INTERNATIONAL STANDARD

ISO 10333-5

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Personal fall-arrest systems —

Part 5: Connectors with self-closing and self-locking gates

Systèmes individuels d'arrêt de chute —

Partie 5: Connecteurs à portail autofermant et autoverrouillant

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 10333 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10333-5 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 4, *Personal equipment for protection against falls*.

ISO 10333 consists of the following parts, under the general title *Personal fall-arrest systems*:

— *Part 1: Full-body harnesses*

— *Part 2: Lanyards and energy absorbers*

— *Part 3: Self-retracting lifelines*

— *Part 4: Vertical rails and vertical lifelines incorporating a sliding-type fall arrester*

— *Part 5: Connectors with self-closing and self-locking gates*

The system performance tests will be the subject of a future part 6 to ISO 10333.

Introduction

In cases where the hazard of falling from a height exists and where, for technical reasons or for work of very short duration, safe access cannot be otherwise provided, it is necessary to consider the use of personal fall-arrest systems (PFAS). Such use should never be improvised and its adoption should be specifically provided for in the appropriate formal provisions for safety in the work place.

PFAS complying with this part of ISO 10333 should satisfy ergonomic requirements and should only be used if the work allows means of connection to a suitable anchor device of demonstrated strength and if it can be implemented without compromising the safety of the user. Personnel should be trained and instructed in the safe use of the equipment and be observant of such training and instruction.

This part of ISO 10333 is based on current knowledge and practice concerning the use of PFAS that incorporate a full body harness.

This part of ISO 10333 presumes that the manufacturer of the PFAS, 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 9000 (all parts), *Quality management and quality assurance standards*.

Personal fall-arrest systems —

Part 5:
Connectors with self-closing and self-locking gates

1 Scope

This part of ISO 10333 specifies requirements, test methods, instructions for use and maintenance, marking, labelling and packaging, as appropriate, for connectors with self-closing and self-locking gates made from metallic materials.

Connectors are used in personal fall-arrest systems (PFAS), which will be specified in a future International Standard (see ISO 10333-6 in the Bibliography), such that, if an arrest takes place, the arresting force will not exceed 6 kN. This part of ISO 10333 is applicable only to connectors limited to single person use of a total mass not exceeding 100 kg.

NOTE Users of fall protection equipment whose total mass (including tools and equipment) exceeds 100 kg are advised to seek advice from the equipment manufacturer regarding the suitability of this equipment, which may need additional testing.

The scope of this part of ISO 10333 does not extend to:

a) attachment elements, fastening buckles, adjusting buckles and other metallic fittings used in the manufacture of full-body harnesses, which are specified in ISO 10333-6;

b) connectors used for material-lifting purposes;

c) connectors used in special techniques or situations, e.g. rescue, or rope access.

This part of ISO 10333 does not specify those additional requirements that would apply when connectors are subjected to special conditions of use (where, for example, there exist unusual limitations concerning access to the place of work and/or particular environmental factors). Thus, treatments to ensure the durability of the materials of construction (such as heat treatment, anti-corrosion treatment, protection against physical and chemical hazards) are not specified in this part of ISO 10333, but should comply with appropriate International Standards or, failing that, with national standards and other specifications dealing with relevant physical characteristics and/or the safety of users. In particular, when it is considered necessary to test the corrosion resistance of metallic parts of the equipment, reference should be made to ISO 9227.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10333. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10333 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO 10333-1, *Personal fall-arrest systems — Part 1: Full-body harnesses*

3 Terms and definitions

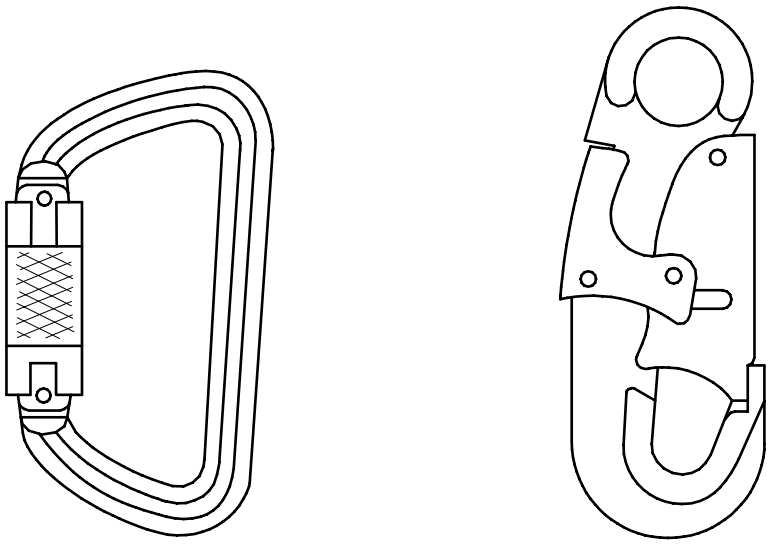
For the purposes of this part of ISO 10333, the following terms and definitions apply.

3.1 Connectors

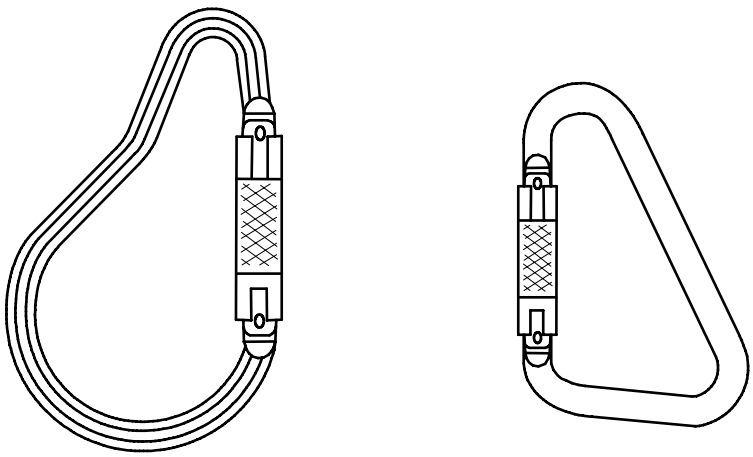
3.1.1
connector
device, which is used to assemble a PFAS by enabling two other components or subsystems to be physically connected

See Figure 1.

NOTE A connector has an opening guarded by a self-closing gate with a self-locking feature.

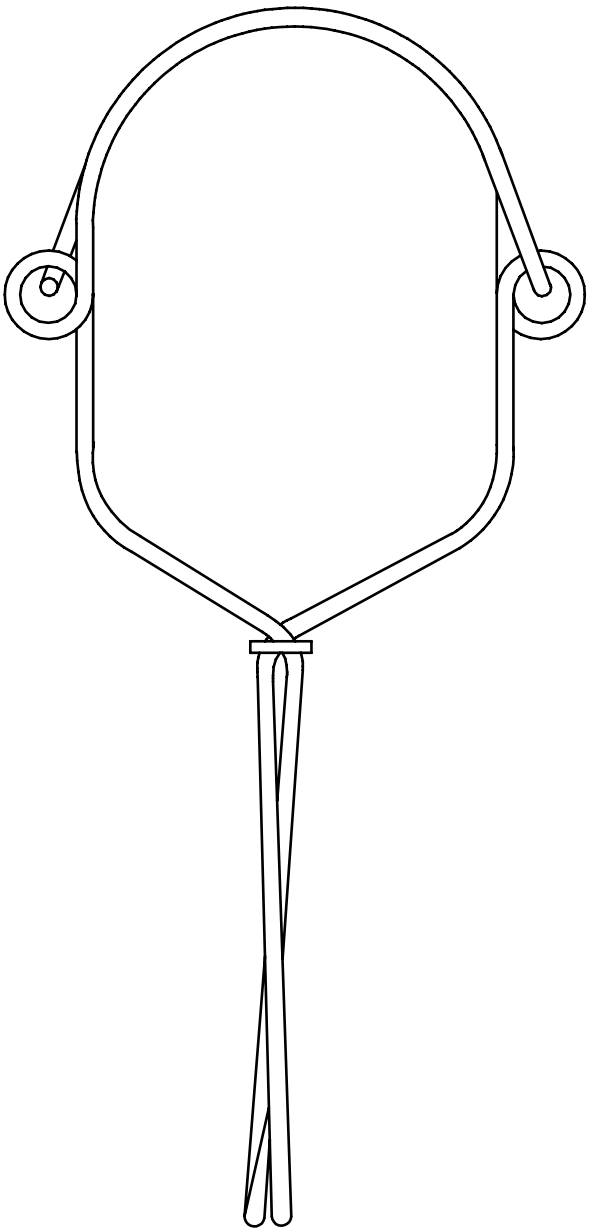


a) Karabiner and small snap hook

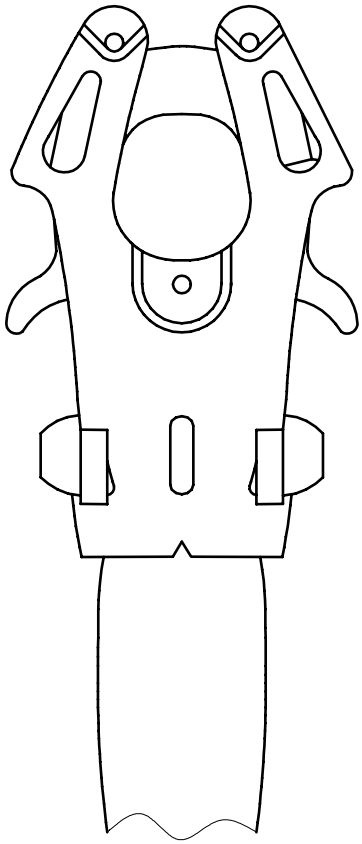


b) Large hooks

Figure 1 — Examples of connectors



c) Anchor connector



d) System assembly connector

Figure 1 — Examples of connectors (*continued*)

3.1.2
gate
self-closing, sliding or hinged mechanism which, when opened, allows passage of the components or sub-systems to be coupled into the connector

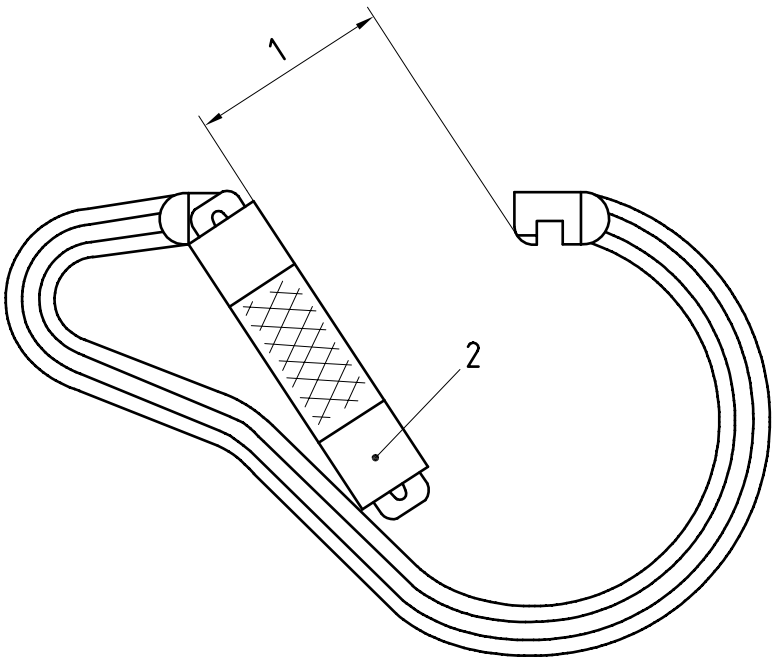
See Figure 2.

NOTE When closed and with the locking feature engaged it is designed to prevent the unintentional separation of the coupled components or subsystems.

3.1.3
self-locking feature
mechanism which operates automatically upon closure of the gate and is opened by at least two consecutive, deliberate actions

3.1.4
opening
maximum gap for the passage of a component or subsystem into the connector with a fully opened gate

See Figure 2.



Key
1 Opening
2 Gate

Figure 2 — Example of opening dimension

3.1.5
retention pin
pin, which when inserted across one end of a connector, maintains the position of a lanyard termination, so that the termination is constrained to bear on a part of the connector which has been designed to sustain a fall-arrest force

3.1.6
retention eye
eye or hole which is similar in function to a retention pin, but which becomes integral to the connector during manufacture

3.1.7
latch
that part of the connector which engages with the free end of the gate

3.1.8
total mass
sum of the user's mass plus the mass of all attached clothing and equipment

3.2 General terms and definitions

3.2.1
personal fall-arrest system
PFAS
assembly of interconnected components and subsystems, including a full-body harness worn by the user, that when connected to a suitable anchor device will arrest a fall from a height

NOTE A PFAS minimizes the fall-arrest forces, controls the total fall distance as to prevent collision with the ground or other relevant obstruction and maintains the faller in a suitable post fall-arrest attitude for rescue purposes.

3.2.2
component
constituent part of a PFAS or subsystem that has completed the manufacturer's production cycle and is available for purchase

3.2.3
subsystem
constituent part of a PFAS which may consist of one or more components and is used to connect the user from the fall-arrest attachment element of the full-body harness to the anchor device and performs the two essential functions of a PFAS as follows:

a) connecting;

b) arresting and energy absorbing

4 Requirements

4.1 General

4.1.1 All connectors shall be made from smoothly finished metal and shall be free from defects due to faulty material and manufacture; they shall not have sharp edges or burrs that may cause injury to the user, or that may cut, abrade or otherwise damage webbing or rope.

4.1.2 In order to reduce the probability of involuntary opening, all connectors shall be self-closing and self-locking and shall be capable of being opened only by at least two consecutive, deliberate actions.

4.1.3 The self-closing gate shall be so designed that when it is released from the open position, it shall automatically close, and the locking feature shall automatically engage.

4.2 Gate resistance

4.2.1 Gate-face resistance

When tested in accordance with 5.1, the connector shall withstand a minimum force of 1,0 kN for 1 min without the gate separating from the latch by more than 3 mm. Following this test, the gate shall function in accordance with 4.1.3.

4.2.2 Gate side-load resistance

When tested in accordance with 5.1, the connector shall withstand a minimum force of 1,5 kN for 1 min without the gate separating from the latch by more than 3 mm. In addition, there shall be no partial fractures, and permanent deformation of the gate shall not exceed 3,0 mm. Following this test, the gate shall function in accordance with 4.1.3.

4.3 Static strength

When conditioned in accordance with 5.3 and tested in accordance with 5.2, the connector shall withstand a minimum force of 20 kN for 1 min. There shall be no partial fractures or inadvertent opening of the gate.

NOTE When special circumstances require a higher minimum strength, this value should replace the 20 kN requirement for testing, instructions and marking.

4.4 Corrosion resistance

When tested in accordance with 5.3, the connector gate shall continue to function in accordance with 4.1.3.

There shall be no evidence of corrosion of the base metal; tarnishing and/or white scale is acceptable.

5 Test methods

5.1 Gate-resistance tests

5.1.1 Gate-face resistance

Insert the connector into a fixture with the gate uppermost, and so as to apply the test load or force in a perpendicular direction, towards the gate, as shown in Figure 3. Using a rigid bar, of the dimensions shown in Figure 3, apply a minimum force of 1,0 kN for 60 s^{+10}_{0}s to the gate at a point as close to the latch as possible. The rate of application of the force shall not exceed 75 mm/min.

With the 1,0 kN force applied, measure and record any gap between the gate and the latch.

5.1.2 Gate side-load resistance

Insert the connector into a fixture with its side uppermost, so as to apply the test load or force in a perpendicular direction, towards the gate, as shown in Figure 4. Measure and record the height to the gate, as shown in Figure 4. Using a rigid bar, of the dimensions shown in Figure 3, apply a minimum force of 1,5 kN to the gate at a point halfway between the hinge and latch for 60 s^{+10}_{0}s. The rate of application of the force shall not exceed 75 mm/min.

With the 1,5 kN force applied, measure and record any gap between the gate and the latch. Remove the load and measure the height to the gate. Calculate the permanent deformation of the gate.

5.2 Static strength test

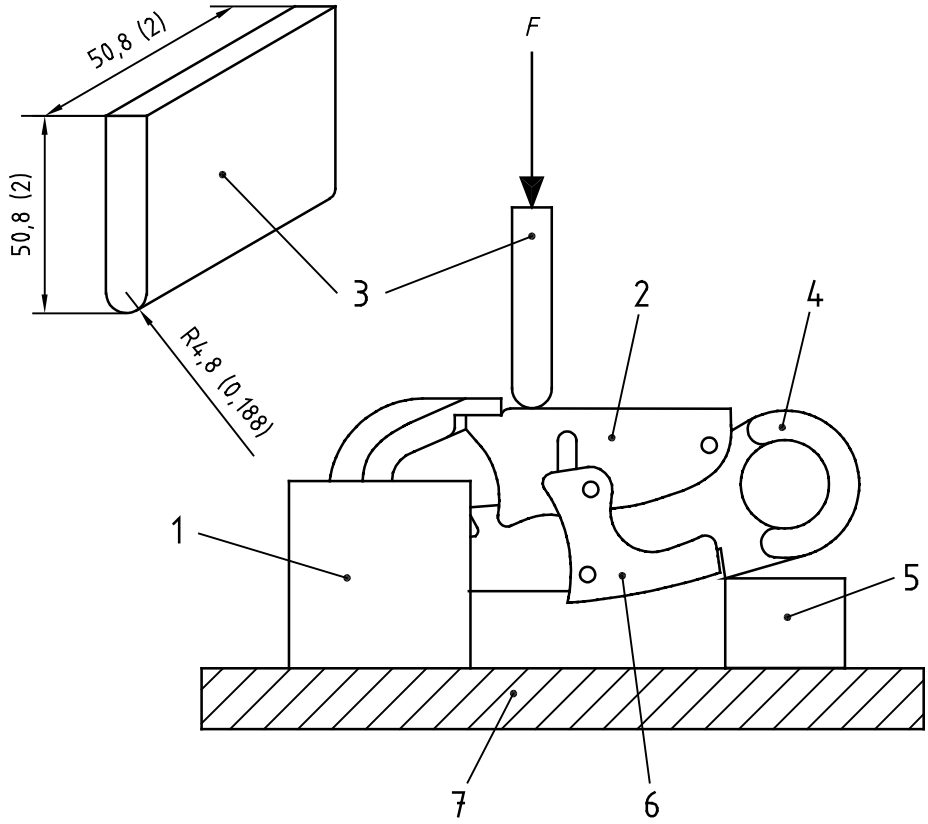
5.2.1 Mount the connector in a conventional tensile-testing machine to enable a tensile load to be applied by means of two pins of diameter $(12 \pm 0{,}1)$ mm, which are arranged to be perpendicular to the major axis. It is important that the connector be free so as to be located on the pins at the start of the test and as the load is applied. The pins shall be coated with a molybdenum-based grease where they come into contact with the tests specimen. Alternative fixtures may be used, providing that the application of the tensile load reproduces as closely as practicable the manner in which the connector is to be stressed in service, in accordance with the manufacturer's instructions. See Figure 5.

Alternatively the connector may be tested in a horizontal-axis test machine, with the connector positioned in a vertical plane with the gate downwards.

5.2.2 Apply a minimum force of 20 kN and maintain it for 60 s^{+10}_{0}s. During loading, the crosshead velocity shall lie within the range of 20 mm/min to 50 mm/min.

NOTE When special circumstances require a higher minimum strength, this value should replace the 20 kN requirement for testing, instructions and marking.

Dimensions in millimetres (inches)



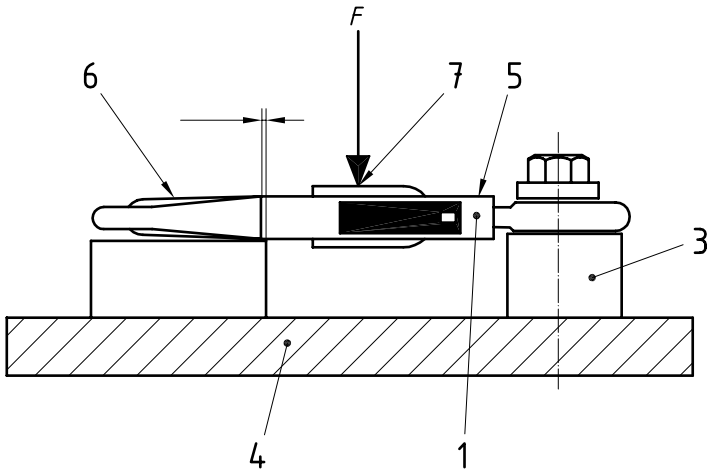
Key

1	Clamping feature
2	Gate
3	Load (rigid bar)
4	Snap hook
5	Resting block
6	Latch
7	Test bed
F	Force applied to gate

Figure 3 — Gate-face resistance test

5.3 Corrosion test

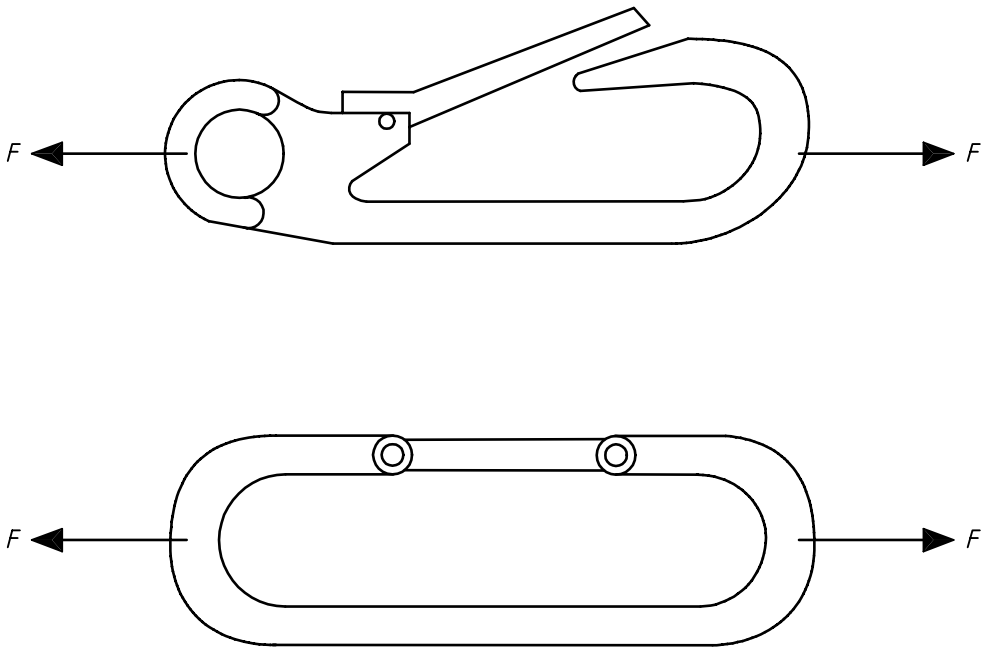
Salt-spray test the connector in accordance with ISO 9227, with an initial exposure of 24 h, followed by 1 h drying, followed by an additional exposure of 24 h. Check that the requirements of 4.4 have been met.



Key

1 Gate
2 Load
3 Resting block
4 Test bed
5 Hinge
6 Nose
7 Halfway between nose and hinge
F Force applied to gate

Figure 4 — Gate side-load resistance test



F Force applied to connector

Figure 5 — Example of a static strength test for an alternative fixture

6 Instructions for general use, marking, packaging and maintenance

6.1 Instructions for general use

6.1.1 A connector shall be supplied with clear instructions for use in the appropriate national language, and shall include the following information:

a) the name of the manufacturer and the model/type identification of the connector;

b) where appropriate, the name and address of the supplier or other information that enables the supplier to be traced;

c) a statement of the purposes and limitations of the product;

d) a warning against making any alterations or additions to the product;

e) advice that great care should be taken to ensure that the connector, when incorporated into a personal fall-arrest system, performs correctly, and that the recommended way to achieve this is by testing such an assembly (see reference [1] in the Bibliography);

f) advice that the product should only be used by a trained and/or otherwise competent person, or that the user should be under the direct supervision of such a person;

g) advice that for any personal fall-arrest system, the maximum impact force experienced by a person in a fall should not exceed 6 kN, and the system may need an energy absorber to achieve this;

h) advice that in any personal fall-arrest system, care should be taken to chose a reliable anchor point;

i) a warning against the danger that may arise by the use of combinations of components and/or sub-system in which the safe function of any one component and/or sub-system is affected by, or interferes with, the safe function of another;

j) an instruction to make a visual inspection of the equipment immediately before use and to ensure that the equipment is in a serviceable condition and operates correctly;

k) an instruction that if there is any doubt arising about the safety of the connector, it should be removed from service immediately until such time as it has been inspected, and if appropriate, tested by a competent person authorized by the manufacturer;

l) a corresponding warning in general terms together with advice to the effect that the user should consult the manufacturer in case of doubt for a product which includes any material susceptible to attack by chemicals;

m) storage instructions;

n) instructions for cleaning and/or washing;

o) instructions for maintenance;

p) advice that the equipment be inspected periodically according to the manfacturer's instructions by a competent person, and that the period between inspections should take into account the conditions of use but at least one inspection should be performed annually;

q) a warning that repairs to the equipment be carried out only by the manufacturer or by a competent person appropriately authorized by the manufacturer;

r) guidance concerning the inspection of the equipment and those factors that should cause the equipment to be discarded;

s) an instruction that any equipment that has been used to arrest a fall be removed from service;

t) advice that before and during use, consideration should be given as to how any rescue could be safely and efficiently carried out.

6.1.2 Particular information shall be given in regard to the precautions to be observed when making a connection as follows:

a) The connector should be capable of free and easy engagement with the components or subsystems to be connected without the need for the application of force.

b) There should be sufficient clearance to allow the gate to fully close and lock after the connection has been made.

c) The closure of the gate and lock should be physically checked after the connection is made to avoid subsequent and unintentional disengagement.

d) When the connection is made the connector should be manipulated within the connection to ensure that the connector's intended bearing surface bears upon the mating component's intended bearing surface. The gate of the connector should not bear upon any surface.

e) When the connection is made, the connector should be capable of aligning in all directions in which the personal fall-arrest system can possibly be loaded as a result of the arrest of a fall. (This is to avoid weakening the connector by subjecting it to bending).

f) When the connection is made, the connector should not be used in orientations other than in-line, end-to-end. Severe weakening can take place if a connector is loaded over an edge.

g) Connectors with a retention eye or retention pin are to be preferred in making connections, to minimize the possibility of the inadvertent release of components. Retention pins should not be inserted through the lanyard termination.

6.2 Marking

Connectors shall be clearly and indelibly marked or permanently labelled in accordance with relevant national regulations to include the following information:

a) the number of this part of ISO 10333, i.e. ISO 10333-5;

b) the name, trade mark or other means of identification of the manufacturer or the supplier responsible for acting on behalf of the manufacturer claiming compliance with this part of ISO 10333;

c) the manufacturer's product identification information including the model/type and the batch or serial number that enables the origin of the item to be traced;

d) the year of manufacture;

e) the minimum breaking strength of 20 kN, in accordance with this part of ISO 10333.

6.3 Packaging

6.3.1 Manufacturers and suppliers shall take all reasonable care to ensure that their product is sufficiently packaged to prevent damage and deterioration during transportation.

6.3.2 Where severe environmental conditions exist, or special conditions of supply are detailed for long-term storage, or transportation requirements, arrangement should be specified by the purchaser and agreed by the supplier.

Bibliography

[1] ISO 10333-6:—[1)], *Personal fall-arrest systems — Part 6: System performance tests*

1) In preparation. Further information may be obtained from Technical Committee ISO/TC 94, Subcommittee 4.

ICS 13.340.99

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