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Personal equipment for protection against falls — Descending devices

Équipement personnel de protection contre les chutes — Dispositifs de descente

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 22159 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 4, *Personal equipment for protection against falls*.

Introduction

Descending devices conforming to this International Standard are intended to be used in conjunction with an appropriate descent line and other equipment, e.g. an appropriate harness or rescue loop and a reliable anchor, to enable a person to descend from one position to another, either on their own or assisted by another person. Typical uses are emergency egress and work positioning. In addition to their primary function of allowing access to a lower point, descending devices and descent lines have a fall protection function.

Descending devices in this International Standard have been divided into six types. Types 1 and 2 are further divided into four classes.

Type 1 descending devices have an integrated descent line and are intended for multiple evacuations to a safe lower place when users do not need to control their descent speed. The descent speed is automatically controlled, i.e. without the need for intervention by the user.

Type 2 descending devices have an integrated descent line and are manually controlled. They are generally more suitable for single person evacuations to a safe lower place when users may need to control their descent speed and may need to stop somewhere on the descent line.

Types 3 and 4 descending devices are not required to have an integrated descent line. The descent line can be fitted to the descending device on site. These types of descending device are equipped with a manually operated descent control device which, when it is let go, will automatically lock to the descent line and stop the descent (hands-free locking element). In addition, type 3 descending devices will "fail to the locked position" and the descent will stop if the descent control device is moved beyond its descent control parameters, e.g. in a panic situation when the user squeezes the descent control device too far (panic locking element).

Types 5 and 6 descending devices do not have a hands-free automatic locking element or a panic locking element. These descending devices rely on the user to stop the descent manually and to lock off manually, too, typically by wrapping the descent line around the descending device to create enough friction to stop movement. These types are also not required to have an integrated descent line: the descent line can be fitted to the descending device on site.

Descending devices types 1 and 2, which are typically intended primarily for emergency egress, have been classified further by performance. A value, called descent energy, is calculated based on the product of the mass of the user, the maximum descent height for the descending device and the number of descents for which the descending device is designed. In practice, descending devices are subjected to different loads, e.g. a descending device for descending 100 passengers from a cable car at a height of 100 m needs to conform to more stringent requirements than a descending device used by a crane driver to descend from a height of 20 m. The descent energy provides an indication of the appropriateness of a descending device and its descent line for a given application. The descent energy may be used to calculate the maximum combination of descent height and number of descents for a particular use. The classes are A, B, C and D, which are explained in more detail within this International Standard.

Type 2 class D descending devices deserve special mention because they are intended for a specific purpose, i.e. for single use emergency egress only, by trained and competent personnel who, as part of their training, have experienced a descent using this type of descending device.

Descent lines are a necessary component in a descending system and need to meet some basic requirements to ensure that they are suitable for use with relevant descending devices. This International Standard therefore includes such basic requirements for descent lines.

This International Standard recognizes that a descending device could not only travel with the user (normal in rope access, for example) but could also in some circumstances be designed to operate from a fixed position (e.g. at the top of the descent). The test methods reflect this. Operating from a fixed position is normal for type 1 descending devices. It is perhaps not so normal for other types, but is possible.

This International Standard presumes that the manufacturer of the descending device, subsystems or components will, for the sake of consistency and traceability, operate a quality management system which will comply with national and regional regulations in force at the time. Guidance on the form this quality management system may take can be found in ISO 9001.

It is highly advisable that manufacturers claiming conformity of their descending devices with this International Standard have their claims verified by an independent, nationally recognized test organisation.

Note the points below.

— It is essential that users of all types of descending devices and their descent lines are trained and assessed as competent before using them unsupervised. This applies even to the totally automatic descending devices of type 1. It applies particularly to types 5 and 6 descending devices, where any mismanagement could have disastrous results. It is advisable that training be ongoing and not just a one-off at the first introduction to the equipment.

— This International Standard does not encompass all foreseeable uses of descending devices or requirements for all possible descending devices. Manufacturers, specifiers and end users can identify uses for which descending devices that are outside the scope of this International Standard are appropriate.

— The requirements specified are generally minimum requirements.

Annex A provides advice on the packaging of descending devices and Annex B gives functional recommendations for the use of descending devices in the workplace.

Personal equipment for protection against falls — Descending devices

1 Scope

This International Standard specifies requirements, test methods, marking and information to be supplied by the manufacturer for descending devices. It also specifies some basic requirements for the descent lines to be used with the descending devices.

This International Standard is applicable to automatic and manually operated descending devices intended for use in the workplace in access, egress, work positioning and rescue systems. Various types and classes of descending devices are defined according to function and performance. These descending devices can be used in situations other than the workplace if adequate training and/or supervision are provided.

This International Standard is not intended to apply to descending devices used in leisure activities such as recreational climbing and caving, although its requirements can be useful in specifying such equipment.

NOTE Descending devices conforming to this International Standard can be designed for use by one or two persons simultaneously.

2 Normative references

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

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

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms, definitions and classifications

3.1 Terms and definitions

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

3.1.1
anchor point
secure place of attachment to which the descent line or descending device is connected

3.1.2
attachment element
primary point of connection to the descending device, as specified by the manufacturer

3.1.3
automatic descending device
device that enables a person or persons to descend at a controlled rate without any intervention once the descent has commenced

NOTE Automatic descending devices are also known as controlled descent devices.

3.1.4
competent person for periodic detailed inspection
person who knows the current periodic detailed inspection requirements, recommendations and instructions issued by the manufacturer applicable to the descending device, subsystem or system, and who has the authority, skills and resources to initiate corrective action

3.1.5
competent person for repair
person authorized by the manufacturer to repair the descending device, subsystem or system

3.1.6
descending device
automatic or manually operated device used in conjunction with an appropriate descent line, which allows the user, either individually or assisted by another person, to achieve a descent with a controllable velocity

NOTE A descending device can be used for self-descent, self-rescue, rescue by a second person or for rescue by a rescuer and rescuee in a tandem descent.

3.1.7
descent control element
integral element of the descending device, normally operated by hand, used to control the velocity of descent down the descent line

3.1.8
descent energy
W
energy measured in joules which results from the product of descent height, descent load and number of descents

3.1.9
descent line
flexible line for descending, used in conjunction with a descending device

3.1.10
emergency egress
evacuation from a location in the event of an emergency

3.1.11
hands-free locking element
integral part or function of the descent control element which stops the descent and thereby prevents an uncontrolled descent or a fall if the user fails to engage the device

NOTE Some creep of the descending device along the descent line can occur (see 4.6).

3.1.12
integrated descent line
descent line assembled by the manufacturer with a compatible descending device such that the descent line can only be removed by the use of a tool, and in such a way that removal would be clearly evident

3.1.13
manually operated descending device
descending device that allows a person or persons to descend at a rate that is controlled manually

NOTE 1 Some creep of the descending device along the descent line can occur (see 4.6).

NOTE 2 Manually operated descending devices are also known as descent control devices.

3.1.14
manufacturer
maker, authorized representative of a maker or an assembler responsible, where relevant, for the design, test and release of the completed component, subsystem or system placed on the market

3.1.15
maximum rated load
maximum mass of person(s), including tools and equipment, to be used with the descending device, as specified by the manufacturer

NOTE Maximum rated load is specified in kilograms.

3.1.16
minimum rated load
minimum mass of person(s), including tools and equipment, to be used with the descending device, as specified by the manufacturer

NOTE Minimum rated load is specified in kilograms.

3.1.17
panic locking element
integral part or function of the descent control element which stops the descent and thereby prevents an uncontrolled descent or a fall if the user panics and operates the descending device beyond its intended descent control parameters

NOTE Some creep of the descending device along the descent line can occur (see 4.6).

3.2 Classifications

3.2.1 Classification by type

Descending devices are classified by type, as described below (see Figure 1 for generic examples of the different types of descending device and Figure 2 for their characteristics):

a) type 1: automatically operated descending device with integrated descent line;

b) type 2: manually operated descending device with integrated descent line;

c) type 3: manually operated descending device with mechanically variable friction, hands-free locking and panic locking features;

d) type 4: manually operated descending device with mechanically variable friction and hands-free locking features;

e) type 5: manually operated descending device with mechanically variable friction and non-automatic locking;

f) type 6: manually operated descending device with non-mechanically variable friction and non-automatic locking.

NOTE Descending devices can conform to the requirements of more than one type.

3.2.2 Classification by performance

Descending devices of types 1 and 2 are classified by performance, as follows (see 4.9):

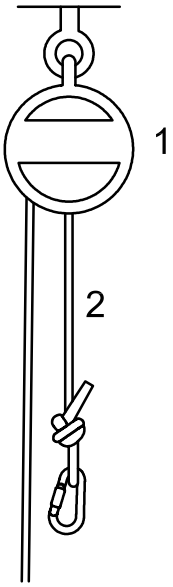
a) class A for a descent energy, W, up to $7{,}5 \times 10^6$ J;

b) class B for a descent energy, W, up to $1{,}5 \times 10^6$ J;

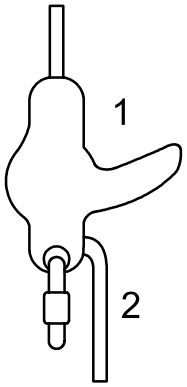
c) class C for a descent energy, W, up to $0{,}5 \times 10^6$ J;

d) class D for one descent only; the descent energy, W, depends on the maximum descent height and the maximum rated load.

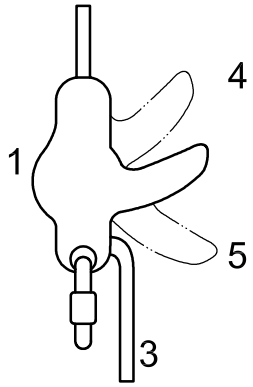
NOTE In practice, descending devices are subjected to different loads, e.g. a descending device for descending 100 passengers from a cable car at a height of 100 m conforms to more stringent requirements than a descending device used by a crane driver to descend from a height of 20 m. The descent energy can be used to calculate the maximum combination of descent height and number of descents for a particular use.



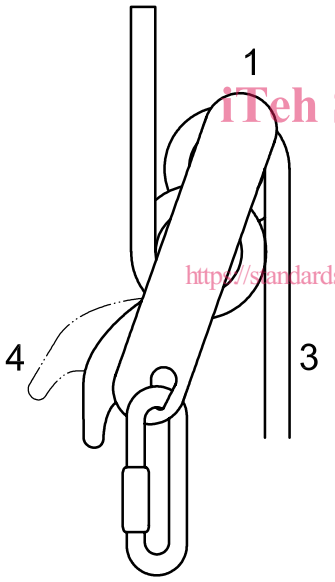
a) Type 1



b) Type 2

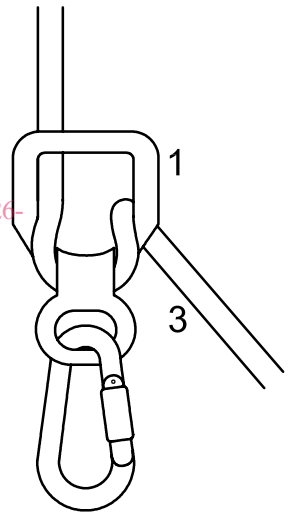


c) Type 3



d) Type 4

e) Type 5



f) Type 6

Key

1 descending device
2 integrated descent line
3 descent line
4 descent control element in hands-free locking position
5 descent control element in panic locking position

Figure 1 — Generic examples of different types of descending device

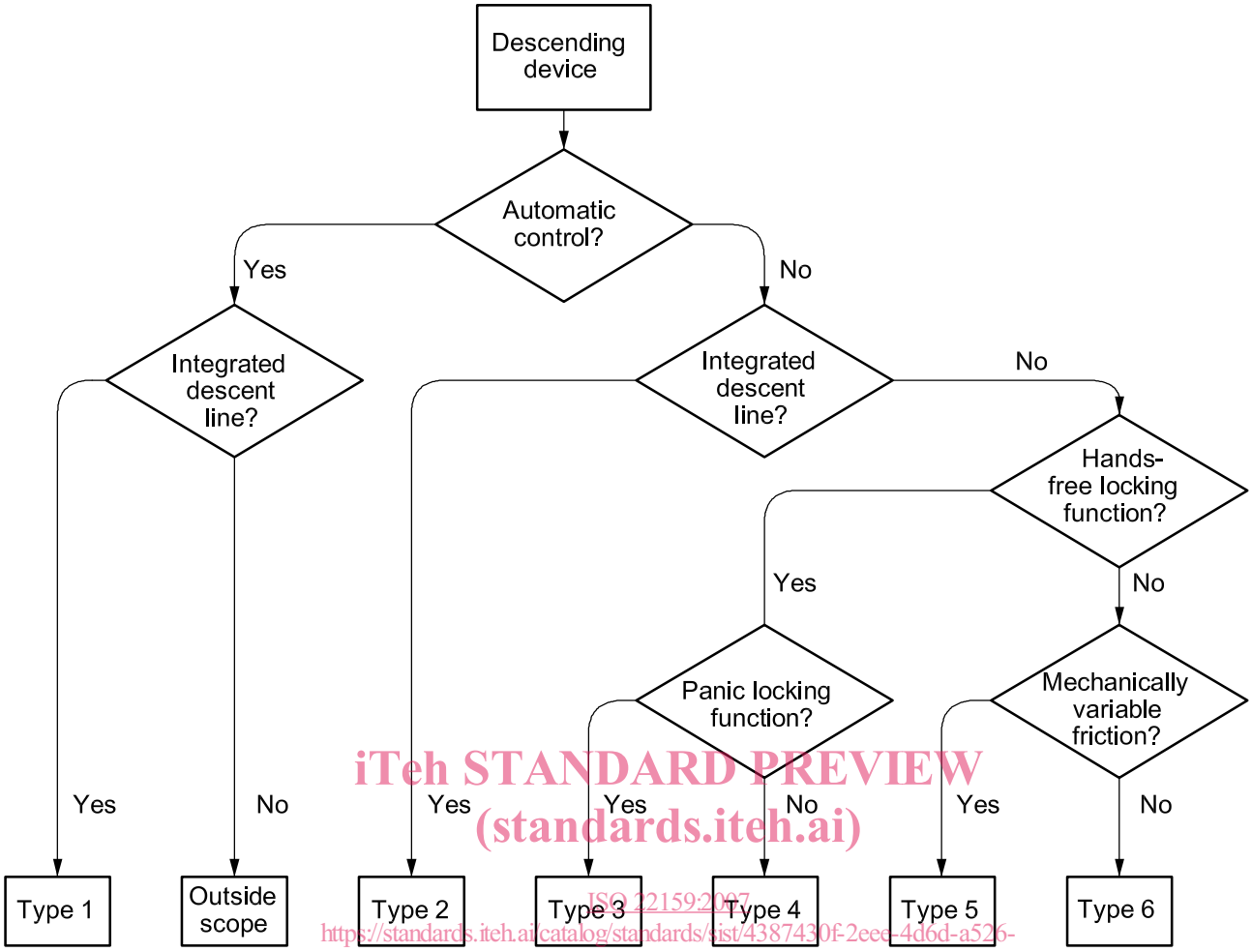


Figure 2 — Characteristics of different types of descending device

Table 1 — Requirements related to descending device type and class

Clause No.	Requirement	Conditioning				Type and class							
		General 4.15.2	Wet 4.15.3	Wet & cold 4.15.4	Very cold 4.15.5	1A, 1B, 1C	1D	2A, 2B, 2C	2D	3	4	5	6
4.1	General requirements	a	a	a	a	b	b	b	b	b	b	b	b
4.2	Descent lines: basic requirements	a	a	a	a	b	b	b	b	b	b	b	b
4.3	Descent line stopper	b	a	a	a	b	b	b	b	a	a	a	a
4.4	Descent line residual static strength	b	a	a	a	b	b	b	b	b	b	b	b
4.5	Rated loads	a	a	a	a	b	b	b	b	b	b	b	b
4.6.1	Holding load: hands-free locking	b	a	a	a	a	a	b	b	b	b	a	a
4.6.2	Holding load: panic locking	b	a	a	a	a	a	b	b	b	a	a	a
4.6.3	Holding load: locked	b	a	a	a	a	a	a	a	a	a	b	b
4.7	Static strength	b	a	a	a	b	b	b	b	b	b	b	b
4.8	Dynamic performance	b	b	c	c	b	b	b	b	b	b	b	b
4.9	Descent energy	b	a	a	a	b	b	b	b	a	a	a	a
4.10	Descent velocity	b	b	c	c	b	b	b	b	b	b	b	b
4.11	Temperature rise	b	a	a	a	b	b	b	b	b	b	b	b
4.12	Special requirements for class D	a	a	a	a	a	b	a	b	a	a	a	a
4.13	Function	b	b	c	a	b	b	b	b	b	b	b	b
4.14	Corrosion resistance	a	a	a	a	b	b	b	b	b	b	b	b
4.16.1	Marking	a	a	a	a	b	b	b	b	b	b	b	b
4.16.2	Information	a	a	a	a	b	b	b	b	b	b	b	b

NOTE All tests are carried out on the minimum and maximum diameters of descent line of the range marked on the descending device, except the corrosion test and where otherwise stated.

[a] No requirement.

[b] Requirement.

[c] Optional.

4 Requirements

NOTE A list giving an overview of the requirements relating to each individual type/class of descending device is given in Table 1.

4.1 General

4.1.1 The material specification of all components, including the descent line recommended for use with the descending device, shall be known to be durable at temperatures in which the descending device may be used.

4.1.2 Components made of materials that may degrade due to exposure to sunlight or other environmental factors shall be protected against such degradation, either by proper shielding of the components, e.g. by the use of UV inhibitors in textiles, or by other suitable means, e.g. a protective coating.

4.1.3 Descending devices intended to allow removal of the descent line shall have a mechanism or function to prevent the descent line from being detached unintentionally. The descending device shall have a mechanism or shall function to prevent it being detached from the descent line without at least two consecutive deliberate manual actions.

4.1.4 Descending devices shall not have sharp or rough edges that may cut, abrade or otherwise damage ropes or webbing or cause injury to the user.

4.1.5 Types 1 and 2 descending devices shall be tested in combination with any descent line with which they will be placed on the market.

4.1.6 Types 3, 4, 5 and 6 descending devices for use with descent lines that conform to a recognized and appropriate standard, e.g. EN 1891, CI-1801, AS/NZS 4142.3, as specified in the information supplied by the manufacturer of the descending device, shall be tested with the minimum and maximum diameters of descent line for the range marked on the descending device for each standard claimed by the manufacturer. The exception shall be where a particular test method specifies that the test shall be carried out only at either a minimum or a maximum diameter.

4.1.7 Types 3, 4, 5 and 6 descending devices that do not specify a recognized and appropriate standard to which the descent line shall conform shall be tested on the minimum and maximum diameters of descent line marked on the descending device of every model of the type of descent line which the manufacturer of the descending device claims is appropriate for use with the descending device. The exception shall be where a particular test method specifies that the test shall be carried out only at either a minimum or a maximum diameter.

4.1.8 Metals which could react together galvanically in normal use to the detriment of the descending device or descent line shall not be used in descending devices and descent lines.

4.1.9 Connectors supplied with descending devices shall conform to an appropriate standard, e.g. ISO 10333-5, EN 362, CAN/CSA Z259.12, and shall have a manual or an automatic locking gate.

4.2 Descent lines: basic requirements

4.2.1 General

4.2.1.1 Descent lines shall be made from textile rope or webbing or from steel wire rope or any other appropriate material.

4.2.1.2 Descent lines shall be capable of visual inspection or else subjected to manufacturers' guidance for appropriate examination to confirm that the descent line is satisfactory for continued use.

4.2.2 Textile descent lines

4.2.2.1 Descent lines made from textiles shall be made from virgin filament or multi-filament synthetic fibres suitable for the use intended. The breaking tenacity of the synthetic fibre shall be known to be at least 0,6 N/tex.

4.2.2.2 The materials used for the construction of textile descent lines shall be known to have a melting point of more than 195 °C. Ropes or webbing made from polypropylene or polyethylene shall not be used for descent lines.

4.2.2.3 Descent lines made from textiles supplied with, or recommended for use with, types 3, 4, 5 and 6 descending devices shall have a minimum static strength of 18 kN. If the minimum static strength of the textile descent line is not specified by the manufacturer, it shall be tested in accordance with 5.5.4.

4.2.2.4 When tested in accordance with 5.5.6, descent lines containing aramid fibres shall not break when the test in 5.5.6.6 is carried out with forces equivalent to those specified in 4.7.

4.2.2.5 When descent lines made from textiles are supplied with permanent end terminations, the eyes formed shall be protected from wear.

4.2.3 Wire rope descent lines

4.2.3.1 Wire rope descent lines made from steel shall be known not to work-harden unduly under foreseeable conditions of use and shall have an appropriate degree of protection against corrosion for such conditions of use. They shall be made from one piece (i.e. no joins in the rope).

NOTE It is advisable that manufacturers of descending devices be particularly careful when selecting or recommending descent lines made from stainless steel as some types of stainless steel can have unpredictable fatigue and corrosion characteristics.

4.2.3.2 Descent lines made from wire rope supplied with, or recommended for use with, types 3, 4, 5 and 6 descending devices shall be known to have a minimum static strength of 15 kN.

4.2.3.3 When tested in accordance with 5.5.6, descent lines made from stainless steel wire shall not break when the test in 5.5.6.6 is carried out with forces equivalent to those specified in 4.7.

4.2.3.4 Wire rope descent lines shall be supplied with permanent end terminations. Eyes formed on wire rope or webbing descent lines shall incorporate a thimble and a termination that has a rated strength of at least 90 % of the descent line nominal strength.

4.3 Descent line stopper

For types 1 and 2 descending devices (i.e. descending devices with integrated descent lines), the free or tail end of the descent line shall be protected against slipping through the descending device. Stopper knots (see Figure 3 and 5.5.3.1 b) or clamps with or without stopper devices (see Figure 4 and 5.5.3.1 b) used as protection on textile descent lines shall be made at a distance of at least 0,5 m from the end of the descent line.