INTERNATIONAL STANDARD

ISO 8083

Second edition
2006-01-15

Machinery for forestry — Falling-object protective structures (FOPS) — Laboratory tests and performance requirements

Matériel forestier — Structures de protection contre les chutes d'objets (FOPS) — Essais de laboratoire et exigences de performance

Reference number
ISO 8083:2006(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 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 8083 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 15, *Machinery for forestry*.

This second edition cancels and replaces the first edition (ISO 8083:1989), which has been technically revised.

A new bolt and nut class as well as the − 20 °C temperature class for Charpy V-notch impact strength have been added. The normative references have been updated and the model test report modified to be more complete from the point of test laboratory accreditation. In addition, the text has been editorially rearranged for clarity.

Introduction

Special forestry machinery needs a falling-object protective structure (FOPS) standard of its own. It is recognized that there are various classes and sizes of forestry machinery that operate in a variety of environmental conditions as well as variations in log size the machines are capable of handling. Therefore, two alternative levels of acceptance criteria are given.

Machinery for forestry — Falling-object protective structures (FOPS) — Laboratory tests and performance requirements

1 Scope

This International Standard establishes a consistent, reproducible means of evaluating characteristics of falling-object protective structures (FOPS) under loading, and prescribes performance requirements for a representative specimen under such loading. It is applicable to mobile or self-propelled, specially designed forestry machines as defined in ISO 6814.

NOTE Research work is being done to develop a test method and criteria for certain polycarbonate materials and constructions where the present requirement levels may not be adequate.

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs*

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*

ISO 3164, *Earth-moving machinery — Laboratory evaluations of protective structures — Specifications for deflection-limiting volume*

ISO 3411, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope*

ISO 6814, *Machinery for forestry — Mobile and self-propelled machinery — Terms, definitions and classification*

ISO 8082, *Self-propelled machinery for forestry — Roll-over protective structures — Laboratory tests and performance requirements*

3 Terms and definitions

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

3.1
falling-object protective structure
FOPS
system of structural members arranged in such a way as to provide operators with reasonable protection from falling objects (e.g. trees, rocks)

3.2
deflection-limiting volume
DLV
orthogonal approximation of large, seated, male operator as defined in ISO 3411 wearing normal clothing and a protective helmet

3.3
roll-over protective structure
ROPS
system of structural members whose primary purpose is to reduce the possibility of a seat-belted operator being crushed should the machine roll over

NOTE These structural members include any subframe, bracket, mounting, socket, bolt, pin, suspension or flexible shock absorber used to secure the system to the machine frame, but exclude mounting provisions that are integral with the machine frame.

4 Laboratory tests

CAUTION — Some of the tests specified in this International Standard involve the use of processes which could lead to a hazardous situation.

4.1 Apparatus

4.1.1 Standard laboratory drop test object, made of steel, as shown in Figure 1.

4.1.2 Means of raising the standard laboratory drop object to the required height.

4.1.3 Means of releasing the standard drop test object so that it drops without restraint.

4.1.4 Hard surface, of such firmness that it is not penetrated by the vehicle or test bed under the loading of the drop test.

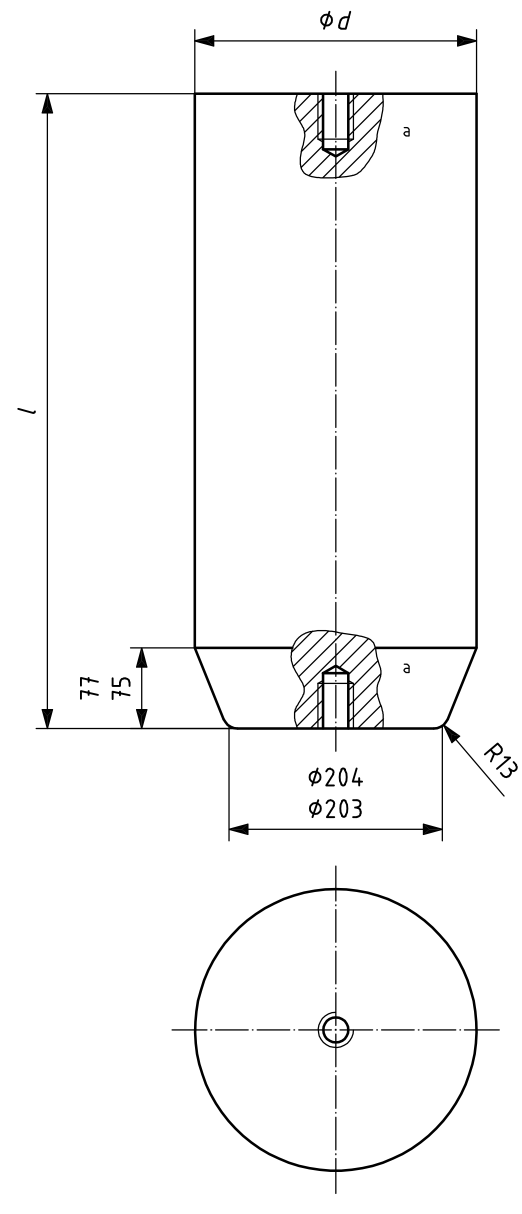
4.1.5 Measuring device, to determine whether the FOPS enters the deflection-limiting volume during the drop test.

4.2 Test conditions

4.2.1 DLV and its location

The DLV and its location shall be in accordance with ISO 3164. The DLV should be fixed firmly to the same part of the machine as that to which the operator's seat is secured, and should remain there during the entire formal test period.

Dimensions in millimetres



NOTE Dimensions *d* and *l* are optional, depending on the mass of the test object required to match the drop height that will provide the energy specified in 4.3.4. For example, for a drop test object mass of 227 kg:

— d = 255 to 260 mm;

— l = 583 to 585 mm.

a May be drilled and tapped for a lifting eye.

Figure 1 — Standard laboratory drop test object

4.2.2 Measuring accuracy

The accuracy of the measuring device (4.1.5) used to measure the deflection of the FOPS and of the energy applied to the FOPS shall be in accordance with Table 1.

Table 1 — Measuring accuracy requirements

Measurement	Accuracy [a]
Deflection of FOPS	± 5 % of maximum deflection measured or ± 1 mm
Energy applied to FOPS	± 5 % of energy applied
[a] The percentages are nominal ratings of the accuracy of the instrumentation and shall not be taken to indicate that compensating overtest is required.	

4.2.3 Machine or test bed condition

4.2.3.1 The FOPS to be evaluated shall be attached to the machine structure as it would be in actual machine use. A complete machine is not required; however, the portion to which the FOPS is mounted shall be identical to the actual structure, and the vertical stiffness of any test bed used shall be not less than that of an actual machine as described in 4.2.3.2.

4.2.3.2 If the FOPS is mounted on a machine, the following requirements apply:

— there are no limitations on customary attachments and/or payload;

— all suspension systems, including pneumatic tyres, shall be set at operating levels; variable suspensions shall be in the maximum stiffness range;

— all cab elements, such as normally removable windows, panels or non-structural fittings, shall be removed so that they do not contribute to the strength of the FOPS.

4.3 Test procedure

4.3.1 The test procedure shall consist of the operations given in 4.3.2 to 4.3.6, in the order listed.

4.3.2 Place the standard laboratory drop test object (4.1.1) on the FOPS top (small end down) at the location designated in 4.3.3.

4.3.3 The small end of the object shall be entirely within the vertical projection of the DLV, on the FOPS top. The centre of the object shall be at a point which depends on whether major, upper, horizontal members of the FOPS do or do not enter the vertical projection of the DLV on the upper part of the FOPS, as follows.

a) Case 1:

When major, upper, horizontal members of FOPS do not enter the vertical projection of the DLV on the upper part of the FOPS. The centre of the drop test object shall be at that point which has the greatest possible sum of perpendicular distances ($x + y$ in Figure 2) from the major, upper, horizontal structural members.

b) Case 2:

When major, upper, horizontal members of FOPS do enter the vertical projection of the DLV on the upper part of the FOPS.

1) Where the covering material of all the surface areas above the operator is the same but of unknown thickness, the centre of the drop test object shall be in the surface of greatest area. This area is the

projected area of the DLV without major, upper, horizontal members. The centre of the drop test object shall be at that point, within the surface of greatest area, which has the greatest possible sum of perpendicular distances ($x + y$ in Figure 2) from the major, upper, horizontal structural members.

2) Where different materials are used in different areas above the operator, each area in turn shall be subjected to a drop test.

4.3.4 Raise the drop test object vertically to a height above the position indicated in 4.3.2 and 4.3.3 to develop an energy of 5 800 J or 11 600 J based on the mass of an object shaped as shown in Figure 1. Two energy levels are given: national authorities may choose the level of requirement according to local conditions such as log size, etc. The drop test object shall be aimed to impact at a location on the FOPS to produce the maximum deflection.

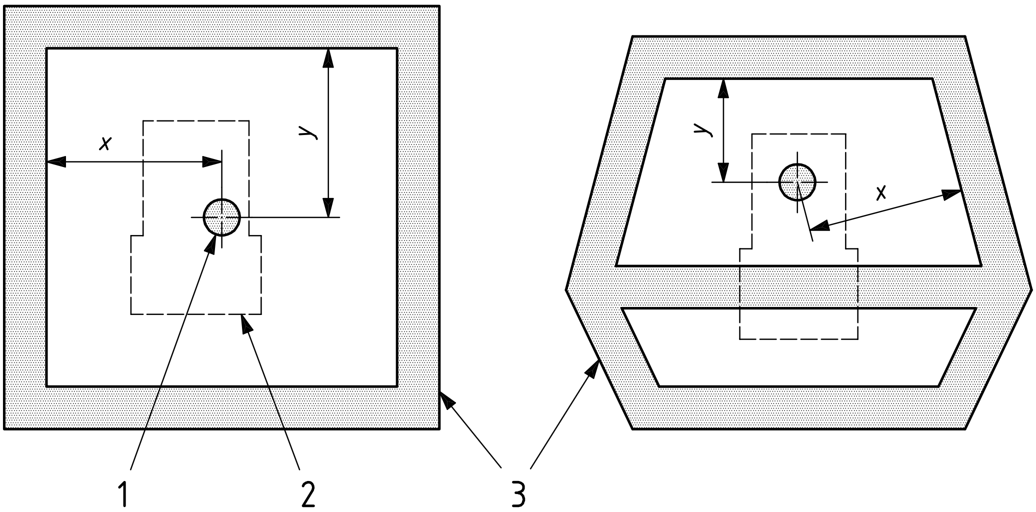
4.3.5 Release the drop test object so that it falls freely onto the FOPS.

4.3.6 As it is unlikely that the free fall will result in the drop test object hitting at the location and/or in the attitude of 4.3.2 and 4.3.3, the limits given in 4.3.6.1 to 4.3.6.3 are placed on deviations.

4.3.6.1 The initial impact of the small end of the drop test object shall be entirely within a circle of 200 mm radius (the centre of this circle is to coincide with the vertical centre line of the drop test object as positioned according to 4.3.2 and 4.3.3) but not on any major, upper, horizontal member.

4.3.6.2 The first contact between the drop test object and the FOPS shall only be along the small end of the drop test object and/or the radius contiguous to that end (see Figure 1).

4.3.6.3 There is no limitation on location or attitude of subsequent impacts due to rebound.



Key

1 small end of drop test object

2 vertical projection of DLV

3 major, upper, horizontal member

Figure 2 — Drop test impact points

5 Performance requirements

5.1 Protective properties

The protective properties of the FOPS system shall be estimated by the ability of the cabin or protective structure to retain its safety zone intact after the impact. The DLV as defined in 3.2 and specified in 4.2.1 shall not be entered by any part of the protective structure under the first or subsequent impact of the drop test object. If the drop test object penetrates the DLV, the FOPS shall be deemed to have failed.

5.2 Additional ROPS requirements

Where the structure is intended to fulfil both ROPS and FOPS requirements, it shall also meet the performance requirements for the appropriate ROPS as given in ISO 8082. Where roll-over protection is not required, a different structure may be used to support the FOPS as long as the DLV is not entered in the test.

Should the same structure be used for both ROPS and FOPS evaluations, the drop test procedure shall precede the ROPS loading. The removal of impact dents or replacement of the FOPS is permitted.

The indicated volume of a ROPS and FOPS having four or more vertical members need not entirely enclose the DLV. Nor is it intended that a simple (two-post) frame be excluded as either a FOPS or ROPS.

5.3 Temperature and material requirements

5.3.1 General

The laboratory evaluations should be performed with FOPS and machine frame members soaked to temperature of – 18 °C or below. If the evaluations are not performed at this temperature, the minimum material requirements in 5.3.2 and 5.3.3 shall be met.

5.3.2 Bolts and nuts

Bolts and nuts used to attach the FOPS (or FOPS cover and its supporting structure) to the machine frame and to connect structural parts of the FOPS shall be

— property class 8.8, 9.8 or 10.9 for bolts (see ISO 898-1:1999), and

— property class 8, 9 or 10 for nuts (see ISO 898-2:1992).

5.3.3 Impact strength

The structural members of the FOPS and ROPS (or FOPS cover) and the mounts which attach them to the machine frame shall be made of steels or equivalent materials having a Charpy V-notch impact strength in accordance with Table 2.

Specimens are to be “longitudinal” and taken from flat stock, tubular or structural sections before forming or welding for use in the FOPS. Specimens from tubular or structural sections shall be taken from the middle of the side of greatest dimensions and shall not include welds (see ISO 148-1).

Table 2 — Minimum Charpy V-notch impact strength

Specimen size mm	Strength – 30 °C J	 – 20 °C J [b]
10 × 10[a]	11	27,5
10 × 9	10	25
10 × 8	9,5	24
10 × 7,5[a]	9,5	24
10 × 7	9	22,5
10 × 6,7	8,5	21
10 × 6	8	20
10 × 5[a]	7,5	19
10 × 4	7	17,5
10 × 3,3	6	15
10 × 3	6	15

[a] Indicates preferred size. Specimen size shall be no less than the largest preferred size that the material will permit.

[b] The energy requirement at the temperature of – 20 °C is 2,5 times the value specified for – 30 °C. Other factors affect impact energy strength, i.e. direction of rolling, yield strength, grain orientation and welding. These factors shall be considered when selecting and using a steel.

6 Reporting results

The results of the tests shall be reported using a test report in accordance with Annex A.

Annex A
(normative)

Test report for ISO 8083

A.1 Client identification

FOPS submitted to test by: ....

Client: ....

Submitted to test on (date): ....

A.2 Machine identification

Type: ....

Manufacturer: ....

Model: ....

Serial number (if any): ....

Machine (frame part number): ....

A.3 FOPS identification

Manufacturer: ....

Model: ....

Serial number (if any): ....

FOPS (may include ROPS) part number: ....

A.4 Manufacturer-supplied information

Location of DLV: ....

A.5 Criteria

Energy level used: .... J

A.6 Temperature and materials

Test performed with FOPS and machine frame soaked to .... °C

The following is to be completed only if this temperature is above – 18 °C.

The Charpy V-notch impact strength requirements for FOPS structural metallic members were tested on a specimen of size …….. mm × ……… mm.

Absorbed energy: .... J

Nut property class: ....

Bolt property class: ....

A.7 Drop test object

Diameter: .... mm

Length: .... mm

Mass: .... kg

Height of fall for the test: .... m

A.8 Photographs

One photograph as necessary of drop test object and test arrangement before application of drop test or tests.

Photographs as necessary to show top and bottom of FOPS structure after application of drop test or tests.

A.9 Attestation

The minimum performance requirement of ISO 8083 with drop energy of ……. J (5 800 or 11 600 J; see 4.3.4), was met in this test.

Uncertainty of measurements: .... %

Date of test: ....

Name and address of test facility: ....

Test engineer: ....

Date/number of test report: ....

A.10 Marking

A possible marking on the machine about conformance ISO 8083 shall always include the energy level met in the test, e.g.:

Tested to ISO 8083:xxxx (year of publication) with drop energy level of …… J (5 800 or 11 600 J; see 4.3.4)

ICS 65.060.80

Price based on 9 pages