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Agricultural and forestry tractors — Roll-over protective structures on narrow-track wheeled tractors —

Part 2: Rear-mounted ROPS

Tracteurs agricoles et forestiers — Structures de protection contre le retournement (ROPS) pour tracteurs à roues à voie étroite —

Partie 2: ROPS montées à l'arrière

Reference number
ISO 12003-2:2008(E)

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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 12003-2 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

This second edition cancels and replaces the first edition (ISO 12003-2:2002), which has been technically revised.

ISO 12003 consists of the following parts, under the general title *Agricultural and forestry tractors — Roll-over protective structures on narrow-track wheeled tractors*:

— *Part 1: Front-mounted ROPS*

— *Part 2: Rear-mounted ROPS*

Introduction

Testing of roll-over protective structures (ROPS) for 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 roll-over protective structure is tested by applying loads to simulate actual loads which may 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 may be affected by the load imposed on the structure.

This part of ISO 12003 enables the strength of a tractor's rear-mounted roll-over protective structure to be tested by the application of dynamic and static loads that simulate the 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.

Agricultural and forestry tractors — Roll-over protective structures on narrow-track wheeled tractors —

Part 2: Rear-mounted ROPS

1 Scope

This part of ISO 12003 specifies procedures for both the static and dynamic testing of roll-over protective structures (ROPS) rear-mounted on narrow-track wheeled agricultural and forestry tractors. It defines the clearance zone and acceptance conditions for rigid or tiltable, rear, two-post roll bar, frame and cab ROPS, and is applicable to tractors so equipped having the following characteristics.

— A ground clearance of not more than 600 mm beneath the lowest points of the front- and rear-axle housings (not considering lower points on the axle differential).

— A fixed or adjustable minimum track width of one of the two axles of less than 1 150 mm when fitted with the widest specified tyres, and with the overall width of the other axle being less than that of the first axle.

— A mass greater than 600 kg but less than 3 000 kg, unladen, including the ROPS and tyres of the largest size recommended by the manufacturer.

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*

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 2408, *Steel wire ropes for general purposes — Minimum requirements*

ISO 5353, *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 wheeled agricultural and forestry tractors, which minimizes the likelihood of driver injury resulting from accidental overturning during normal field work

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 the ground; it is capable of supporting the tractor in an overturned position.

3.2
rear-mounted ROPS
two-post, roll-bar-type, roll-over protective structure mounted on the tractor rearwards of the driving seat, or a frame or cab

NOTE Compare with front-mounted ROPS described in ISO 12003-1.

3.3
tractor mass
mass of the unladen tractor in working order with tanks and radiator full, rear-mounted ROPS with cladding, and any track equipment or additional front-wheel drive components required for normal use

NOTE The operator, optional ballast weights, additional wheel equipment, and special equipment and tools are not included.

3.4
reference mass
mass, not less than the tractor mass, selected by the manufacturer for calculation of the energy inputs to be used in the tests

3.5
horizontal loading test
application of a horizontal load to the rear, front and side of the roll-over protective structure

3.6
crushing test
application of a vertical static load through a beam placed laterally across the uppermost members of the rear-mounted ROPS

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 reference plane coincides with the longitudinal median plane of the tractor.

3.8
longitudinal median plane
longitudinal plane of symmetry
zero Y plane
vertical plane Y passing through the mid-points of AB, perpendicular to AB, where, 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 where 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 "Mid-plane of the wheel" designates the plane equidistant from the inner edges of the rim. In the case of dual wheels, 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.

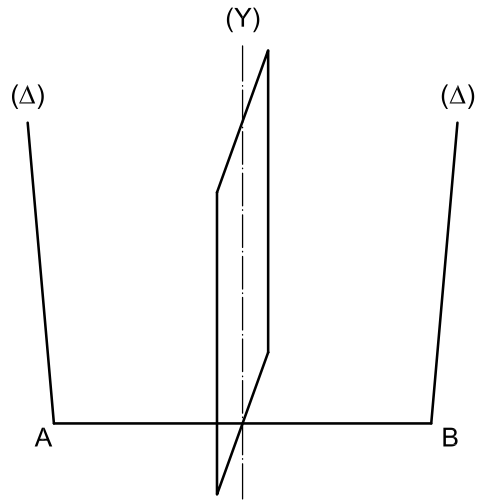


Figure 1 — Longitudinal median plane

3.9
impact test
application of a dynamic load produced by a block acting as a pendulum

3.10
wheelbase
horizontal distance between the two vertical planes passing through the rotational centre-lines of the wheels, where one plane is for the front wheels and the other for the rear wheels

4 Symbols

See Table 1.

Table 1 — Symbols

Symbol	Description	Unit
a_h	Half of the horizontal seat adjustment	mm
a_v	Half of the vertical seat adjustment	mm
B	Minimum overall width of the tractor	mm
B_b	Maximum outer width of the rear-mounted ROPS	mm
D	Deflection of the ROPS for the calculated basic energy at the point of, and in line with, the load application	mm
E_{il}	Energy to be absorbed during longitudinal loading	J
E_{is}	Energy to be absorbed during side loading	J
F	Static load force	N
F_{max}	Maximum static load force occurring during loading, with the exception of overload	N
F_v	Vertical crushing force	N
H	Falling height of the pendulum block	mm
I	Moment of inertia about rear axle, whatever the mass of the rear wheels may be	kg·m^2
L	Tractor reference wheelbase	mm
m	Tractor mass (see 3.5)	kg
m_t	Reference mass (see 3.4)	kg
W	Overall width of the upper part of the protective structure	mm

5 Test apparatus and equipment

5.1 Apparatus for both dynamic and static testing

5.1.1 Clearance zone framework

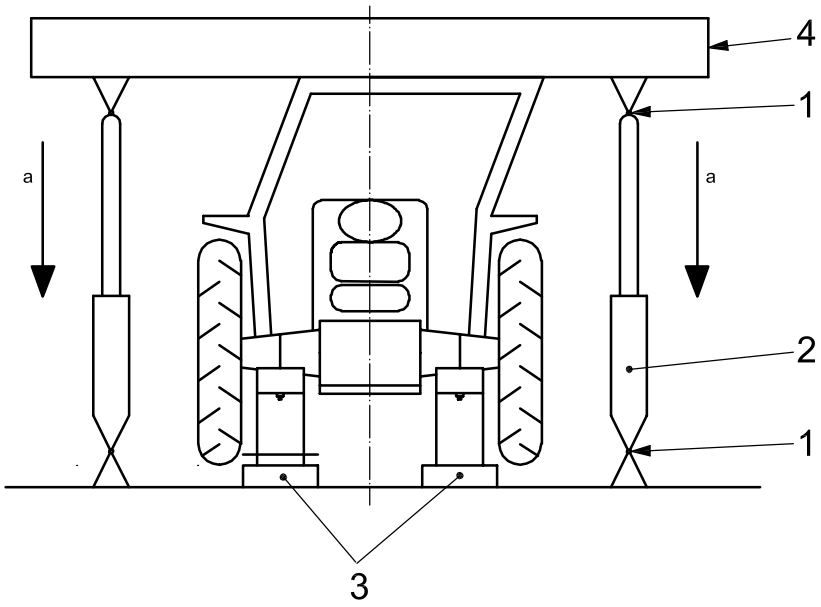
Means to prove that the clearance zone has not been entered during the test: a measuring rig complying with Figures 10 and 11 can be used.

5.1.2 Apparatus for crushing tests

The crushing tests shall be carried out by means of the elements described in 5.1.2.1 and 5.1.2.2.

5.1.2.1 Means to apply downward force on the protective structure, such as that shown in Figure 2, including a stiff beam with a width of 250 mm.

5.1.2.2 Equipment to measure total vertical force applied.



Key

1 universal pin joints
2 hydraulic cylinder
3 supports
4 crushing beam

[a] Direction of force.

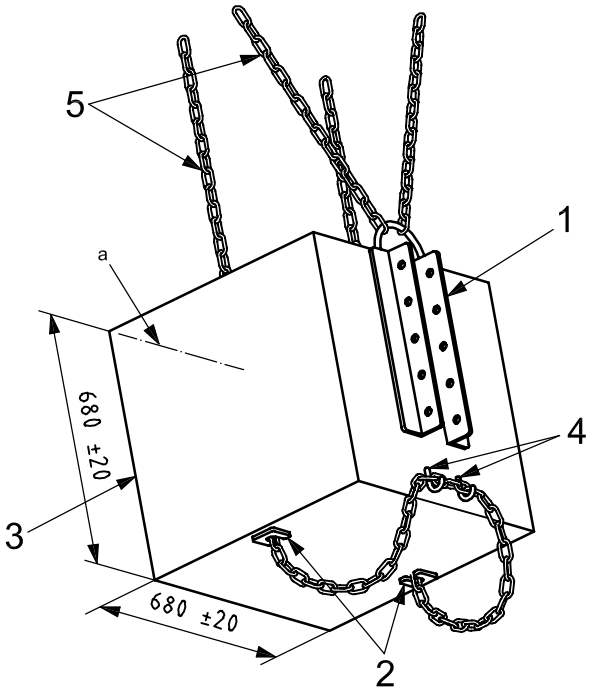
Figure 2 — Crushing test — Example

5.2 Apparatus for dynamic testing

5.2.1 Device to strike a blow against the protective structure

A pendulum block with 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 pendulum chains

a Axis of centre of gravity.

Figure 3 — Illustration of pendulum block

5.2.2 Pendulum supports

The pendulum pivot points shall be rigidly fixed such that their displacement in any direction does not exceed 1 % of the height of fall.

5.2.3 Means to lash the tractor to the ground

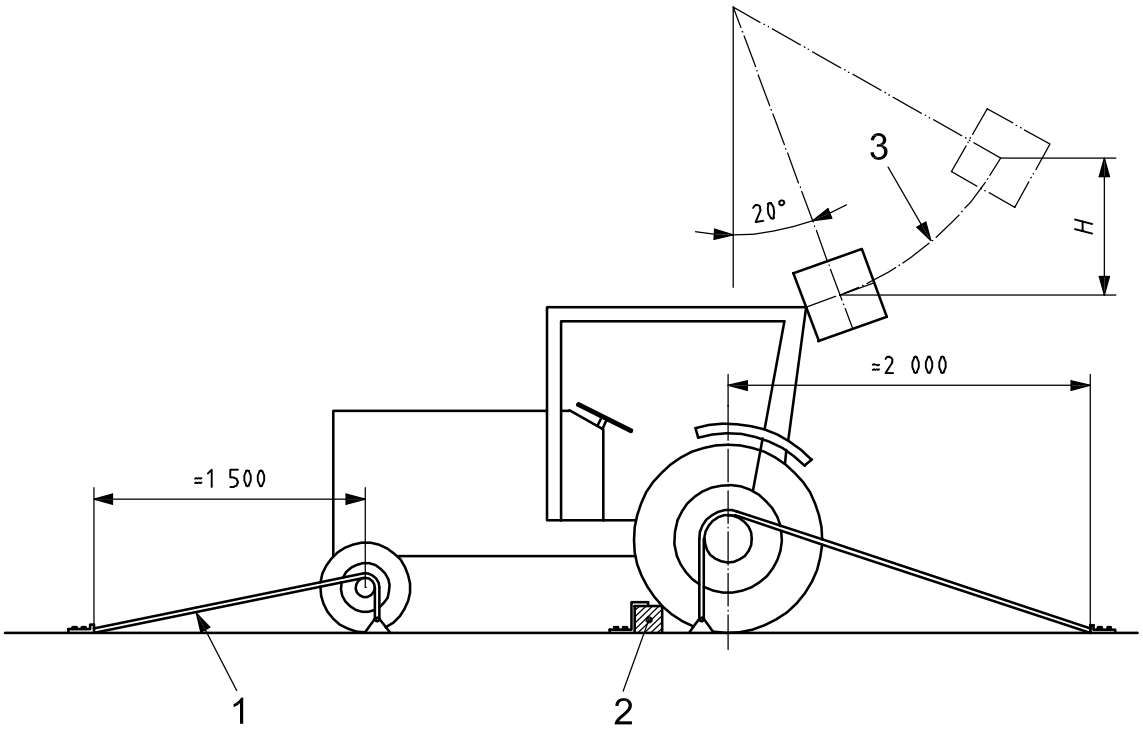
The tractor shall be lashed, by means of steel wire ropes incorporating tensioning devices, to ground rails preferably spaced approximately 600 mm apart throughout the area immediately below the pivot points and extending for approximately 9 m along the pendulum block axis and approximately 1 800 mm 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 12,5 mm to 15 mm diameter, tensile strength 1 100 MPa to 1 260 MPa, meeting the requirements of ISO 2408. Details of the lashing means are given in Figures 4, 5 and 6.

The front and rear wheels are not required to be in line if this is more convenient for attaching appropriate ropes.

5.2.4 Softwood beam

A softwood beam, of cross-section 150 mm × 150 mm, to restrain the rear wheels when striking from the front or 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.

Dimensions in millimetres

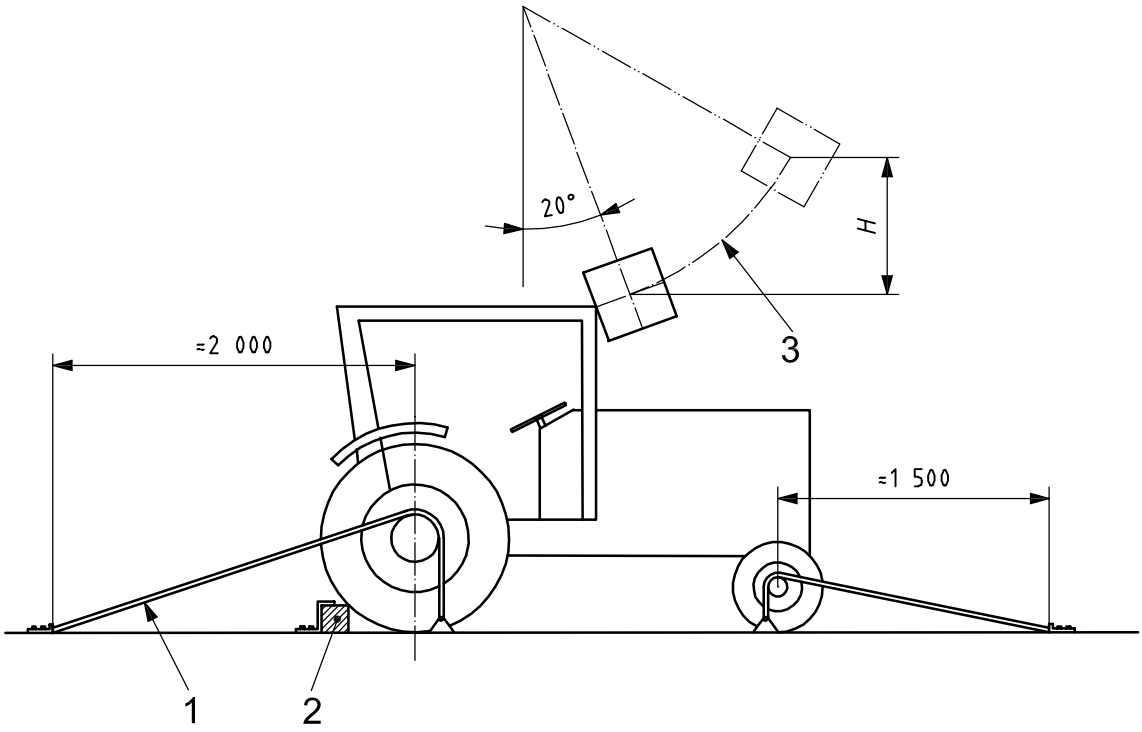


Key

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 — Impact from rear

Dimensions in millimetres



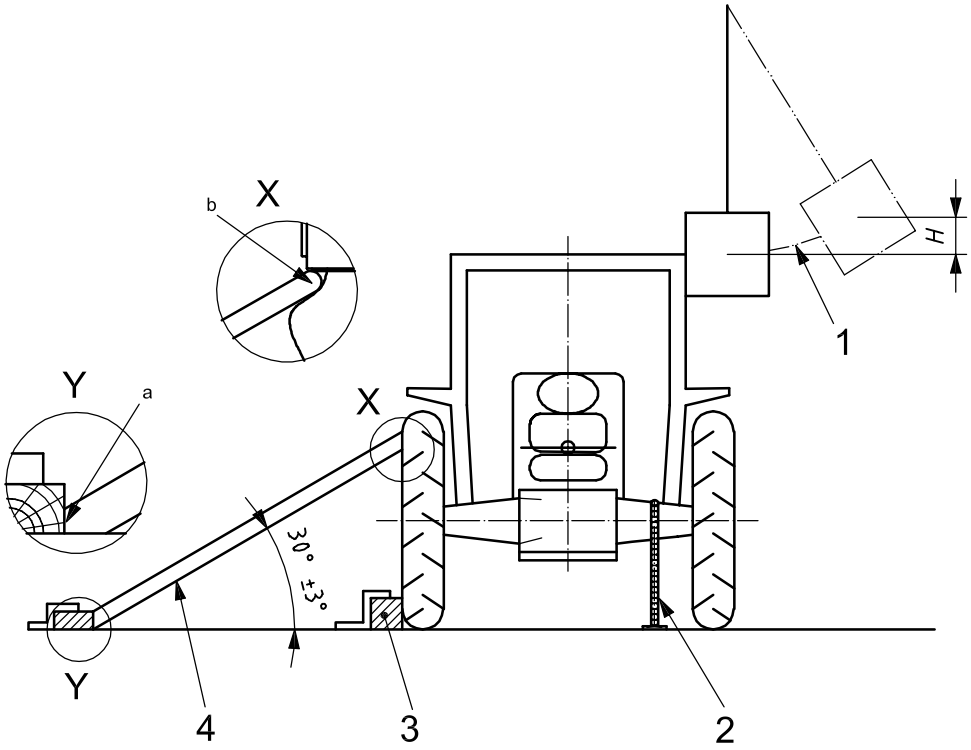
Key

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 5 — Example of lashing method — Impact from front



Key

1 travel arc of pendulum block centre of gravity passing through contact point
2 lashing (see 5.2.3)
3 150 mm square softwood beam
4 wooden prop

[a] Chamfered.
[b] Rounded to secure contact against rim.

Figure 6 — Example of lashing method — Impact from side

5.2.5 Wooden prop

Wooden prop to restrain the opposite rear wheel when striking from the side as shown in Figure 6. Its length shall be 20 to 25 times its thickness and its width 2 to 3 times its thickness.

5.2.6 Props and lashings for articulated tractors

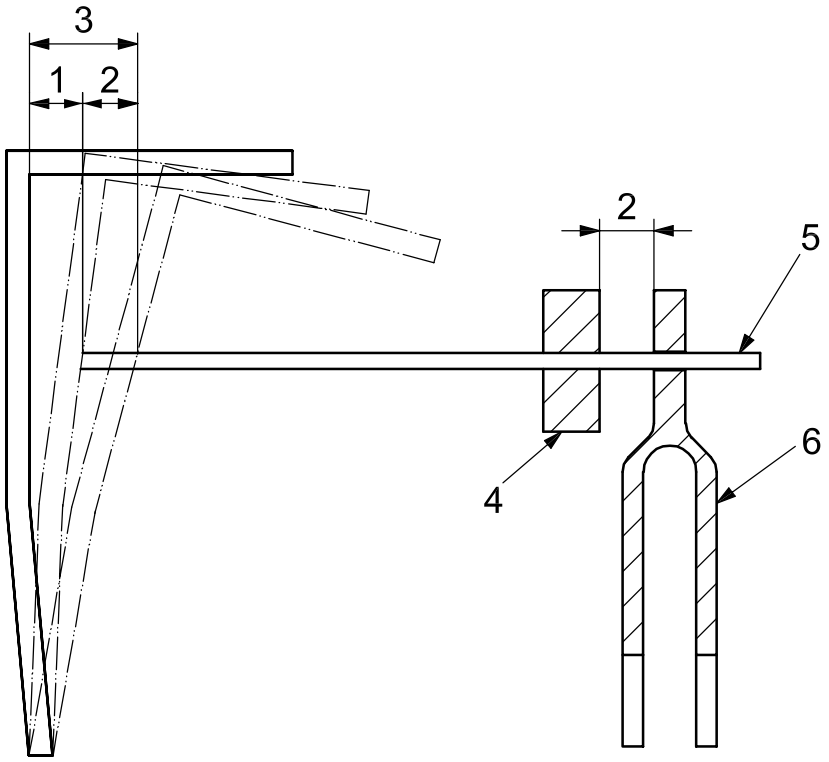
The central pivot of an articulated tractor shall be supported and lashed down as appropriate for all test procedures. For the side impact test procedure, the pivot shall also be propped from the side opposite the impact.

5.2.7 Tyre pressures and deflection

The tractor tyres shall not be liquid-ballasted and shall be inflated to the pressures prescribed by the tractor manufacturer for field work. The lashings shall be tensioned in each particular case such that the tyres undergo a deflection equal to 12 % of the tyre wall height (distance between the ground and the lowest point of the rim) before tensioning.

5.2.8 Device to measure elastic deflection

Device to measure elastic deflection, such as that shown in Figure 7, in a horizontal plane that coincides with the upper limiting surface of the clearance zone.



Key

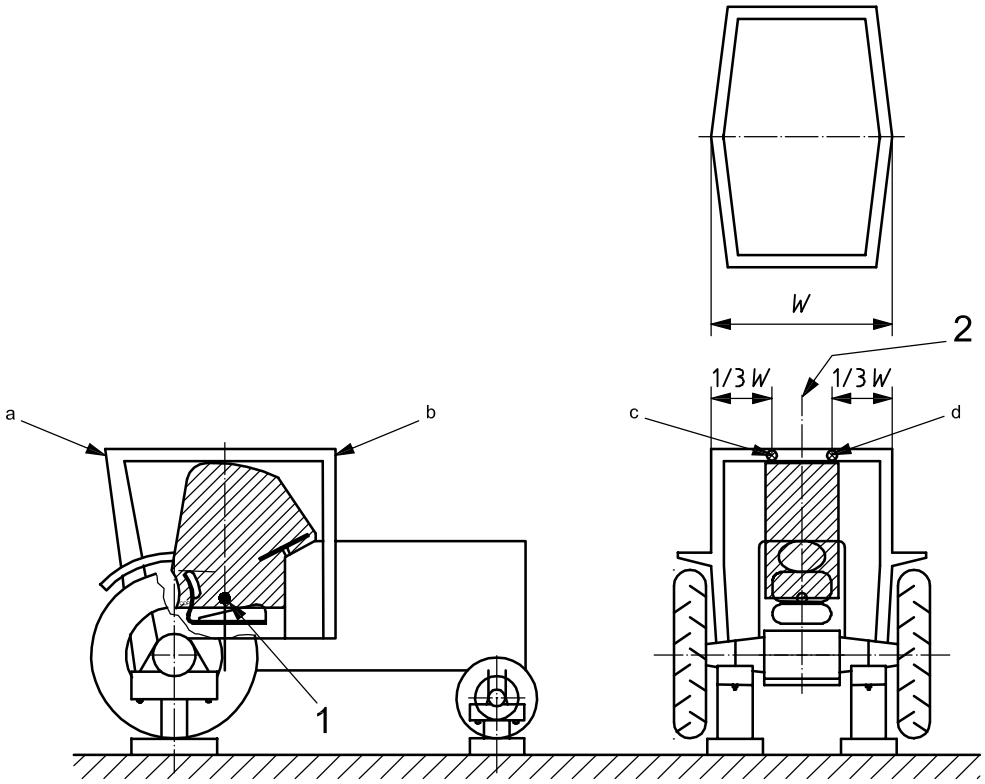
1 permanent deflection
2 elastic deflection
3 total (permanent + elastic) deflection
4 friction collar
5 horizontal rod attached to frame
6 vertical bar attached to tractor chassis

Figure 7 — Apparatus for measuring elastic deflection – Example

5.3 Apparatus for static testing

5.3.1 Material, equipment and attachment means to ensure that the tractor chassis is firmly fixed to the ground (and supported) independently of the tyres.

5.3.2 Means to apply a horizontal force to the ROPS, such as shown in Figures 8 and 9, complying with the requirements of 5.3.2.1 to 5.3.2.4.



Key

1 seat index point

2 seat index point, longitudinal centre plane

a Rear load.

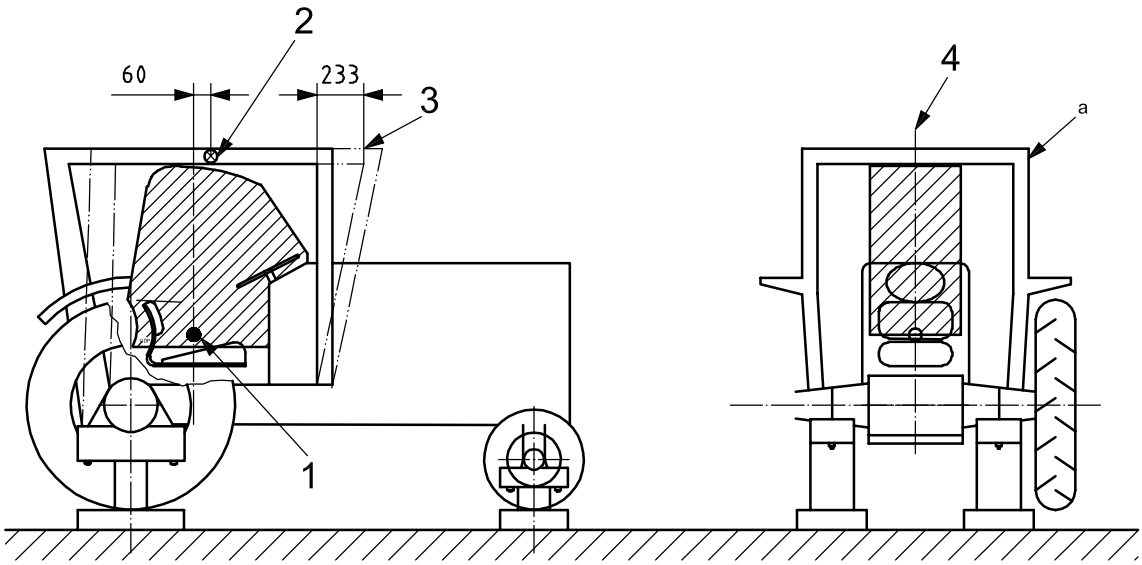
b Front load.

c Second longitudinal load, front or rear.

d Longitudinal load, rear or front.

Figure 8 — Front and rear load application

Dimensions in millimetres



Key

1 seat index point
2 point of side load application (see 7.4.5)
3 deflection due to rear longitudinal loading
4 seat index point, longitudinal centre plane

[a] Load.

Figure 9 — Side load application

5.3.2.1 It shall be ensured that the load can be uniformly distributed normal to the direction of loading and along a beam of length between 250 mm and 700 mm, in an exact multiple of 50 mm.

5.3.2.2 The edges of the beam in contact with the ROPS shall be curved with a maximum radius of 50 mm.

5.3.2.3 Universal joints, or the equivalent, shall be incorporated to ensure that the loading device does not constrain the structure in rotation or translation in any direction other than the loading direction.

5.3.2.4 Where the roll-over protective structure length, covered by the appropriate load-applying beam, does not constitute a straight line normal to the direction of load application, the space shall be packed so as to distribute the load over this length.

5.3.3 Equipment to measure force and deflection along the direction of application of the force and relative to the tractor chassis. To ensure accuracy, measurements shall be taken as continuous recordings. The measuring devices shall be located so as to record the force and deflection at the point of, and along the line of, loading.

6 Tractor preparation

The rear-mounted ROPS under test shall be in accordance with production specifications and shall be fitted in its protective position to the appropriate tractor model chosen in accordance with the manufacturer's declared attachment method.

NOTE A complete tractor is not required for the static strength test; however, the protective structure and part of the tractor to which it is attached represent an operating installation; hereinafter referred to as “the assembly”.

The tractor as assembled (or the assembly) must be fitted with all series production components which may affect the strength of the protective structure or which may be necessary for the strength test.

All detachable windows, panels and removable non-structural fittings shall be removed so that they do not contribute to the strength of the rear-mounted ROPS.

Where it is possible to fix doors and windows open or remove them during work, they shall be either removed or fixed open for the test, so that they do not add to the strength of the rear-mounted ROPS. It shall be noted whether, in this position, they would create a hazard for the driver in the event of overturning.

For a test conducted according to the dynamic test procedure, a track width shall be chosen so that the rear-mounted ROPS will not, in as far as possible, be supported by the tyres during the strength test procedure. If conducting testing according to the static test procedure, the wheels may be removed.

7 Test procedures

7.1 General requirements

7.1.1 If, during any test, any part of the tractor restraining equipment breaks or moves, the test shall be restarted.

7.1.2 No repairs or adjustments to the tractor or rear-mounted ROPS may be carried out during the tests.

7.1.3 For the dynamic test, the tractor gear box shall be in neutral and the brakes off during testing.

7.1.4 If the tractor is fitted with a suspension system between the tractor body and the wheels, it shall be blocked during testing.

7.1.5 The side chosen for application of the first impact from the rear (in the case of dynamic test procedures) or the first load from the rear (in the case of static test procedures) shall be that which will result in the application of the series of impacts or loads under the most unfavourable conditions for the rear-mounted ROPS. The lateral and rear impacts or loads shall be on different sides of the longitudinal median plane of the rear-mounted ROPS. The front impact or load shall be on the same side of the longitudinal median plane as the side impact or load.

7.2 Test sequence

Either the dynamic or the static test procedure, at the discretion of the manufacturer, shall be carried out on the rear-mounted ROPS, the two methods being considered equivalent. The crushing test procedure is common to both test methods.

The sequence of strength testing of the rear-mounted ROPS shall be as follows:

a) impact (dynamic test procedure) or longitudinal loading (static test procedure) applied from the rear;

b) vertical crushing (dynamic and static test procedure);

c) impact (dynamic test procedure) or longitudinal loading (static test procedure) applied from the front;

d) impact (dynamic test procedure) or horizontal loading (static test procedure) applied from the side;

e) vertical crushing (dynamic and static test procedure).

For a tractor with a reversible driving position, the front wheels of the tractor shall be as defined by the manufacturer. However, where the front/rear of the tractor is not clearly defined, the front wheels shall be assumed to be those carrying less than 50 % of the tractor mass.

7.3 Dynamic (impact) test procedures for rear-mounted ROPS

7.3.1 Rear impact test procedure

7.3.1.1 The tractor shall be positioned in relation to the pendulum block such that the block will strike the rear-mounted ROPS when the impact face of the block and the supporting chains or wire ropes are at an angle with the vertical plane, α, equal to m_t/100 with a 20° maximum, unless, during deflection, the rear-mounted ROPS at the point of contact forms a greater angle to the vertical. In that case, the impact face of the block shall be adjusted by means of an additional support such that it is parallel to the rear-mounted ROPS at the point of impact at the moment of maximum deflection, the supporting chains or wire ropes remaining at the specified angle.

The suspended height of the pendulum block shall be adjusted and any necessary steps taken to prevent the block from turning about the point of impact.

The point of impact is that part of the rear-mounted ROPS likely to hit the ground first in a rearward overturning accident, normally the upper edge. The position of the centre of gravity of the block shall be one-sixth the width of the top of the rear-mounted ROPS, inwards from a vertical plane parallel to the median plane of the tractor touching the outside extremity of the top of the rear-mounted ROPS.

If the rear-mounted ROPS is curved or protruding at this point, add wedges enabling the impact to be applied to it, but without thereby reinforcing the rear-mounted ROPS.

7.3.1.2 The tractor shall be lashed to the ground as prescribed in 5.2.3 and as shown in Figure 4 and the lashings tensioned as prescribed in 5.2.7. The rear lashings shall, in addition, be so arranged that the point of convergence of the two wire ropes is located in the vertical plane in which the centre of gravity of the pendulum block travels. With the wire ropes tensioned, the wedging beam shall be placed in front of, and tight against, the rear wheels, and then fixed to the ground.

7.3.1.3 If the tractor is of the articulated type, its pivot shall be additionally supported by a wooden block at least 100 mm square and firmly lashed to the ground.

7.3.1.4 The pendulum block shall be pulled back to achieve the height, H, of its centre of gravity as given by one of the following two formulae:

$$H = 2{,}165 \times 10^{-8} m_t \times L^2$$

or

$$H = 5{,}73 \times 10^{-2} m_t \times I$$

7.3.1.5 For tractors with a reversible seat position, one of the preceding formulae or one of the following formulae shall be used, whichever gives the greater result.

— For tractors with a reference mass of less than 2 000 kg:

$$H = 25 + 0{,}07 m_t$$

— For tractors with a reference mass of 2 000 kg to 3 000 kg:

$$H = 125 + 0{,}02 m_t$$

7.3.1.6 The pendulum block shall be released so that it strikes the rear-mounted ROPS.

7.3.2 Front impact test procedure

7.3.2.1 The tractor shall be positioned in relation to the pendulum block such that the block will strike the rear-mounted ROPS when the impact face of the block and the supporting chains or wire ropes are at an angle with the vertical plane, α, equal to m_t/100 with a 20° maximum, unless, during deflection, the rear-mounted ROPS at the point of contact forms a greater angle to the vertical. In that case, the impact face of the block shall be adjusted by means of an additional support such that it is parallel to the rear-mounted ROPS at the point of impact at the moment of maximum deflection, with the supporting chains or wire ropes remaining at the specified angle.

The suspended height of the pendulum block shall be adjusted and any necessary steps taken to prevent the block from turning about the point of impact.

The point of impact is that part of the rear-mounted ROPS likely to hit the ground first in a rearward overturning accident, normally the upper edge. The position of the centre of gravity of the block shall be one-sixth the width of the top of the rear-mounted ROPS, inwards from a vertical plane parallel to the median plane of the tractor touching the outside extremity of the top of the rear-mounted ROPS.

If the rear-mounted ROPS is curved or protruding at this point, add wedges enabling the impact to be applied to it, but without thereby reinforcing the rear-mounted ROPS.

7.3.2.2 The tractor shall be lashed to the ground as prescribed in 5.2.3 and as shown in Figure 5 and the lashings tensioned as prescribed in 5.2.7. The rear lashings shall, in addition, be so arranged that the point of convergence of the two wire ropes is located in the vertical plane in which the centre of gravity of the pendulum block travels. With the wire ropes tensioned, the wedging beam shall be placed in front of, and tight against, the rear wheels and then fixed to the ground.

7.3.2.3 If the tractor is of the articulated type, its pivot shall be additionally supported by a wooden block at least 100 mm square and firmly lashed to the ground.

7.3.2.4 The pendulum block shall be pulled back to achieve the height, H, as given by one of the following two formulae.

— For tractors with a reference mass of less than 2 000 kg:

$$H = 25 + 0{,}07 m_t$$

— For tractors with a reference mass of 2 000 kg to 3 000 kg:

$$H = 125 + 0{,}02 m_t$$

7.3.2.5 For tractors with a reversible seat position and a rear, two-post roll bar, the preceding formulae shall be used.

For tractors with a reversible seat position and any other type of rear-mounted ROPS, one of the preceding formulae or one of the following formulae shall be used, whichever gives the greater result.

$$H = 2{,}165 \times 10^{-8} m_t \times L^2$$

or

$$H = 5{,}73 \times 10^{-2} m_t \times I$$

7.3.2.6 Release the pendulum block so that it strikes the rear-mounted ROPS.

7.3.3 Side impact test procedure

7.3.3.1 The tractor shall be positioned in relation to the pendulum block such that the block will strike the rear-mounted ROPS when the impact face of the block and the supporting chains or wire ropes are vertical, unless, during deflection, the rear-mounted ROPS at the point of contact forms an angle of less than 20° to the vertical. In this case, the impact face of the block shall be adjusted by means of an additional support such that it is parallel to the rear-mounted ROPS at the point of impact at the moment of maximum deflection, with the supporting chains or wire ropes remaining vertical on impact.

The suspended height of the pendulum block shall be adjusted and any necessary steps taken to prevent the block from turning about the point of impact.

The point of impact shall be that part of the rear-mounted ROPS likely to hit the ground first in a sideways overturning accident (normally the upper edge). Unless it is certain that another part of this edge would hit the ground first, the point of impact shall be in the plane at right angles to the median plane and passing 60 mm in front of the SIP.

7.3.3.2 The tractor shall be lashed to the ground as prescribed in 5.2.3 and as shown in Figure 6 and the lashings tensioned to produce the tyre deflection values given in 5.2.7 on the side which is to receive the impact. The wedging beam shall be placed on the ground, pushed tight against the tyres on the side opposite that which is to receive the impact and then fixed to the ground. (It may be necessary to use two beams or wedges if the outer sides of the front and rear tyres are not in the same vertical plane.)

The wooden prop shall be placed, as shown in Figure 6, against the rim of the wheel opposite to the impact, pushed firmly against the rim and fixed at its base. The length of the prop shall be chosen such that it makes an angle of $30° \pm 3°$ with the ground when in position against the rim. In addition, its length shall, if possible, be between 20 and 25 times greater than its thickness, and its width between two and three times greater than its thickness. The props shall be shaped at both ends.

7.3.3.3 If the tractor is of the articulated type, its pivot shall, in addition, be supported by a wooden block at least 100 mm square, as well as being laterally supported by a block similar to that specified in 7.3.1 for articulated type tractors against the rear wheel. Lash the point of articulation firmly to the ground.

7.3.3.4 The pendulum block shall be pulled back to achieve the height, H, as given by whichever of the following two formulae is applicable.

— For tractors with a reference mass of less than 2 000 kg:

$$H = 25 + 0{,}20 m_{\mathrm{t}}$$

— For tractors with a reference mass of 2 000 kg to 3 000 kg:

$$H = 125 + 0{,}15 m_{\mathrm{t}}$$

7.3.3.5 For tractors with a reversible seat position and a rear, two-post roll bar, one of the preceding formulae or one of the following formulae shall be used, whichever gives the greater result.

— For tractors with a reference mass of less than 2 000 kg:

$$H = \frac{\left(25 + 0{,}2 m_{\mathrm{t}}\right)\left(B_{\mathrm{b}} + B\right)}{2B}$$

— For tractors with a reference mass of 2 000 kg to 3 000 kg:

$$H = \frac{\left(125 + 0{,}15 m_{\mathrm{t}}\right)\left(B_{\mathrm{b}} + B\right)}{2B}$$

For tractors with a reversible seat position and any other type of rear-mounted ROPS, the following formulae shall be used.

— For tractors with a reference mass of less than 2 000 kg:

$$H = 25 + 0{,}20 m_t$$

— For tractors with a reference mass of 2 000 kg to 3 000 kg:

$$H = 125 + 0{,}15 m_t$$

The load shall be applied in the vertical plane, at mid-point between the two SIPs.

7.3.3.6 The pendulum block shall be released so that it strikes the rear-mounted ROPS.

7.4 Static test procedures for rear-mounted ROPS

7.4.1 Test preparation

7.4.1.1 The assembly shall be secured to the bedplate so that the members connecting the assembly and the bedplate do not deflect significantly in relation to the roll-over protective structure under loading. The assembly shall not receive any support under loading other than that due to the initial attachment.

7.4.1.2 A track width setting for the rear wheels if present shall be chosen such that no interference exists with the roll-over protective structure during the tests.

7.4.1.3 The assembly shall be supported and secured or modified so that all the test energy is absorbed by the roll-over protective structure and its attachment to the tractor rigid components.

7.4.2 General requirements for horizontal loading test procedures

7.4.2.1 The loads applied to the roll-over protective structure shall be distributed by means of a stiff beam, complying with the requirements of 5.3.2, located normal to the direction of load application; the stiff beam may have a means of preventing its being displaced sideways. The rate of load application shall be such that the rate of deflection does not exceed 5 mm/s. As the load is applied, force and deflection data shall be recorded simultaneously as continuous recordings to ensure accuracy. Once the initial application has commenced, the load shall not be reduced until the test has been completed; but it is permissible to cease increasing the load if desired, for example to record measurements.

7.4.2.2 If the structural member to which the load is to be applied is curved, the requirements of 5.3.2.4 shall be met. The application of the load shall, however, still comply with the requirements of 7.4.2.1 and 5.3.2.

7.4.2.3 If no structural cross-member exists at the application point, a substitute test beam which does not add strength to the structure may be used to complete the test procedure.

7.4.3 Rear loading

Apply the load horizontally, in a vertical plane parallel to the tractor's median plane. The load application point shall be that part of the rear-mounted ROPS likely to hit the ground first in a rearward overturning accident, normally the upper edge. The vertical plane in which the load is applied is located at a distance of one-third the external width of the upper part of the rear-mounted ROPS from the median plane. If the rear-mounted ROPS is curved or protruding at this point, wedges enabling the load to be applied to it shall be added, without thereby reinforcing the rear-mounted ROPS.

The tractor or assembly shall be secured to the ground using lashings in accordance with 5.3.1.

The energy absorbed by the rear-mounted ROPS during the test shall be at least:

$$E_{il} = 2{,}165 \times 10^{-7} m_t \times L^2$$

or

$$E_{il} = 0{,}574 \times I$$

For tractors with a reversible seat position, either of the preceding formulae, or the following formula, shall be used:

$$E_{il} = 500 + 0{,}5 m_t$$

7.4.4 Front loading

Apply the load horizontally, in a vertical plane parallel to the tractor's reference plane and located at a distance of one-third the external width of the upper part of the rear-mounted ROPS from the reference plane. The load application point is that part of the rear-mounted ROPS likely to hit the ground first, were the tractor to overturn in a sideways direction while travelling forwards, normally the upper corner. If the rear-mounted ROPS is curved or protruding at this point, wedges enabling the load to be applied thereon shall be added, without thereby reinforcing the rear-mounted ROPS.

The tractor or assembly shall be lashed to the ground in accordance with 5.3.1.

The energy absorbed by the rear-mounted ROPS during the test shall be at least:

$$E_{il} = 500 + 0{,}5 m_t$$

For tractors with a reversible seat position and a rear, two-post roll bar, the same formula shall be used.

For tractors with a reversible seat position and other types of rear-mounted ROPS, either the preceding formula or one of the following formulae shall be used, whichever gives the greater result:

$$E_{il} = 2{,}165 \times 10^{-7} m_t \times L^2$$

or

$$E_{il} = 0{,}574 \times I$$

7.4.5 Side loading

Apply the load horizontally, in a vertical plane perpendicular to the tractor's median plane, passing 60 mm in front of the SIP (see Figure 9 and Clause 8) with the seat in the longitudinal seat adjustment mid-position. The load application point is that part of the rear-mounted ROPS likely to hit the ground first in a sideways overturning accident, normally the upper edge.

The tractor or assembly shall be secured to the ground in accordance with 5.3.1.

The energy absorbed by the rear-mounted ROPS during the test shall be at least:

$$E_{is} = 1{,}75 m_t$$

For tractors with a reversible seat position and a rear, two-post roll bar, either the preceding or the following formula may be used, whichever gives the greater result:

$$E_{is} = \frac{1{,}75 m_t \left(B_b + B \right)}{2B}$$

For tractors with a reversible seat position and other types of rear-mounted ROPS, the first of these formulae shall be used.

The load shall be applied in the vertical plane at mid-point between the two SIPs.

7.5 Vertical crushing test procedure

Position the beam across the uppermost structural members of the rear-mounted ROPS, with the resultant crushing forces located in the tractor's median plane.

Apply a vertical crushing force, F_v, of 20 m_t.

Maintain this force for at least 5 s after the cessation of any visually deflectable movement of the rear-mounted ROPS. The second crushing test may be at the same point as the first.

Where the rear or front part of the ROPS roof does not sustain the full crushing force, apply the force until the roof is deflected to coincide with the plane joining the upper part of the ROPS with that part of the tractor rear or front capable of supporting the vehicle mass when overturned. Then remove the force and position the tractor or loading force such that the beam is over that point of the ROPS that would then support the tractor rear or front were the tractor to completely overturn and the full force be applied.

7.6 Observations during testing

7.6.1 Fractures and cracks

After each test, all structural members, joints and fastening systems shall be visually examined for fractures or cracks. Small cracks in unimportant parts and any tears caused by the edges of the pendulum weight may be ignored.

7.6.2 Clearance zone

During each test, an examination shall be made to ascertain whether any part of the rear-mounted ROPS has entered the clearance zone (see Clause 9).

In addition, an examination shall be made to determine whether any part of the clearance zone is outside the protection of the rear-mounted ROPS, which could be the case were any part of the zone to come into contact with flat ground in the event of the tractor overturning in the direction of impact. For this purpose, the front and rear tyres, and track width setting, shall be the smallest specified by the manufacturer.

7.6.3 Permanent deflection

After the final crushing test procedure has been carried out, the permanent deflection of the rear-mounted ROPS shall be recorded. For this purpose, before the start of the test procedure, the position of the main rear-mounted ROPS members shall be noted.

8 Seat index point

The seat index point (SIP) shall be determined in accordance with ISO 5353.

For a suspended seat, the manufacturer’s directions for setting the suspension shall be followed if provided. Otherwise, the seat suspension shall be set to the suspension mid-travel point. After the installation of the seat on the tractor, the seat index point (SIP) becomes a fixed point with respect to the tractor and does not move with the seat through its horizontal and vertical adjustment range.

9 Clearance zone

9.1 The clearance zone is illustrated in Figures 10 and 11. The zone is defined in relation to the reference plane and the SIP. The reference plane is a vertical plane, generally longitudinal to the tractor and passing through the SIP and the centre of the steering wheel. Normally the reference plane coincides with the longitudinal median plane of the tractor. This reference plane shall be assumed to move horizontally with the seat and steering wheel during loading but to remain perpendicular to the tractor or the floor of the roll-over protective structure. The clearance zone shall be defined on the basis of 9.2 and 9.3.

9.2 The clearance zone for tractors with a non-reversible seat is defined in a) to m) below and is bounded by the following planes, the tractor being on a horizontal surface, the seat, where adjustable, adjusted to its rear uppermost position[1)], and the steering wheel, where adjustable, adjusted to the mid-position for seated driving:

a) a horizontal plane (A_1 B_1 B_2 A_2), (810 + a_v) mm above the SIP with line B_1B_2 located (a_h – 10) mm behind the SIP;

b) an inclined plane (H_1 H_2 G_2 G_1), perpendicular to the reference plane, including both a point 150 mm behind line B_1B_2 and the rearmost point of the seat backrest;

c) a cylindrical surface (A_1 A_2 H_2 H_1), perpendicular to the reference plane, having a radius of 120 mm, tangential to the planes defined in a) and b);

d) a cylindrical surface (B_1 C_1 C_2 B_2), perpendicular to the reference plane, having a radius of 900 mm extending forward for 400 mm and tangential to the plane defined in a) above along line B_1B_2;

e) an inclined plane (C_1 D_1 D_2 C_2), perpendicular to the reference plane, joining the surface defined in d) and passing 40 mm in front of the forward external edge of the steering wheel. In the case of a high steering-wheel position, this plane extends forward from line B_1B_2 tangentially to the surface defined in d);

f) a vertical plane (D_1 K_1 E_1 E_2 K_2 D_2), perpendicular to the reference plane, 40 mm forward of the external edge of the steering wheel;

g) a horizontal plane (E_1 F_1 P_1 N_1 N_2 P_2 F_2 E_2) passing through a point (90 – a_v) mm below the SIP;

h) a surface (G_1 L_1 M_1 N_1 N_2 M_2 L_2 G_2), if necessary curved from the bottom limit of the plane defined in b) to the horizontal plane defined in g), perpendicular to the reference plane, and in contact with the seat backrest throughout its length;

i) two vertical planes (K_1 I_1 F_1 E_1) and (K_2 I_2 F_2 E_2), parallel to the reference plane, 250 mm either side of the reference plane and bounded at the top 300 mm above the plane defined in g);

j) two inclined and parallel planes (A_1 B_1 C_1 D_1 K_1 I_1 L_1 G_1 H_1) and (A_2 B_2 C_2 D_2 K_2 I_2 L_2 G_2 H_2), starting from the upper edge of the planes defined in i) and joining the horizontal plane defined in a) at least 100 mm from the reference plane on the side where loading is applied;

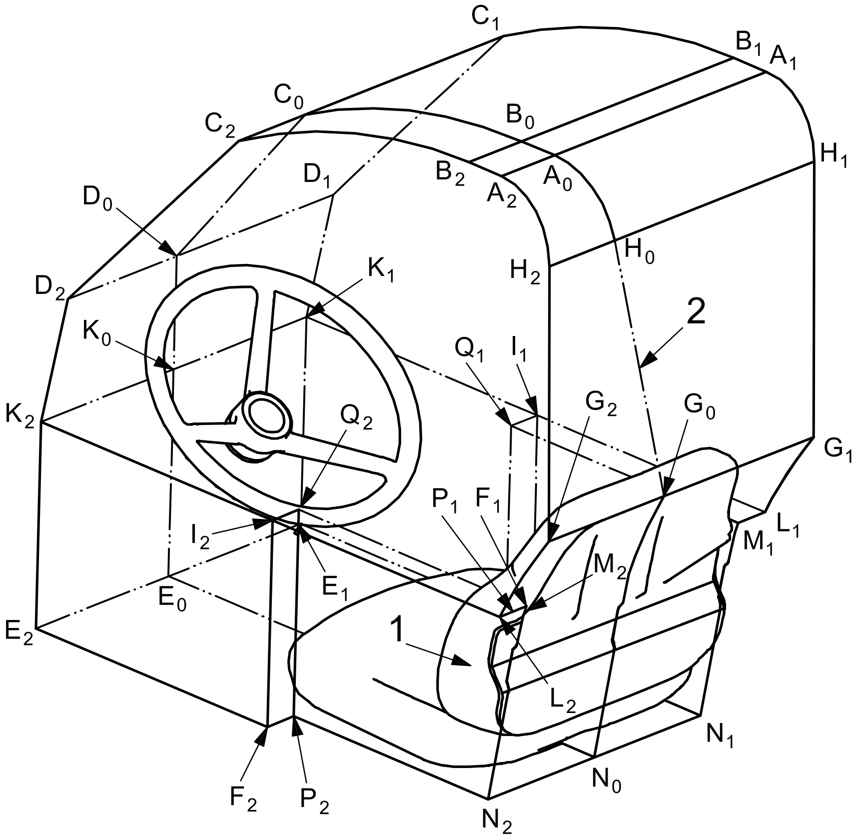
k) two portions of vertical planes (Q_1 P_1 N_1 M_1) and (Q_2 P_2 N_2 M_2), parallel to the reference plane, 200 mm on either side of the reference plane, and bounded toward the top 300 mm above the horizontal plane defined in g);

l) two portions, (I_1 Q_1 P_1 F_1) and (I_2 Q_2 P_2 F_2), of a vertical plane, perpendicular to the reference plane and passing (210 – a_h) mm in front of the SIP;

m) two portions, (I_1 Q_1 M_1 L_1) and (I_2 Q_2 M_2 L_2), of the horizontal plane passing 300 mm above the plane defined in g).

---

1) It should be noted that the SIP is established in accordance with ISO 5353 with the seat located at the mid-position of travel, both horizontally and vertically. The SIP does not move with the seat but is a fixed point on the tractor. For purposes of constructing the clearance zone, the seat is located at its rearmost and upward position.



Key

1 seat index point

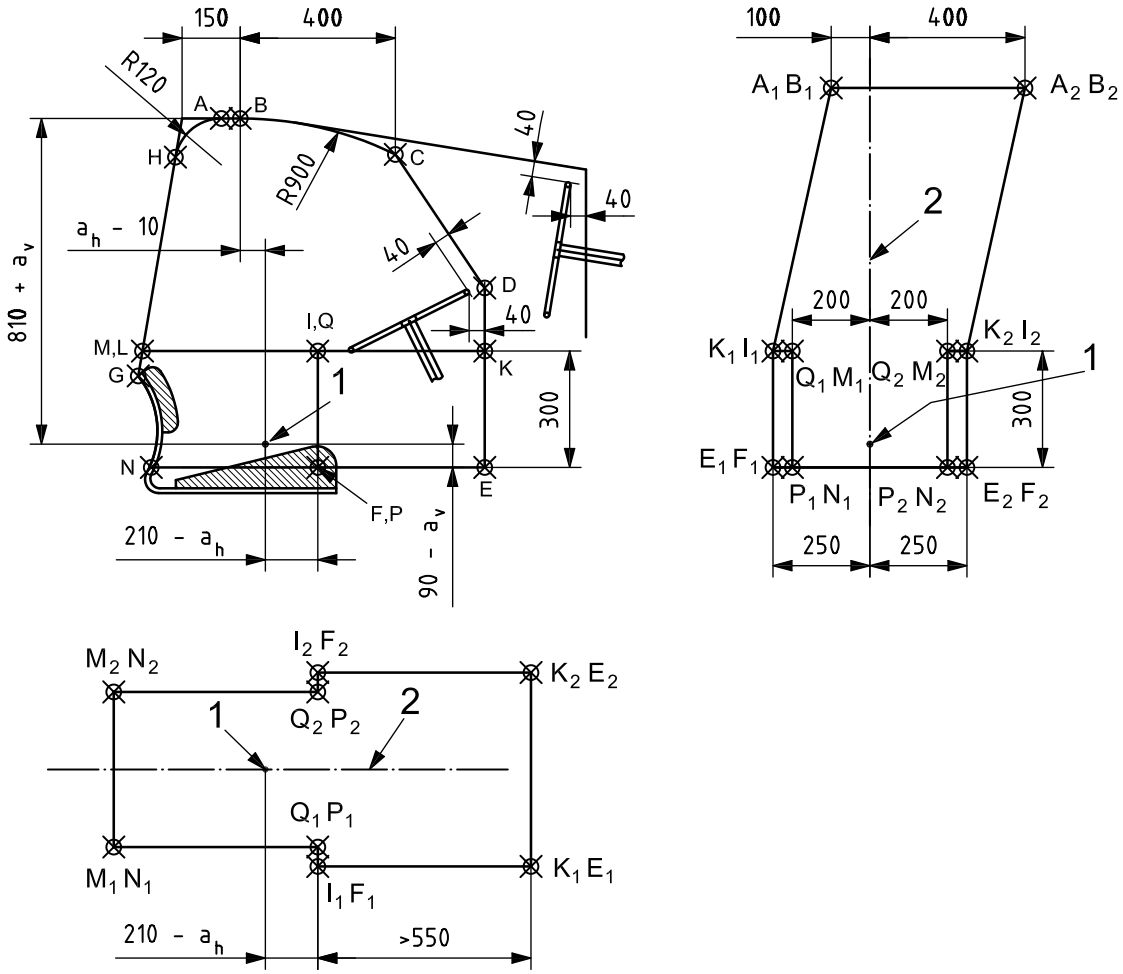
2 vertical reference plane

Dimensions mm		Remarks	Dimensions mm		Remarks
A_1A_0 B_1B_0	100	Minimum	K_1K_0 K_2K_0	250	Minimum or equal to the steering wheel radius plus 40 mm, whichever is greater
A_1A_2 B_1B_2 C_1C_2	500		L_1L_2	500	
			M_1M_2 N_1N_2 Q_1Q_2	400	
D_1D_2 E_1E_2	500	Minimum or equal to the steering wheel radius plus 40 mm, whichever is greater	K_0E_0	300	
F_1F_2	500		G_0N_0	—	Depending on the tractor
G_1G_2	400		G_0H_0	—	
H_1H_2 I_1I_2	500		C_0D_0 E_0N_0	— —	
NOTE For other dimensions, see Figure 11.					

Figure 10 — Clearance zone measuring rig

9.3 For tractors with a reversible driving position (reversible seat and steering wheel), the zone of clearance is the envelope of the two clearance zones defined by the two different positions of the steering wheel and the seat.

Dimensions in millimetres



Key

1 seat index point

2 vertical reference plane

Figure 11 — Clearance zone

10 Tolerances

Measurements during the tests shall be made to the following tolerances:

Time	± 0,2 s
Distance	± 0,5 %
Force	± 1,0 %
Mass	± 0,5 %

11 Acceptance conditions

11.1 General requirements

11.1.1 For articulated tractors, the clearance zone shall remain protected at any angle of articulation of the tractor when overturned.

11.1.2 No part of the tractor shall enter the clearance zone (see Clause 9). No part may strike the seat during the tests. Further, the clearance zone shall not be outside the protection of the rear-mounted ROPS as defined in 3.2. For this purpose, it shall be considered to be outside the roll-over protective structure protection if any part of the zone would come into contact with flat ground if the tractor were to overturn in the direction from which the load was applied. To estimate this, the front and rear tyres, and track width setting, shall be the smallest specified by the manufacturer.

NOTE It is the responsibility of the tractor manufacturer to ensure that other components not present during the ROPS test do not present a hazard to the operator in the event of an overturn by entering the clearance zone.

11.1.3 If the rear-mounted ROPS is claimed to have properties resistant to cold weather embrittlement, the manufacturer shall give details that shall be included in the report. See Annex A.

11.2 After impact loads

After impact loads have been applied, the following conditions shall be met.

a) There shall be no cracks in structural members, mounting components or tractor parts contributing to the strength of the rear-mounted ROPS, except in accordance with the provisions of c).

b) There shall be no cracks in welds contributing to the strength of the rear-mounted ROPS or its mounting components (spot- or tack-welding used for attaching cladding panels is normally excluded from this requirement).

c) Energy-absorbing tears in sheet metal rear-mounted ROPS are acceptable, provided they are judged to have not significantly reduced the resistance to deflection of the rear-mounted ROPS. Tears in sheet metal components caused by the edge of the pendulum block shall normally be ignored.

d) During the side impact test, the elastic deformation shall not exceed 250 mm in a horizontal plane coinciding with the upper limiting surface of the clearance zone.

11.3 After static horizontal loads

After static horizontal loads have been applied, the following conditions shall be met.

a) At the point at which the required energy is met in each of the specified horizontal loading tests, the force shall exceed $0{,}8F_{\text{max}}$.

b) An overload test to determine the residual strength of the rear-mounted ROPS may be required, after a horizontal loading test which may have caused cracks, tears or buckling, in order to ensure adequate residual strength to resist a potential multiple upset accident. The overload test shall be carried out as follows (see Figures 12 to 14).

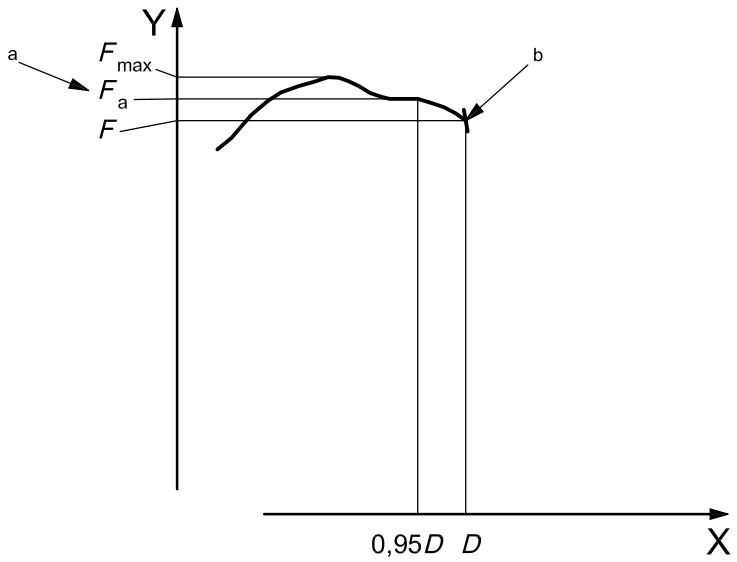
   1) An overload test shall be performed if the force drops by more than 3 % over the last 5 % of deflection attained while absorbing the required energy (Figure 13).

   2) An overload test shall consist of a continuation of the horizontal loading in increments of 5 % of the original required energy up to a total of 20 % additional energy (Figure 14).

3) The overload test shall be considered to have been successfully completed, if, after the absorption of 5 %, 10 % or 15 % additional energy, the force drops by less than 3 % for each 5 % increment, and if the force is greater than $0{,}8F_{max}$.

4) The overload test shall be considered to have been successfully completed, if, after the absorption of 20 % additional energy, the force is greater than $0{,}8F_{max}$.

5) Entry into the clearance zone or lack of protection of the clearance zone is permitted during the overload test. After removing the load, the rear-mounted ROPS shall not be in the clearance zone and shall protect the clearance zone.



Key

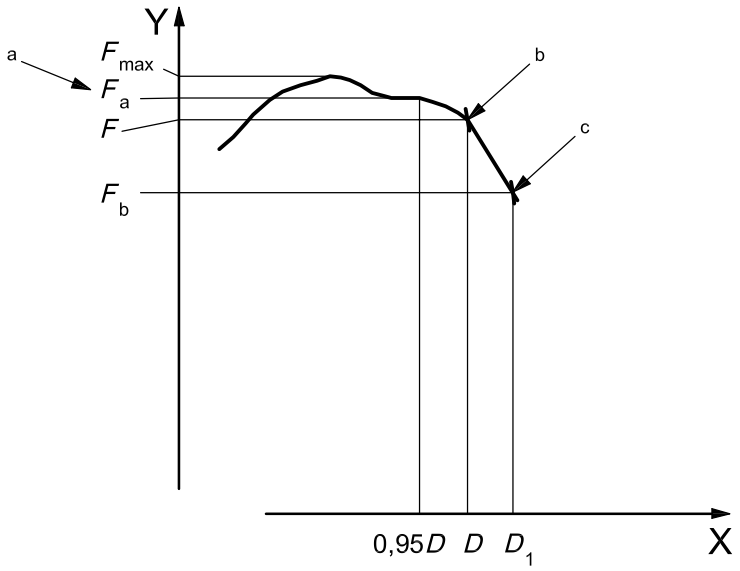
X deflection

Y static load force

a Locate F_a in relation to $0{,}95D$.

b Overload test not necessary as $F_a \leqslant 1{,}03F$.

Figure 12 — Static load force — Deflection diagram, overload test not necessary



Key

X deflection

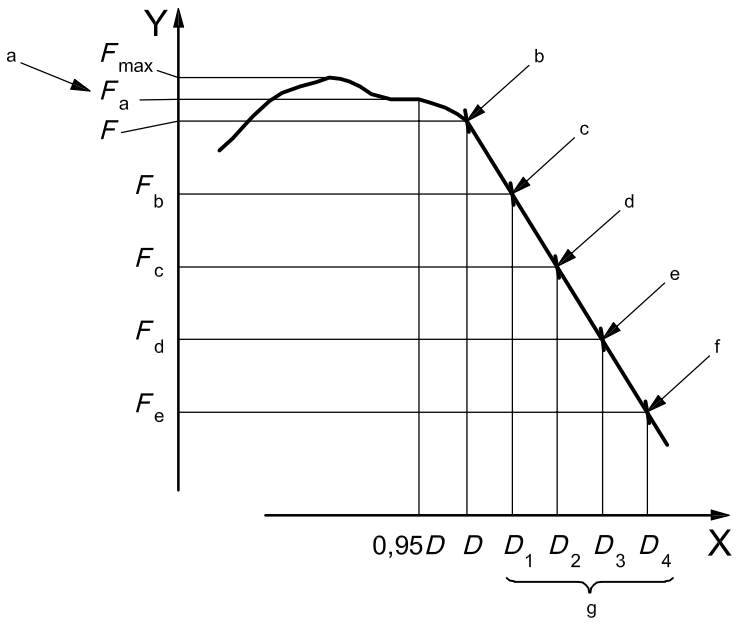
Y static load force

a Locate F_a in relation to 0,95D.

b Overload test necessary as $F_a > 1{,}03F$.

c Overload test performance satisfactory as $F_b > 0{,}97F$ and $F_b > 0{,}8F_{max}$.

Figure 13 — Static load force — Deflection diagram, overload test necessary



Key

X deflection

Y static load force

a Locate F_a in relation to 0,95D.

b Overload test necessary as $F_a > 1{,}03F$.

c $F_b < 0{,}97F$ therefore further overload necessary.

d $F_c < 0{,}97F_b$ therefore further overload necessary.

e $F_d < 0{,}97F_c$ therefore further overload necessary.

f Overload test performance satisfactory, if $F_e > 0{,}8F_{max}$.

g Failure at any stage when load drops below $0{,}8F_{max}$.

Figure 14 — Static load force — Deflection diagram, continuing overload test

11.4 Additional crushing tests

If cracks or tears that cannot be considered as negligible appear during a crushing test, a second, similar crushing test, but with a force of $1{,}2F_v$, shall be carried out immediately after the crushing test that caused the cracks or tears to appear.

12 Extension to other tractor models

In the case of a rear-mounted ROPS that has fulfilled the conditions required for acceptance (see Clause 11) and which is designed to be used on other tractor models, the test procedures specified in Clause 7 need not be carried out on each tractor model, provided that the rear-mounted ROPS and tractor under test comply with the following conditions, and the test report refers to the previous test report.

a) The required energy shall not exceed the energy calculated for the original test by more than 5 %.

b) The attachment method and the tractor components to which the attachment is made shall be identical or of equivalent strength.

c) Any components (e.g. mudguards, bonnet) that could provide support for the rear-mounted ROPS shall be identical, or judged to give at least the same support.

d) The position and critical dimensions of the seat and the relative position of the tractor rear-mounted ROPS shall be such that the clearance zone shall remain within the protection of the deflected rear-mounted ROPS throughout all test procedures.

13 Labelling

If a label is required, it shall be durable and permanently attached to the main rear-mounted ROPS such as to be easily read. It shall be protected from damage and contain at least the following information:

a) name and address of the manufacturer or constructor of the rear-mounted ROPS;

b) identification number of the rear-mounted ROPS;

c) make, model(s) or series number(s) of the tractor(s) the rear-mounted ROPS is designed to fit;

d) reference to this part of ISO 12003, i.e. ISO 12003-2:2008, stating conformance with it.

14 Test report

The test report shall contain at least the information given in Annex B.

Annex A
(normative)

Requirements for providing resistance to brittle fracture of rear-mounted ROPS at a reduced operation temperature

A.1 The following requirements and procedure are intended to provide strength and resistance to brittle fracture at reduced temperature. The following minimum material requirements shall be met in judging the roll-over protective structure suitability at reduced operating temperature in those countries requiring this additional operating protection. Resistance to brittle fracture at reduced temperatures may also be proved by successfully completing the dynamic test procedures specified in this part of ISO 12003 at a temperature of −18 °C or colder. If this method is chosen, the protective structure and all mounting hardware shall be cooled to −18 °C or colder prior to beginning the dynamic test.

In certain countries, compliance with this annex is mandatory. A partial listing of these countries is given in Table A.1.

Table A.1 — Countries for which proving cold weather embrittlement using the method described in this annex is mandatory

Country	Country Code
Canada	CA
United States	US

A.2 Bolts and nuts used to attach the ROPS to the machine frame and to connect structural parts of the ROPS shall be property class 8.8, 9.8 or 10.9 for bolts in accordance with ISO 898-1:1999 and property class 8, 9 or 10 for nuts in accordance with ISO 898-2:1992.

A.3 All welding electrodes used in the fabrication of structural members and mounts shall be compatible with the roll-over protective structure material as given in A.4.

A.4 Steel materials for structural members of the roll-over protective structure shall be of controlled toughness and exhibiting minimum Charpy V-notch impact energy requirements as shown in Table A.2. Structural members that can be demonstrated to be in plane stress or which are subjected to sufficiently low strain rates such that the possibility of brittle fracture is precluded in the event of a low temperature field upset need not comply with this requirement.

NOTE Steel with an as-rolled thickness less than 2,5 mm and with a carbon content less than 0,2 % is considered to meet this requirement.

Structural members of the roll-over protective structure made from materials other than steel shall have equivalent low temperature impact resistance. Specimens shall be “longitudinal” and taken from flat stock, or tubular or structural sections before forming or welding for use in the roll-over protective structure. Specimens from tubular or structural sections shall be taken from the middle of the biggest side and shall not include welds.

A.5 The Charpy V-notch tests shall be carried out in accordance with the procedure in ASTM A370[2)], except that specimen sizes shall be in accordance with the dimensions given in Table A.2.

2) Reference to ASTM A370, is to be replaced as soon as a corresponding International Standard becomes available.

A.6 One alternative to this procedure is to use killed or semi-killed steel for which a specification shall be provided.

Table A.2 — Minimum Charpy V-notch energy requirements for roll-over protective structure material at a specimen temperature of –20 °C and –30 °C

Specimen size	Absorbed Energy	
	–30 °C	–20 °C
mm	J	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
10 × 2,5 [a]	5,5	14

[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 –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.

Annex B
(normative)

Test report for rear-mounted ROPS

B.1 General

Units shown below, according to ISO 1000[2], shall be stated, followed by national units in parentheses if necessary.

— Name and address of manufacturer of rear-mounted ROPS:

— Submitted for test by:

— Make of rear-mounted ROPS:

— Model of rear-mounted ROPS:

— Type of protective structure (cab, frame, rear roll bar, cab with integrated frame, etc.):

— Date and location of test:

B.2 Specification of test tractor

B.2.1 Identification of tractor to which a rear-mounted ROPS is fitted for the test

B.2.1.1 General

— Make of tractor:[3)]

— Model (trade name):

— Type [2 WD or 4 WD; rubber or steel tracks (if applicable); articulated 4 WD or articulated 4 WD with twin (dual) wheels (if applicable)]:

B.2.1.2 Numbers

— 1st serial No. or prototype:

— Serial No.:

B.2.1.3 Other specifications (if applicable)

— Model denomination(s) for other countries:

— Transmission type of gears × range:

— Speed version (30, 40 or other km/h):

— Manufacturer identification or technical type number:

3) Possibly different from tractor manufacturer's name.

B.2.2 Tractor mass

Front	kg
Rear	kg
Total	kg

— Reference mass used for calculating loading energies and crushing forces: kg

B.2.3 Wheelbase/moment of inertia of the tested tractor

— Wheelbase of the tested tractor: mm

— Moment of inertia used for calculating impact energy at the rear: $kg \cdot m^2$

B.2.4 Test tyre and track settings

	Minimum track mm	**Tyres**		
		Dimensions mm	**Diameter** mm	**Pressure** kPa
Front				
Rear				

B.2.5 Tractor seat

— Tractor with a reversible driving position (reversible seat and steering wheel): Yes/No

— Make/type/model of seat:

— Make/type/model of optional seat(s) and position(s) of the seat index point (SIP):

(Description of seat 1 and SIP position)

(Description of seat 2 and SIP position)

(Description of seat... and SIP position)

B.3 Specification of rear-mounted ROPS

B.3.1 Photographs from side and rear showing mounting details including mudguards.

B.3.2 General arrangement drawing of the side and the rear of the structure including position of the seat index points (SIP) and details of mountings.

B.3.3 Brief description of the protective structure comprising:

— type of construction;

— details of mountings;

— details of cladding and padding;

— means of access and escape.

B.3.4 Tiltable or not tiltable/folding or not folding structure

B.3.5 Dimensions

Dimensions should be measured with the seat loaded as required by ISO 5353 to determine the seat index point and then located as required by Clause 9 for determination of the clearance zone.

When the tractor is fitted with different optional seats or has a reversible driver's position (reversible seat and steering wheel), the dimensions in relation to the seat index points shall be measured in each case (SIP 1, SIP 2, etc.).

— Height of roof members above the seat index point: mm

— Height of roof members above the tractor footplate: mm

— Interior width of the protective structure ($810 + a_V$) mm above the seat index point: mm

— Interior width of the protective structure vertically above the seat index point at the level of centre of the steering-wheel: mm

— Distance from the centre of the steering-wheel to the right-hand side of the rear-mounted ROPS: mm

— Distance from the centre of the steering-wheel to the left-hand side of the rear-mounted ROPS: mm

— Minimum distance from the steering-wheel rim to the rear-mounted ROPS: mm

— Width of the doorways:

  — at the top: mm

  — in the middle: mm

  — at the bottom: mm

— Height of the doorways:

  — above foot platforms: mm

  — above the highest mounting steps: mm

  — above the lowest mounting steps: mm

— Overall height of the tractor with the rear-mounted ROPS fitted: mm

— Overall width of the rear-mounted ROPS (if mudguards are included, this is to be stated): mm

— Horizontal distance from the seat index point to the rear of the rear-mounted ROPS at a height of ($810 + a_V$) mm above the seat index point: mm

— Position (with reference to the rear axle) of the front part of the tractor capable of supporting the tractor when overturned (if necessary):

  — horizontal distance mm

  — vertical distance mm

B.3.6 Details of materials used in the construction of the protective structure and specifications of steels used

Steel specifications shall be in conformity with ISO 630.

— Main frame: (parts – materials – sizes)

  — Is steel rimmed, semi-killed, killed?

  — Steel standard and reference:

— Mountings: (parts – materials – sizes)

  — Is steel rimmed, semi-killed, killed?

  — Steel standard and reference:

— Assembly and mounting bolts: (parts – sizes)

— Roof: (parts – materials – sizes)

— Cladding: (parts – materials – sizes)

— Glass: (type – grade – sizes)

B.3.7 Details of tractor manufacturer's reinforcements on original parts

B.4 Test results

B.4.1 Impact and crushing tests

B.4.1.1 Condition of tests

— Impact tests were carried out:

  — to the rear left/right

  — to the front right/left

  — to the side right/left

— Mass used for calculating impact energies and crushing forces: kg

— Energies and forces applied:

  — rear: kJ

  — front: kJ

  — side: kJ

  — crushing force: kN

  — during additional overload test: kN

B.4.1.2 Permanent deflections measured after the tests

Permanent deflections of the extremities of the protective structure measured after the series of tests:

— Back (forwards/backwards):

  — left-hand: mm

  — right-hand: mm

— Front (forwards/backwards):

  — left-hand: mm

  — right-hand: mm

— Sideways (to the left/to the right):

  — front: mm

  — rear: mm

— Top (downwards/upwards):

  — rear:

    — left-hand: mm

    — right-hand: mm

  — front:

    — left-hand: mm

    — right-hand: mm

Difference between total instantaneous deflection and residual deflection during sideways impact test (elastic deflection): mm

Statement:

The acceptance conditions of these tests relative to the protection of the zone of clearance are fulfilled. The structure is a roll-over protective structure in accordance with this part of ISO 12003.

B.4.2 Static loading and crushing tests

B.4.2.1 Condition of tests

— Loading was applied:

  — to the rear left/right

  — to the front right/left

  — to the side right/left

— Mass used for calculating loading energies and crushing forces: kg

— Energies and forces applied:

  — rear: kJ

  — front: kJ

  — side: kJ

  — crushing force: kN

B.4.2.2 Permanent deflections measured after the tests

Permanent deflections of the extremities of the protective structure measured after the series of tests:

— Back (forwards/backwards):

  — left-hand: mm

  — right-hand: mm

— Front (forwards/backwards):

  — left-hand: mm

  — right-hand: mm

— Sideways (to the left/to the right):

  — front: mm

  — rear: mm

— Top (downwards/upwards):

  — rear:

    — left-hand: mm

    — right-hand: mm

— front:

  — left-hand: mm

  — right-hand: mm

Difference between total instantaneous deflection and residual deflection during side loading test (elastic deflection): mm

Statement:

The acceptance conditions of these tests relative to the protection of the zone of clearance are fulfilled. The structure is a roll-over protective structure in accordance with this part of ISO 12003.

B.4.2.3 Curves (static test only)

A copy of the force/deflection curves derived during the tests shall be included.

If a horizontal overload test was required, the reason for the overload shall be described and the copy of additional force/deflection curves obtained during overload shall be included.

B.4.3 Cold weather performance (resistance to brittle fracture)

Method used to identify resistance to brittle fracture at reduced temperature:

Steel specifications shall be in conformity with ISO 630.

Steel specification: (reference and relevant standard)

Table B.1 — Tractors to which the protective structure is fitted

Make, model and type	Number of driving wheels	Mass			Tiltable	Wheel-base	Minimum track	Test reference number
		Front	Rear	Total				
	2/4 WD	kg	kg	kg	Yes/No	mm	mm	

B.5 Minor modification certificate

— Test reference number according to ISO 12003-2:

— Copy of the referenced original test report:

— Date and location of test:

— Date of approval:

— Modification reference number: MOD

Previous Modification Certificate (MOD.....) remains/does not remain valid.

B.5.1 Specification of the protective structure

— Frame or cab:

— Manufacturer:

— Submitted for test by:

— Make:

— Model:

— Type:

— Serial number for which modification applies:

B.5.2 Denomination of tractors to which the protective structure is fitted

Make and model	Number of driving wheels	Reference-number

B.5.3 Details of modifications

Since the original test report the following modifications have been made:

.....

.....

.....

B.5.4 Statement

The effect of these modifications on the strength of the protective structure has been examined.

The modifications are considered not to affect the results of the original test.

The original test report therefore applies to the protective structure of the modified tractor.

Drafted on the responsibility of _____ who carried out the original test, this certificate is circulated as an annex to the original test report and subject to the same circulation.

Signature:

Date:

Location:

Bibliography

[1] ISO 612:1978, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*

[2] ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units + Amd. 1 1998*

[3] OECD Standard Code 7, *OECD Standard Code for the official testing of rear mounted roll-over protective structures on narrow-track wheeled agricultural and forestry tractors*

ICS 65.060.10

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