography and any other pertinent historic or local information;

— summary of report including any analysis methods used, results and recommendations;

— the date of the assessment;

— location of the site (e.g. GPS data);

— name of the arboricultural expert.

A.2 Individual tree description

— Tree schedule number or other unique identifier;

— species (common name is sufficient);

— stem diameter at stated height (usually 1,3 m to 1,5 m);

— estimated height or height class in metres;

— growing environment (inclination of ground, proximity to other features such as paths, etc.).

A.3 Observations

— Description of any defects or abnormalities (such as pests and disease, excessive basal movement, constraints to development by course installations);

— details of remedial action;

— a description of the tree's use in the course may be included to assist identification and future planning;

— other comments and observations as may be of assistance to course managers.

A.4 Assessment of condition

A coding system for assessing the tree's condition and suitability for continued use shall be employed. The code used should alert the reader to the relative priority of a tree's condition or action required. Written reports, signed and dated by the inspector, should be completed within 28 days of inspection and made available to course managers in written and/or electronic format. Any indications of immediate danger should be reported verbally to the duty site manager before leaving site.

Annex B
(normative)

Instructions for the use of the ropes course

This document is produced by the ropes course manufacturer (see 8.2). It specifies the restrictions regarding the use of the ropes courses and shall contain, at least the following information:

a) use of the elements:

   1) an accurate description of the way in which participants are to negotiate each element and the way in which their safety is ensured;

b) the meteorological conditions under which the elements are not to be used:

   1) storm;

   2) wind;

   3) snow and/or frost;

c) the number of persons allowed:

   1) on each element;

   2) on each platform;

d) the acceptable morphology of the participants:

   1) minimum and maximum height

   2) minimum and maximum weight;

e) access restriction with respect to:

   1) age and/or height;

f) appropriate clothing, long hair tied back, etc.;

g) Description and characteristics of the PPE to be used on all ropes courses. For example:

   1) harness;

   2) lanyard (length);

   3) impact absorber;

   4) connector;

   5) pulley;

   6) ropes;

   7) gloves, helmets, coveralls;

h) a security and emergency plan with a description of the procedures for evacuating:

   1) an injured person from an elevated position (different procedures and/or equipment to be used according to the place where the person is located);

   2) all the participants from the site (in the event of a storm, high wind, flood, etc.).

Annex C
(informative)

Relevance of ISO 4309:2010 to EN 15567–1 for Ropes Courses

Table C.1 — Relevance of ISO 4309:2010 to EN 15567–1 for Ropes Courses

Clause	Relevant	Partially Relevant	Not relevant
3.1	•		
3.2	•		
3.3			•
3.4			•
3.5			•
3.6	•		
3.7	•		
3.8		•	
3.9	•		
3.10	•		
4.1		•	
4.2			•
Figure 1		•	
4.3	•		
4.4		•	
4.5		•	
Figure 2	•		
Figure 3	•		
Figure 4	•		
4.6			•
4.7		•	
4.8			•
5.1		•	
5.2		•	
5.3.1	•		
Table 1	•		
5.3.2		•	
Figure 6		•	
5.3.3			•
5.3.4	•		

Clause	Relevant	Partially Relevant	Not relevant
5.3.5	●		
5.4		●	
5.5			●
5.6	●		
6.1		●	
6.2.1	●		
Table 2	●		
6.2.2		●	
6.2.3			●
Figure 7	●		
Table 3		●	
Table 4		●	
6.3.1		●	
Table 5		●	
6.3.2	●		
6.3.3	●		
6.4	●		
6.5	●		
Table 6	●		
6.6.1	●		
6.6.2		●	
6.6.3	●		
6.6.4	●		
6.6.5	●		
6.6.6	●		
6.6.7		●	
6.6.8	●		
6.6.9		●	
6.6.10		●	
Figure A.1			●
Figure A.2			●
Table B.1	●		
Figure B.1	●		
Figure B.2	●		
Figure B.3	●		
Figure B.4	●		

Clause	Relevant	Partially Relevant	Not relevant
Figure B.5	●		
Figure B.6	●		
Figure B.7	●		
Figure B.8	●		
Figure B.9	●		
Figure B.10	●		
Figure B.11	●		
Figure B.12	●		
Figure B.13	●		
Figure B.14	●		
Figure B.15	●		
Figure B.16	●		
Figure B.17	●		
Figure B.18	●		
Figure B.19	●		
C.1	●		
C.2	●		
C.2.2	●		
Figure C.1a	●		
Figure C.1b	●		
D.1		●	
D.2		●	
E.1 a	●		
E.1 b			●
E.1 c	●		
E.1 d	●		
E.2	●		
E.3	●		
E.4 a	●		
E.4 b	●		
E.4 c	●		
E.4 d	●		
E.4 e	●		
E.4 f	●		
E.4 g		●	
E.4.h			●

Clause	Relevant	Partially Relevant	Not relevant
Annex F	●		
F.1	●		
F.2			●
Table F1	●		
Annex G (all)	●		
Annex H (all)	●		
Bibliography			●

Table C.2 — Partially Relevant Clauses of ISO 4309:2010

Clause	Comment
3.8	Words cranes and hoists should be substituted for ropes courses
4.1	Word crane should be substituted for ropes course
Figure 1	Practice only necessary when cable end is not terminated
4.4	Word crane should be substituted for ropes course. Last two paragraphs not relevant unless the wire rope is moving around a sheave
4.5	Last 3 paragraphs (after Figure 4) not relevant
4.7	Word crane should be substituted for ropes course. Paragraph 2 and paragraph 5 refer to sheaves which are not relevant on a ropes course unless the wire rope is moving around a sheave. The same principles however apply to a trolley (pulley) that is moving along a wire rope. Rope dressing is not relevant.
5.1	Word crane should be substituted for ropes course
5.2	Only paragraph 3 is relevant to ropes courses
5.4	The Note is not relevant
6.1	Word crane should be substituted for ropes course
6.2.2	See comments for Tables 3 and 4
Table 3	Criteria under the headings “Sections of rope working in steel sheaves and / or spooling on a single layer drum” should apply to ropes course use. The last column “Sections of rope spooling on a multi-layer drum” is not generally relevant on a ropes course
Table 4	Same as Table 3
6.3.1	The first paragraph is not relevant on a ropes course. The first sentence of the second paragraph is not relevant.
Table 5	Reference in the heading is made to “Rope spooling on a single layer drum and/ or running through a single layer sheave”. This table applies to all ropes course applications
6.6.2	Clause (a) should relate to wire ropes that having no moving objects (e.g. trolleys and karabiners) running along them. Clause (b) should relate to wire ropes that have a moving object (e.g. trolley or karabiner) running along them
6.6.7	Reference is made to wire ropes that run through a sheave. The same applies to a wire rope that has a trolley running along a rope
6.6.9	In the last paragraph, reference is made to a sheave – the same applies to a trolley

Clause	Comment
	running on a rope
6.6.10	Lightening is the only likely heat source to affect wire ropes on most ropes courses
D.1	Word crane should be substituted for ropes course.
D.2	Word crane should be substituted for ropes course
E.4 g	Lightening is the only likely heat source to effect wire ropes on most ropes courses

Annex D
(informative)

Guidance on risk assessment

Table D.1 gives guidance on how a risk assessment can be carried out.

Table D.1 — Guidance on risk assessment

Area of risk	Who may be harmed?	Risk Likelihood	Risk Consequence	Control Measure
	e.g. all / instructor / participant	e.g. Low / Medium / High	e.g. Low / Medium / High	

Bibliography

[1] 76/769/EEC, Council Directive of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations

[2] 89/686/EEC, Council Directive of 21 December 1989 on the approximation of the laws of the Member States relating to personal protective equipment

[3] 89/391/EEC, Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work

[4] EN 1991-1-1, *Eurocode 1: Actions on structures — Part 1-1: General actions — Densities, self-weight, imposed loads for buildings*

[5] EN 1991-1-2, *Eurocode 1: Actions on structures — Part 1-2: General actions — Actions on structures exposed to fire*

[6] EN 1991-1-3, *Eurocode 1 — Actions on structures — Part 1-3: General actions — Snow loads*

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

[8] EN 1991-1-5, *Eurocode 1 — Actions on structures — Part 1-5: General actions — Thermal actions*

[9] EN 1176 (all parts), *Playground equipment*

[10] EN 341, *Personal fall protection equipment — Descender devices for rescue*

[11] EN 353-1, *Personal fall protection equipment — Guided type fall arresters including an anchor line — Part 1: Guided type fall arresters including a rigid anchor line*

[12] EN 353-2, *Personal protective equipment against falls from a height — Part 2: Guided type fall arresters including a flexible anchor line*

[13] EN 354, *Personal fall protection equipment — Lanyards*

[14] EN 355, *Personal protective equipment against falls from a height — Energy absorbers*

[15] EN 358, *Personal protective equipment for work positioning and prevention of falls from a height — Belts for work positioning and restraint and work positioning lanyards*

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

[17] EN 362, *Personal protective equipment against falls from a height — Connectors*

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

[19] EN 364, *Personal protective equipment against falls from a height — Test methods*

[20] EN 365, *Personal protective equipment against falls from a height — General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging*

[21] EN 14229, *Structural timber — Wood poles for overhead lines*

[22] EN ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs (ISO 7010)*

[23] EN ISO/IEC 17020:2012, *Conformity assessment — Requirements for the operation of various types of bodies performing inspection (ISO/IEC 17020:2012)*

[24] ISO 22727, *Graphical symbols — Creation and design of public information symbols — Requirements*

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