
**Tractors for agriculture and forestry —
Roll-over protective structures (ROPS) —
Dynamic test method and acceptance
conditions**

*Tracteurs agricoles et forestiers — Structures de protection contre le
retournement (ROPS) — Méthode d'essai dynamique et conditions
d'acceptation*

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Reference number
ISO 3463:2006(E)

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Published in Switzerland

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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 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 3463 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

This fourth edition cancels and replaces the third edition (ISO 3463:1989), which has been technically revised. It also incorporates the Amendment ISO 3463:1989/Amd 1:1998.

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Introduction

Testing of roll-over protective structures (ROPS) for wheeled tractors for agriculture and forestry aims at minimizing the likelihood of driver injury resulting from accidental overturning during normal operation (e.g. field work) of the tractor. The strength of the ROPS is tested by applying dynamic impact loads and a static crushing test to simulate actual loads which can be imposed on the cab or frame when the tractor overturns either to the rear or to the side without free fall. The tests allow observations to be made on the strength of the structure and the attachment brackets to the tractor, and also of the tractor parts that could be affected by the load imposed on the structure.

Provision is made to cover both tractors with the conventional forward facing driver's position only, as well as those with a reversible driver's position, which is in agreement with the relevant OECD test code practice. For tractors with a reversible driver's position, a clearance zone is defined to be the combined clearance zones for the two driving positions. The point of application of the side loading is determined as the mid-point between the seat index points measured in the two positions.

It is recognized that there may be designs of tractors — for example, lawn-mowers, narrow vineyard tractors, low profile tractors used in low buildings with limited overhead clearance, orchards, etc., stilt tractors and certain forestry machines such as forwarders — for which this International Standard is not appropriate.

NOTE For narrow-track wheeled tractors, see ISO 12003-1^[5] and ISO 12003-2^[6].

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Tractors for agriculture and forestry — Roll-over protective structures (ROPS) — Dynamic test method and acceptance conditions

1 Scope

This International Standard specifies a dynamic test method and the acceptance conditions for roll-over protective structures (cab or frame) of wheeled tractors for agriculture and forestry.

It is applicable to tractors having at least two axles for wheels mounted with pneumatic tyres, or having tracks instead of wheels, with an unballasted tractor mass of not less than 600 kg, but generally less than 6 000 kg, and with a minimum track width of the rear wheels greater than 1 150 mm.

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 630, *Structural steels — Plates, wide flats, bars, sections and profiles*

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ISO 5353:1995, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

3 Terms and definitions

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

3.1

roll-over protective structure

ROPS

framework protecting drivers of agricultural and forestry tractors that minimizes the likelihood of driver injury resulting from accidental overturning during normal operation

NOTE The ROPS is characterized by the provision of space for a clearance zone, either inside the envelope of the structure or within a space bounded by a series of straight lines from the outer edges of the structure to any part of the tractor that might come into contact with flat ground and that is capable of supporting the tractor in that position if the tractor overturns.

3.2

tractor mass

mass of the unladen tractor in working order with tanks and radiators full, roll-over protective structure with cladding, and any track equipment or additional front-wheel drive components required for normal use

NOTE Not included are the operator, optional ballast weights, additional wheel equipment, special equipment and loads.

3.3

reference mass

m_t

mass, not less than the tractor mass, selected by the manufacturer for calculation of the energy inputs to be used in the tests

3.4

impact test

application of a dynamic load produced by a block acting as a pendulum

3.5

crushing test

application of a vertical load through a beam placed laterally across the uppermost members of the roll-over protective structure.

3.6

longitudinal median plane

longitudinal plane of symmetry

zero Y plane

vertical plane Y passing through the mid-points of AB, perpendicular to AB, A and B being such that

- for each wheel, the vertical plane passing through its axis cuts the mid-plane of the wheel following a straight line Δ which meets the supporting surface of the vehicle at one point, and
- A and B are two points thus defined which correspond to two wheels, both of which are either steering or powered wheels, situated respectively at the two ends of the same real or imaginary axle

See Figure 1.

NOTE 1 The mid-plane of the dual wheels being equidistant from the inner edge of one wheel and the outer edge of the other, the straight line Δ is, in this particular case, the intersection of the mid-plane of the dual wheels and the vertical plane passing through the axis of the axle pin.

NOTE 2 Adapted from ISO 612:1978^[1], Clause 5.

3.7

reference plane

vertical plane generally longitudinal to the tractor and passing through the seat index point and the steering-wheel centre.

NOTE Normally, this plane coincides with the longitudinal median plane of the tractor.

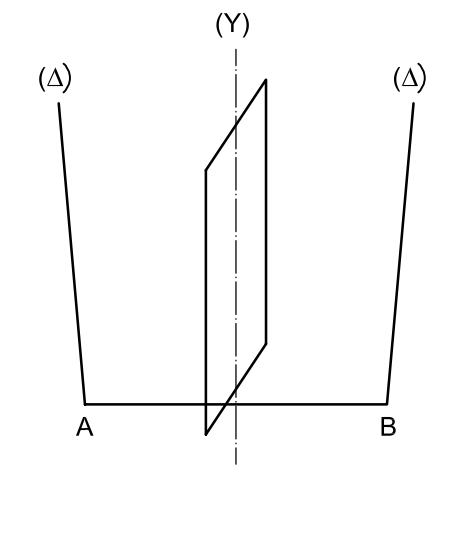


Figure 1 — Longitudinal median plane

4 Symbols and abbreviated terms

For the purposes of this document, the symbols given in Table 1 are used.

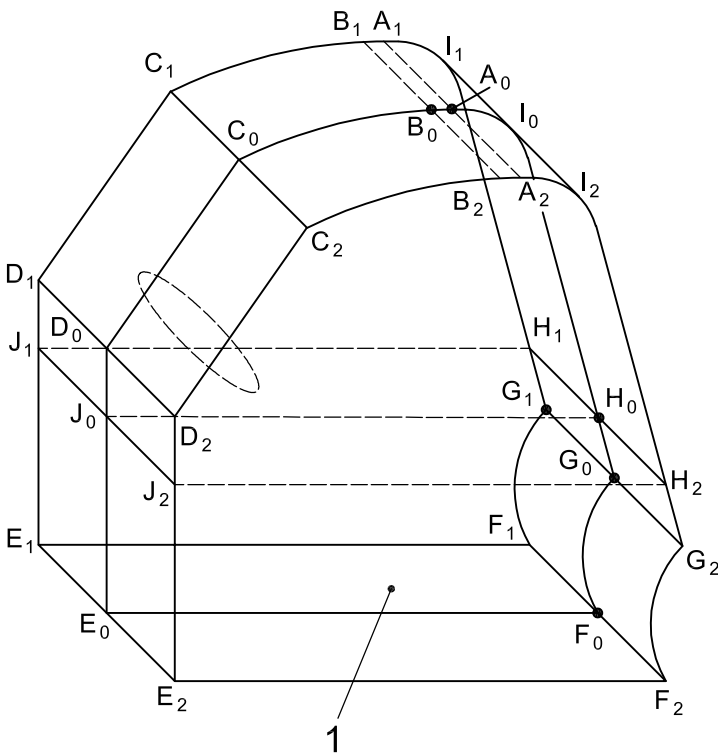
Table 1 — Symbols

Symbol	Description	Unit
a_h	Half of the horizontal seat adjustment	mm
a_v	Half of the vertical seat adjustment	mm
E	Energy input to be absorbed during the test	J
F	Static load force	N
H	Lift height of the pendulum block centre of gravity	mm
I	Moment of inertia about the rear axle excluding the rear wheels	kg·m ²
L	Tractor reference wheel base	mm
m_t	Reference mass	kg

5 Apparatus

5.1 Clearance zone framework

Means to prove that the clearance zone has not been entered during the test: a measuring rig in accordance with Figure 2 and Figure 11 a) and b) can be used.



Key

1 seat index point (SIP)

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Dimensions	mm	Remarks
A ₁ A ₀ B ₁ B ₀	100	Minimum
A ₁ A ₂ B ₁ B ₂ C ₁ C ₂	500	
D ₁ D ₂ E ₁ E ₂	500	Minimum or equal to the steering-wheel radius plus 40 mm, whichever is greater
F ₁ F ₂ G ₁ G ₂ H ₁ H ₂ I ₁ I ₂ J ₁ J ₂	500	
E ₁ E ₀ E ₂ E ₀	250	Minimum or equal to the steering-wheel radius plus 40 mm, whichever is greater
J ₀ E ₀	300	
F ₀ G ₀ I ₀ G ₀ C ₀ D ₀ E ₀ F ₀	---	Depending on the tractor
NOTE For other dimensions, see Figure 11 a) and b).		

Figure 2 — Clearance zone measuring rig

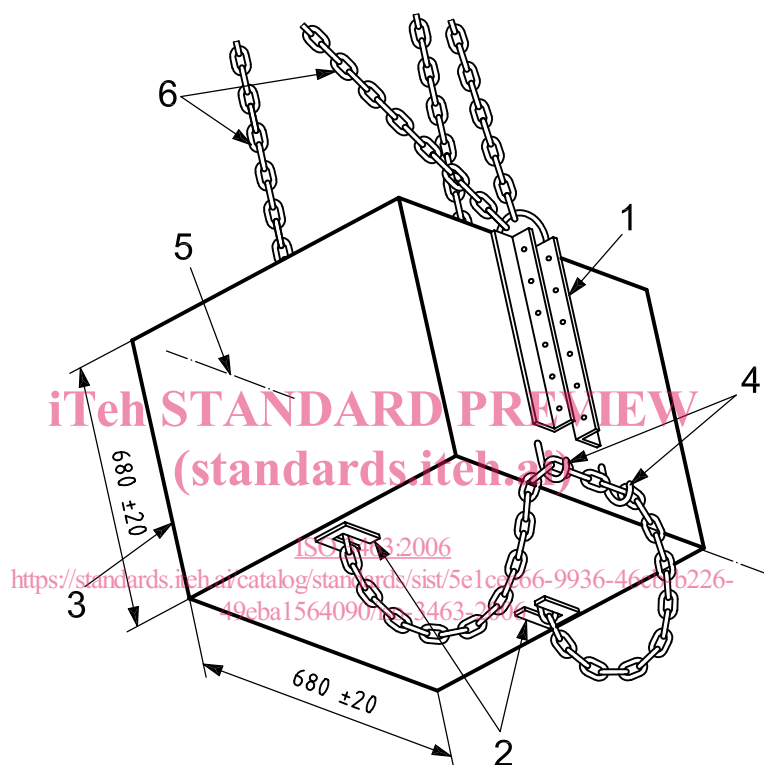
5.2 Impact test

The impact test shall be carried out by means of the elements described in 5.2.1 to 5.2.5.

5.2.1 Device for striking blow against ROPS

A pendulum block of mass of 2 000 kg. The pendulum block mass does not include the mass of the chains. The maximum chain mass shall be 100 kg. The dimensions of the block, which shall be suspended from two chains from pivot points 6 m or more above ground level, shall be as shown in Figure 3. The pendulum block centre of gravity shall coincide with its geometric centre.

Dimensions in millimetres



Key

- 1 attachment for release mechanism
- 2 height adjustment
- 3 impact face
- 4 hooks to hold spare chain
- 5 centre of gravity axis
- 6 pendulum chains

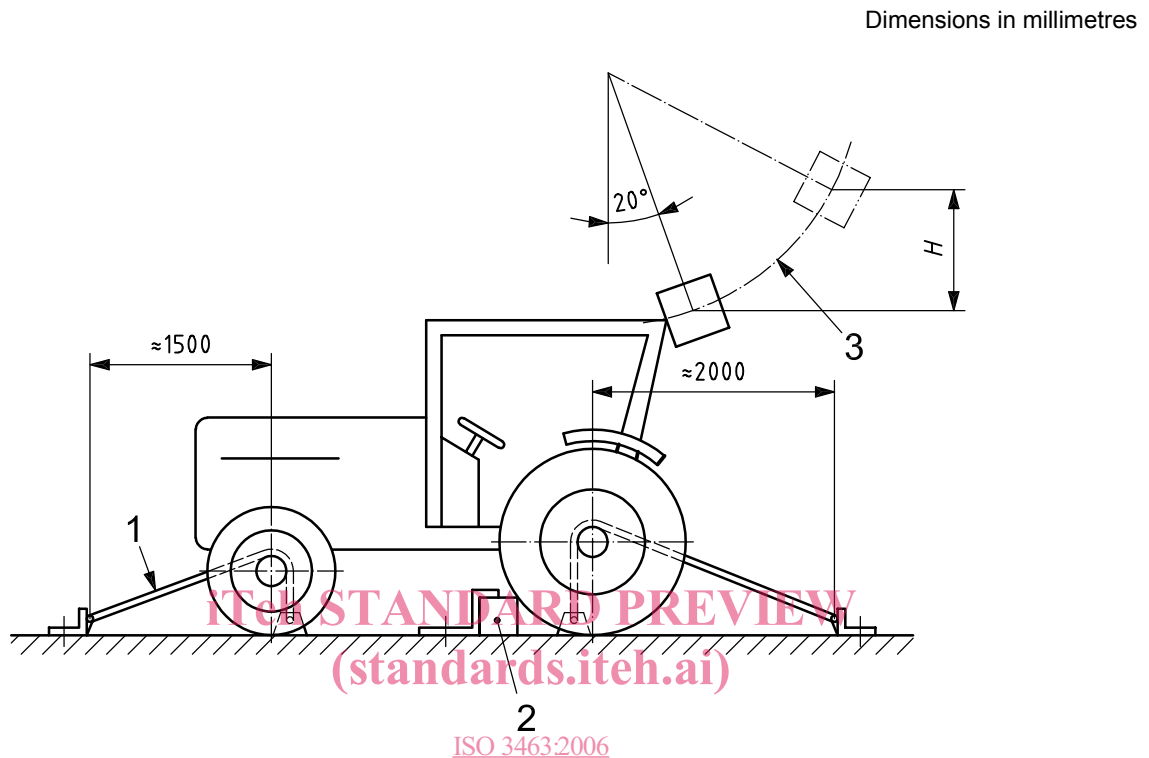
Figure 3 — Illustration of pendulum block

5.2.2 Means to lash the tractor to the ground

The tractor shall be lashed, by means of steel wire ropes incorporating tensioning devices, to ground rails preferably spaced approximately 600 mm apart throughout the area immediately below the pivot points and extending for approximately 9 m along the pendulum block axis and approximately 1 800 mm to either side. The points of attachment of the lashings shall be approximately 2 000 mm behind the rear axle and 1 500 mm in front of the front axle. There shall be two lashings on each axle: one on each side of the median plane of the tractor. The lashings shall be steel cable of from 12,5 to 15 mm diameter, with tensile strength of from 1 100 MPa to 1 260 MPa. Details of the means are given in Figures 4, 5 and 6.

5.2.3 Softwood beam

Softwood beam, of cross-section 150 mm × 150 mm, used to restrain the rear wheels when striking from the front and rear, and to clamp against the side of the front and rear wheels when striking from the side, as shown in Figures 4, 5 and 6.



Key

- 1 positioning tie
- 2 150 mm square softwood beam clamped behind both rear wheels after anchoring
- 3 travel arc of pendulum block centre of gravity passing through contact point

Figure 4 — Example of lashing method — Rear impact