CODE 7

OECD STANDARD CODE FOR THE OFFICIAL TESTING OF REAR MOUNTED ROLL-OVER PROTECTIVE STRUCTURES ON NARROW-TRACK WHEELED AGRICULTURAL AND FORESTRY TRACTORS

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1. DEFINITIONS

1.1 Agricultural and forestry tractors

Self-propelled wheeled vehicles, having at least two axles, or with tracks, designed to carry out the following operations, primarily for agricultural and forestry purposes:

– to pull trailers;

– to carry, pull or propel agricultural and forestry tools or machinery and, where necessary, supply power to operate them with the tractor in motion or stationary.

The present Code is applicable to wheeled tractors only.

1.2 Track

1.2.1 Preliminary definition: median plane of the wheel

The median plane of the wheel is equidistant from the two planes containing the periphery of the rims at their outer edges.

1.2.2 Definition of track

The vertical plane through the wheel axis intersects its median plane along a straight line which meets the supporting surface at one point. If **A** and **B** are the two points thus defined for the wheels on the same axle of the tractor, then the track width is the distance between points **A** and **B**. The track may be thus defined for both front and rear wheels. Where there are twin wheels, the track is the distance between two planes each being the median plane of the pairs of wheels.

1.2.3 Additional definition: median plane of the tractor

Take the extreme positions of points **A** and **B** for the tractor rear axle, which gives the maximum possible value for the track. The vertical plane at right angles to the line **AB** at its centre point is the median plane of the tractor.

1.3 Wheelbase

The distance between the vertical planes passing through the two lines **AB** as defined above, one for the front wheels and one for the rear-wheels.

1.4 Determination of seat reference point; Seat location and adjustment for test

1.4.1 Seat reference point

1.4.1.1 The reference must be established by means of the apparatus illustrated in Figures 7.1, 7.2 and 7.3. The apparatus consists of a seat pan board and backrest boards. The lower backrest board is jointed in the region of the ischium humps (**A**) and loin (**B**), the joint (**B**) being adjustable in height.

1.4.1.2 The seat reference point is defined as the point in the median longitudinal plane of the seat where the tangential plane of the lower backrest and a horizontal plane intersect. This horizontal plane cuts the lower surface of the seat pan board 150 mm in front of the above-mentioned tangent.

1.4.1.3 The apparatus is positioned on the seat. It is then loaded with a force of 550 N at a point 50 mm in front of joint (**A**), and the two parts of the backrest board lightly pressed tangentially against the backrest.

1.4.1.4 If it is not possible to determine definite tangents to each area of the backrest (above and below the lumbar region), the following steps must be taken:

- where no definite tangent to the lower area is possible, the lower part of the backrest board is pressed against the backrest vertically;

- where no definite tangent to the upper area is possible, the point (B) is fixed at a height of 230 mm above the lower surface of the seat pan board, the backrest board being perpendicular to the seat pan board. Then the two parts of the backrest board are lightly pressed against the backrest tangentially.

1.4.2 Seat location and adjustment for test

1.4.2.1 Where the seat position is adjustable, the seat must be adjusted to its rear uppermost position;

1.4.2.2 where the inclination of the backrest and seat pan is adjustable, these must be adjusted so that the reference point is in its rear uppermost position;

1.4.2.3 where the seat is equipped with suspension, the latter must be blocked at mid-travel, unless this is contrary to the instructions clearly laid down by the seat manufacturer*;*

1.4.2.4 where the position of the seat is adjustable only lengthwise and vertically, the longitudinal axis passing through the seat reference point shall be parallel with the vertical longitudinal plane of the tractor passing through the centre of the steering wheel and not more than 100 mm from that plane.

1.5 Clearance zone

1.5.1 Vertical reference plane

The zone of clearance (Figures 7.4, 7.5, 7.6, 7.7, 7.8 and 7.9) is defined on the basis of a vertical reference plane generally longitudinal to the tractor and passing through the seat reference point and the centre of the steering wheel; normally, the vertical reference plane coincides with the median plane of the tractor. This plane must be able to move horizontally with the seat and the steering wheel during impacts and loads, but to remain perpendicular to the floor of the tractor or of the protective structure if this is resiliently mounted.

1.5.2 Determination of clearance zone

The zone is bounded by the following planes, the tractor being on a horizontal surface and, where the steering wheel is adjustable, its position adjusted for normal seated driving:

1.5.2.1 a horizontal plane $\mathbf{A_1 B_1 B_2 A_2}$ 900 mm above the seat reference point;

1.5.2.2 an inclined plane $\mathbf{H_1 H_2 G_2 G_1}$ perpendicular to the vertical reference plane and including a point 900 mm directly above the seat reference point and the rearmost point of the seat backrest;

1.5.2.3 a cylindrical surface $\mathbf{A_1 A_2 H_2 H_1}$ which is perpendicular to the reference plane, has a radius of 120 mm and is tangential to the planes defined above in 1.5.2.1 and 1.5.2.2;

1.5.2.4 a cylindrical surface $\mathbf{B_1 C_1 C_2 B_2}$ perpendicular to the reference plane, having a radius of 900 mm and extending forward by 400 mm the plane defined in 1.5.2.1 above, to which it is tangential, following a horizontal line 150 mm forward of the seat reference point;

1.5.2.5 an inclined plane $\mathbf{C_1 D_1 D_2 C_2}$ perpendicular to the reference plane, extending the surface defined in 1.5.2.4 above and passing through a point 40 mm from the outer edge of the steering wheel;

1.5.2.6 a vertical plane $\mathbf{D_1 K_1 E_1 E_2 K_2 D_2}$ perpendicular to the reference plane and passing 40 mm in front of the other edge of the steering wheel;

1.5.2.7 a horizontal plane $\mathbf{E_1 F_1 P_1 N_1 N_2 P_2 F_2 E_2}$ passing through the seat reference point;

1.5.2.8 a curvilinear surface $\mathbf{G_1 L_1 M_1 N_1 N_2 M_2 L_2 G_2}$ perpendicular to the reference plane and in contact with the back of the seat backrest;

1.5.2.9 two vertical planes $\mathbf{K_1 I_1 F_1 E_1}$ and $\mathbf{K_2 I_2 F_2 E_2}$ parallel to the reference plane, 250 mm either side of this plane, and bounded towards the top 300 mm above the horizontal plane passing through the seat reference point;

1.5.2.10 two inclined and parallel planes $\mathbf{A_1 B_1 C_1 D_1 K_1 I_1 L_1 G_1 H_1}$ and $\mathbf{A_2 B_2 C_2 D_2 K_2 I_2 L_2 G_2 H_2}$ starting from the upper edge of the planes defined in 1.5.2.9 above and joining the horizontal plane defined in 1.5.2.1 above at least 100 mm from the reference plane on the side where the impact is applied;

1.5.2.11 two portions of vertical planes $\mathbf{Q_1 P_1 N_1 M_1}$ and $\mathbf{Q_2 P_2 N_2 M_2}$ parallel to the reference plane, 200 mm either side of this plane, and bounded towards the top 300 mm above the horizontal plane passing through the seat reference point;

1.5.2.12 two portions $\mathbf{I_1 Q_1 P_1 F_1}$ and $\mathbf{I_2 Q_2 P_2 F_2}$ of a vertical plane, perpendicular to the reference plane and passing 350 mm in front of the seat reference point;

1.5.2.13 two portions $\mathbf{I_1 Q_1 M_1 L_1}$ and $\mathbf{I_2 Q_2 M_2 L_2}$ of the horizontal plane passing 300 mm above the seat reference point.

1.5.3 Tractors with a reversible driver's position

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

1.5.3.1 If the protective structure is a of a rear two-post type, for each position of the steering wheel and of the seat, the clearance zone shall respectively be defined on the basis of above sections 1.5.1 and 1.5.2 of present Code for driver's position in normal position and on the basis of sections 1.5.1 and 1.5.2 of Code 6 for driver's position in reverse position (figure 7.10a).

1.5.3.2 If the protective structure is of another type, for each position of the steering wheel and of the seat, the clearance zone shall be defined on the basis of sections 1.5.1 and 1.5.2 of present Code (figure 7.10b).

1.5.4 Optional seats

1.5.4.1 In case of tractors that could be fitted with optional seats, the envelope comprising the seat reference points of all the options offered shall be used during the tests. The protective structure shall not enter the larger clearance zone which takes account of these different seat reference points.

1.5.4.2 In the case where a new seat option is offered after the test has been performed, a determination will be made to see whether the clearance zone around the new SRP falls within the envelope previously established. If it does not, a new test must be performed.

1.6 Permissible measurement tolerances

Linear dimension:	± 3 mm
except for: -- tyre deflection :	± 1 mm
-- structure deflection during horizontal loadings:	± 1 mm
-- height of fall of the pendulum block:	± 1 mm
Masses:	± 1 %
Forces:	± 2 %
Angles:	± 2 °

1.7 Symbols

B	(mm)	Minimum overall width of the tractor;
$\mathbf{B_6}$	(mm)	Maximum outer width of the protective structure;
D	(mm)	Deflection of the structure at the point of impact (dynamic tests) or at the point of, and in line with, the load application (static tests);
D'	(mm)	Deflection of the structure for the calculated energy required;
$\mathbf{E_a}$	(J)	Strain energy absorbed at point when load is removed. Area contained within **F-D** curve;
$\mathbf{E_i}$	(J)	Strain energy absorbed. Area under **F-D** curve;
$\mathbf{E'_i}$	(J)	Strain energy absorbed after additional loading following a crack or tear;
$\mathbf{E''_i}$	(J)	Strain energy absorbed in overload test in the event of the load having been removed before starting this overload test. Area under **F-D** curve;
$\mathbf{E_{il}}$	(J)	Energy input to be absorbed during longitudinal loading;
$\mathbf{E_{is}}$	(J)	Energy input to be absorbed during side loading;
F	(N)	Static load force;

F'	(N)	Loading force for calculated energy required, corresponding to $\mathbf{E'_i}$;
F-D		Force/deflection diagram;
$\mathbf{F_{max}}$	(N)	Maximum static load force occurring during loading, with the exception of the overload;
$\mathbf{F_v}$	(N)	Vertical crushing force;
H	(mm)	Falling height of the pendulum block (dynamic tests);
H'	(mm)	Falling height of the pendulum block for additional test (dynamic tests);
I	($kg.m^2$)	Tractor reference moment of inertia about the centre line of the rear wheels, whatever the mass of these rear wheels may be;
L	(mm)	Tractor reference wheelbase;
M	(kg)	Tractor reference mass during strength tests, as defined in section 3.1.1.4.

2. FIELD OF APPLICATION

2.1 This OECD Standard Code shall apply to tractors having the following characteristics:

2.1.1 ground clearance of not more than 600 mm beneath the lowest points of the front and rear axles, allowing for the differential;

2.1.2 fixed or adjustable minimum track width with one of the axles less than 1 150 mm fitted with tyres of a larger size. It is assumed that the axle mounted with the wider tyres is set at a track width of not more than 1 150 mm. It must be possible to set the track width of the other axle in such a way that the outer edges of the narrower tyres do not go beyond the outer edges of the tyres of the other axle. Where the two axles are fitted with rims and tyres of the same size, the fixed or adjustable track width of the two axles must be less than 1 150 mm;

2.1.3 mass greater than 600 kg unladen but including the roll-over protective structure and tyres of the largest size recommended by the manufacturer. For tractors with a reversible driver's position (reversible seat and steering wheel), the mass shall be less than 3 000 kg.

2.1.4 roll-over protective structure of the rear-mounted rollbar, frame or cab type having a zone of clearance whose upper limit is 900 mm above the seat reference point in order to provide a sufficiently large area or unobstructed space for the protective of the driver.

2.2 It is recognised that there may be designs of tractors, for example, special forestry machines, such as forwarders and skidders, for which this Standard Code is not applicable.

3. RULES AND DIRECTIONS

3.1 Conditions for testing the strength of protective structures and of their attachment to tractors

3.1.1 General requirements

3.1.1.1 Test purposes

Tests made using special rigs are intended to simulate such loads as are imposed on a protective structure, when the tractor overturns. These tests enable observations to be made on the strength of the

protective structure and any brackets attaching it to the tractor and any parts of the tractor which transmit the test load.

3.1.1.2 Test methods

Tests may be performed in accordance with the dynamic procedure or the static procedure. The two methods are deemed equivalent.

3.1.1.3 General rules governing preparation for tests

3.1.1.3.1 The protective structure must conform to the series production specifications. It shall be attached in accordance with the manufacturer's recommended method to one of the tractors for which it is designed.

Note: A complete tractor is not required for the static strength test; however, the protective structure and parts of the tractor to which it is attached represent an operating installation, hereinafter referred to as « the assembly ».

3.1.1.3.2 For both the static test and the dynamic test 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.

Components which may create a hazard in the zone of clearance must also be fitted on the tractor (or the assembly) so that they may be examined to see whether the requirements of the Acceptance Conditions in 3.1.3 have been fulfilled. All components of the tractor or the protective structure including weather protective must be supplied or described on drawings.

3.1.1.3.3 For the strength tests, all panels and detachable non-structural components must be removed so that they may not contribute to the strengthening of the protective structure.

3.1.1.3.4 The track width must be adjusted so that the protective structure will, as far as possible, not be supported by the tyres during the strength tests. If these tests are conducted in accordance with the static procedure, the wheels may be removed.

3.1.1.4 Tractor reference mass during strength tests

The reference mass **M**, used in the formulae to calculate the height of the fall of the pendulum block, the loading energies and the crushing forces, must be at least the mass of the tractor, excluding optional accessories but including coolant, oils, fuel, tools plus the protective structure. Not included are optional front or rear weights, tyre ballast, mounted implements, mounted equipment or any specialised components.

3.1.2 Tests

3.1.2.1 Sequence of tests

The sequence of tests, without prejudice to the additional tests mentioned in sections 3.2.1.1.6, 3.2.1.1.7, 3.2.2.1.6 and 3.2.2.1.7, is as follows:

(1) impact (dynamic test) or loading (static test) at the rear of the structure (see 3.2.1.1.1 and 3.2.2.1.1);

(2) rear crushing test (dynamic or static test)
(see 3.2.1.1.4 and 3.2.2.1.4);

(3) impact (dynamic test) or loading (static test) at the front of the structure
(see 3.2.1.1.2 and 3.2.2.1.2);

(4) impact (dynamic test) or loading (static test) at the side of the structure
(see 3.2.1.1.3 and 3.2.2.1.3);

(5) crushing at the front of the structure (dynamic or static test)
(see 3.2.1.1.5 and 3.2.2.1.5).

3.1.2.2 General requirements

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

3.1.2.2 2 No repairs or adjustments of the tractor or protective structure may be carried out during the tests.

3.1.2.2.3 The tractor gear box shall be in neutral and the brakes off during the tests.

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

3.1.2.2.5 The side chosen for application of the first impact (dynamic test) or the first load (static test) on the rear of the structure shall be that which, in the opinion of the testing authorities, will result in the application of the series of impacts or loads under the most unfavourable conditions for the structure. The lateral impact or load and the rear impact or load shall be applied on both sides of the longitudinal median plane of the protective structure. The front impact or load shall be applied on the same side of the longitudinal median plane of the protective structure as the lateral impact or load.

3.1.3 Acceptance conditions

3.1.3.1 A protective structure is regarded as having satisfied the strength requirements if it fulfils the following conditions:

3.1.3.1.1 after each test in the dynamic test procedure, it shall be free from tears or cracks, as defined in 3.2.1.2.1. If during the dynamic test, significant tears or cracks appear, an additional impact test or crushing test as defined in 3.2.1.1.6 or 3.2.1.1.7 must be performed immediately after the test which caused these tears or cracks to appear;

3.1.3.1.2 during static test, at the point when the energy required is attained in each horizontal load test prescribed or in the overload test the force must be greater than 0.8 F;

3.1.3.1.3 if during a static test, cracks or tears appear as a result of the application of the crushing force, an additional crushing test as defined in 3.2.2.1.7 must be performed immediately after the crushing test which caused these cracks or tears to appear;

3.1.3.1.4 during the tests other than the overload test, no part of the protective structure must enter the zone of clearance as defined in 1.5;

3.1.3.1.5 during the tests other than the overload test, all parts of the zone of clearance shall be secured by the structure, in accordance with 3.2.1.2.2 and 3.2.2.2.2;

3.1.3.1.6 during the tests the protective structure must not impose any constraints on the seat structure;

3.1.3.1.7 the elastic deflection, measured in accordance with 3.2.1.2.3 and 3.2.2.2.3 shall be less than 250 mm.

3.1.3.2 There shall be no accessories presenting a hazard for the driver. There shall be no projecting part or accessory which is liable to injure the driver should the tractor overturn, or any accessory or part which is liable to trap him – for example by the leg or the foot – as a result of the deflections of the structure.

3.1.4 Test report

3.2.4.1 The report shall include:

3.1.4.1.1 a general description of the protective structure's shape and construction (normally at least a scale of 1/20 for the general drawings and 1/2.5 for drawing of the attachments).

The main dimensions must figure on the drawings, including external dimensions of tractor with protective structure fitted and main interior dimensions;

3.1.4.1.2 a general description of materials and fastening;

3.1.4.1.3 details of provisions for normal entry and exit and for escape where appropriate;

3.1.4.1.4 details of heating and ventilation system, where appropriate;

3.1.4.1.5 a brief description of any interior padding.

3.1.4.2 The test report must clearly identify the tractor (make, type, model, trade name, etc.) used for testing and the other tractors for which the protective structure is intended.

3.1.5 Apparatus and equipment for dynamic tests

3.1.5.1 Pendulum block

3.1.5.1.1 A block acting as a pendulum must be suspended by two chains or wire ropes from pivot points not less than 6 m above the ground. Means must be provided for adjusting independently the suspended height of the block and the angle between the block and the supporting chains or wire ropes.

3.1.5.1.2 The mass of the pendulum block must be 2 000 ± 20 kg excluding the mass of the chains or wire ropes which themselves must not exceed 100 kg. The length of the sides of the impact face must be 680 ± 20 mm (see Figure 7.11). The block must be filled in such a way that the position of its centre of gravity is constant and coincides with the geometrical centre of the parallelepiped.

3.1.5.1.3 The parallelepiped must be connected to the system which pulls it backwards by an instantaneous release mechanism which is so designed and located as to enable the pendulum block

to be released without causing the parallelepiped to oscillate about its horizontal axis perpendicular to the pendulum's plane of oscillation.

3.1.5.2 Pendulum supports

The pendulum pivot points must be rigidly fixed so that their displacement in any direction does not exceed 1 per cent of the height of fall.

3.1.5.3 Lashings

3.1.5.3.1 Anchoring rails with the requisite track width and covering the necessary area for lashing the tractor in all the cases illustrated (see Figures 7.12, 7.13 and 7.14) must be rigidly attached to a non-yielding base beneath the pendulum.

3.1.5.3.2 The tractor shall be lashed to the rails by means of wire rope with round strand, fibre core, construction 6 x 19 in accordance with ISO 2408:1985 and a nominal diameter of 13 mm. The metal strands must have an ultimate tensile strength of 1770 MPa.

3.1.5.3.3 The central pivot of an articulated tractor shall be supported and lashed down as appropriate for all tests. For the lateral impact test, the pivot shall also be propped from the side opposite the impact. The front and rear wheels need not be in line if this facilitates the attachment of the wire ropes in the appropriate manner.

3.1.5.4 Wheel prop and beam

3.1.5.4.1 A softwood beam of 150 mm square shall be used as a prop for the wheels during the impact tests (see Figures 7.12, 7.13 and 7.14).

3.1.5.4.2 During the lateral impact tests, a softwood beam shall be clamped to the floor to brace the rim of the wheel opposite the side of impact (see Figure 7.14).

3.1.5.5 Props and lashings for articulated tractors

3.1.5.5.1 Additional props and lashings must be used for articulated tractors. Their purpose is to ensure that the section of the tractor on which the protective structure is fitted is as rigid as that of a non-articulated tractor.

3.1.5.5.2 Additional specific details are given in section 3.2.1.1 for the impact and crushing tests.

3.1.5.6 Tyre pressures and deflections

3.1.5.6.1 The tractor tyres shall not be liquid-ballasted and shall be inflated to the pressures prescribed by the tractor manufacturer for field work.

3.1.5.6.2 The lashings shall be tensioned in each particular case such that the tyres undergo a deflection equal to 12 per cent of the tyre wall height (distance between the ground and the lowest point of the rim) before tensioning.

3.1.5.7 Crushing rig

A rig as shown in Figure 7.15 shall be capable of exerting a downward force on a protective structure through a rigid beam approximately 250 mm wide connected to the load-applying mechanism

by means of universal joints. Suitable axle stands shall be provided so that the tractor tyres do not bear the crushing force.

3.1.5.8 Measuring apparatus

The following measuring apparatus is needed:

3.1.5.8.1 device for measuring the elastic deflection (the difference between the maximum momentary deflection and the permanent deflection, see Figure 7.16).

3.1.5.8.2 device for checking that the protective structure has not entered the zone of clearance and that the latter has remained within the structure's protective during the test (see section 3.2.2.2.2).

3.1.6 Apparatus and equipment for static tests

3.1.6.1 Static testing rig

3.1.6.1.1 The static testing rig must be designed in such a way as to permit thrusts or loads to be applied to the protective structure.

3.1.6.1.2 Provision must be made so that the load can be uniformly distributed normal to the direction of loading and along a flange having a length of one of the exact multiples of 50 between 250 and 700 mm. The stiff beam shall have a vertical face dimension of 150 mm. The edges of the beam in contact with the protective structure shall be curved with a maximum radius of 50 mm.

3.1.6.1.3 The pad shall be capable of being adjusted to any angle in relation to the load direction, in order to be able to follow the angular variations of the structure's load-bearing surface as the structure deflects.

3.1.6.1.4 Direction of the force (deviation from horizontal and vertical):

- at start of test, under zero load: ± 2°;
- during test, under load: 10° above and 20° below the horizontal. These variations must be kept to a minimum.

3.1.6.1.5 The deflection rate shall be sufficiently slow, less than 5 mm/s so that the load may at all moments be considered as static.

3.1.6.2 Apparatus for measuring the energy absorbed by the structure

3.1.6.2.1 The force versus deflection curve shall be plotted in order to determine the energy absorbed by the structure. There is no need to measure the force and deflection at the point where the load is applied to the structure; however, force and deflection shall be measured simultaneously and co-linearly.

3.1.6.2.2 The point of origin of deflection measurements shall be selected so as to take account only of the energy absorbed by the structure and/or by the deflection of certain parts of the tractor. The energy absorbed by the deflection and/or the slipping of the anchoring must be ignored.

3.1.6.3 Means of anchoring the tractor to the ground

3.1.6.3.1 Anchoring rails with the requisite track width and covering the necessary area for anchoring the tractor in all the cases illustrated must be rigidly attached to a non-yielding base near the testing rig.

3.1.6.3.2 The tractor must be anchored to the rails by any suitable means (plates, wedges, wire ropes, jacks, etc.) so that it cannot move during the tests. This requirement shall be checked during the test, by means of the usual devices for measuring length.

If the tractor moves, the entire test shall be repeated, unless the system for measuring the deflections taken into account for plotting the force versus deflection curve is connected to the tractor.

3.1.6.4 Crushing rig

A rig as shown in Figure 7.15 shall be capable of exerting a downward force on a protective structure through a rigid beam approximately 250 mm wide, connected to the load-applying mechanism by means of universal joints. Suitable axle stands must be provided so that the tractor tyres do not bear the crushing force.

3.1.6.5 Other measuring apparatus

The following measure devices are also needed:

3.1.6.5.1 device for measuring the elastic deflection (the difference between the maximum momentary deflection and the permanent deflection, see Figure 7.16).

3.1.6.5.2 device for checking that the protective structure has not entered the zone of clearance and that the latter has remained within the structure's protective during the test (section 3.3.2.2.2).

3.2 Test procedures

3.2.1 Dynamic Tests

3.2.1.1 Impact and crushing tests

3.2.1.1.1 Impact at the rear

3.2.1.1.1.1 The tractor shall be so placed in relation to the pendulum block that the block will strike the protective structure when the impact face of the block and the supporting chains or wire ropes are at an angle with the vertical plane **A** equal to **M/100** with a 20° maximum, unless, during deflection, the protective structure at the point of contact forms a greater angle to the vertical. In this case the impact face of the block shall be adjusted by means of an additional support so that it is parallel to the protective structure at the point of impact at the moment of maximum deflection, the supporting chains or wire ropes remaining at the angle defined above.

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

The point of impact is that part of the protective structure 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 is 1/6 of the width of the top of the protective structure inwards from a vertical plan parallel to the median plane of the tractor touching the outside extremity of the top of the protective structure.

If the structure is curved or protruding at this point, wedges enabling the impact to be applied thereon must be added, without thereby reinforcing the structure.

3.2.1.1.1.2 The tractor must be lashed to the ground by means of four wire ropes, one at each end of both axles, arranged as indicated in Figure 7.12. The spacing between the front and rear lashing points must be such that the wire ropes make an angle of less than 30° with the ground. The rear lashings must 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.

The wire ropes must be tensioned so that the tyres undergo the deflections given in 3.1.5.6.2. 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.

3.2.1.1.1.3 If the tractor is of the articulated type, the point of articulation shall, in addition, be supported by a wooden block at least 100 mm square and firmly lashed to the ground.

3.2.1.1.1.4 The pendulum block shall be pulled back so that the height of its centre of gravity above that at the point of impact is given by one of the following two formulae:

$$H = 2.165 \times 10^{-8} M L^2$$

or

$$H = 5.73 \times 10^{-2} I$$

The pendulum block is then released and strikes the protective structure.

3.2.1.1.1.5 For tractors with a reversible driver's position (reversible seat and steering wheel), the height shall be whichever is greater of either of the above or either of the following:

$$H = 25 + 0.07 M$$

for assemblies with a reference mass of less than 2 000 kg;

$$H = 125 + 0.02 M$$

for assemblies with a reference mass of more than 2 000 kg .

3.2.1.1.2 Impact at the front

3.2.1.1.2.1 The tractor shall be so placed in relation to the pendulum block that the block will strike the protective structure when the impact face of the block and the supporting chains or wire ropes are at an angle with the vertical plane **A** equal to **M/100** with a 20° maximum, unless, during deflection, the protective structure at the point of contact forms a greater angle to the vertical. In this case the impact face of the block shall be adjusted by means of an additional support so that it is parallel to the protective structure at the point of impact at the moment of maximum deflection, the supporting chains or wire ropes remaining at the angle defined above.

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

The point of impact is that part of the protective structure likely to hit the ground first if the tractor overturned sideways while travelling forward, normally the upper edge. The position of the centre of gravity of the block is 1/6 of the width of the top of the protective structure inwards from a vertical plane parallel to the median plane of the tractor touching the outside extremity of the top of the protective structure.

If the structure is curved or protruding at this point, wedges enabling the impact to be applied thereon must be added, without thereby reinforcing the structure.

3.2.1.1.2.2 The tractor must be lashed to the ground by means of four wire ropes, one at each end of both axles, arranged as indicated in Figure 7.13. The spacing between the front and rear lashing points must be such that the wire ropes make an angle of less than 30° with the ground. The rear lashings must 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.

The wire ropes must be tensioned so that the tyres undergo the deflections given in 3.1.5.6.2. With the wire ropes tensioned, the wedging beam shall be placed behind and tight against the rear wheels and then fixed to the ground.

3.2.1.1.2.3 If the tractor is of the articulated type, the point of articulation shall, in addition, be supported by a wooden block at least 100 mm square and firmly lashed to the ground.

3.2.1.1.2.4 The pendulum block shall be pulled back so that the height of its centre of gravity above that at the point of impact is given by one of the following two formulae, to be chosen according to the reference mass of the assembly subjected to the tests:

$$H = 25 + 0.07\,M$$

for assemblies with a reference mass of less than 2 000 kg;

$$H = 125 + 0.02\,M$$

for assemblies with a reference mass of more than 2 000 kg.

The pendulum block is then released and strikes the protective structure.

3.2.1.1.2.5 In case of tractors with a reversible driver's position (reversible seat and steering wheel):

- if the protective structure is a rear two-post rollbar, the above formula shall apply;
- for other types of protective structure, the height shall be whichever is greater from the formula applied above and that selected below:

$$H = 2.165 \times 10^{-8}\,ML^2$$

or

$$H = 0.573 \times 10^{-2}\,I$$

The pendulum block is then released and strikes the protective structure.

3.2.1.1.3 Impact from the side

3.2.1.1.3.1 The tractor shall be so placed in relation to the pendulum block that the block will strike the protective structure when the impact face of the block and the supporting chains or wire ropes are vertical unless, during deflection, the protective structure 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 so that it is parallel to the protective structure at the point of impact at the moment of maximum deflection, the supporting chains or wire ropes remaining vertical on impact.

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

3.2.1.1.3.3 The point of impact shall be that part of the protective structure 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 200 mm in front of the seat reference point, the seat being set at the mid position of the longitudinal seat adjustment.

3.2.1.1.3.4 For tractors with a reversible driver's position (reversible seat and steering wheel), the point of impact shall be in the plane at right angles to the median plane and passing at the midpoint of the segment joining the two seat reference points defined by the two different positions of the seat. For protective structures having a two-post system, the impact shall be located on one of the two posts.

3.2.1.1.3.5 The tractor wheels on the side which is to receive the impact must be lashed to the ground by means of wire ropes passing over the corresponding ends of the front and rear axles. The wire ropes must be tensioned to produce the tyre deflection values given in 3.1.5.6.2.

With the wire ropes tensioned, 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 prop shall then be placed as indicated in Figure 7.14 against the rim of the most heavily loaded wheel opposite to the point of impact, pushed firmly against the rim and then fixed at its base. The length of the prop shall be such that it makes an angle of 30 ± 3° with the ground when in position against the rim. In addition, its thickness shall, if possible, be between 20 and 25 times less than its length and between 2 and 3 times less than its width. The props shall be shaped at both ends as shown in the details on Figure 7.14.

3.2.1.1.3.6 If the tractor is of the articulated type, the point of articulation shall in addition be supported by a wooden block at least 100 mm square and laterally supported by a device similar to the prop pushed against the rear wheel as in 3.2.1.1.3.2. The point of articulation shall then be lashed firmly to the ground.

3.2.1.1.3.7 The pendulum block shall be pulled back so that the height of its centre of gravity above that at the point of impact is given by one of the following two formulae, to be chosen according to the reference mass of the assembly subjected to the tests:

$$H = 25 + 0.20\,M$$

for tractors with a reference mass of less than 2 000 kg;

$$H = 125 + 0.15\,M$$

for tractors with a reference mass of more than 2 000 kg.

3.2.1.1.3.8 In case of tractors with a reversible driver's position (reversible seat and steering wheel):

– if the protective structure is a rear two-post rollbar, the selected height shall be whichever is greater from the formulae applicable above and below:

$$H = (25 + 0.20\,M)\,(B_6 + B) / 2B$$

for assemblies with a reference mass of less than 2 000 kg;

$$H = (125 + 0.15\,M)\,(B_6 + B) / 2B$$

for assemblies with a reference mass of more than 2 000 kg.

– for other types of protective structures, the selected height shall be whichever is greater from the formulae applicable above (see 3.2.1.1.3.7) and below:

$$H = 25 + 0.20\,M$$

for assemblies with a reference mass less than 2 000 kg;

$$H = 125 + 0.15\,M$$

for assemblies with a reference mass of more than 2 000 kg.

The pendulum block is then released and strikes the protective structure.

3.2.1.1.4 Crushing at the rear

The beam shall be positioned over the rear uppermost structural member(s) and the resultant of crushing forces shall be located in the tractor's median plane A force $\mathbf{F_v}$ shall be applied where:

$$F_v = 20\,M$$

The force $\mathbf{F_v}$ shall be maintained for five seconds after the cessation of any visually detectable movement of the protective structure.

Where the rear part of the protective structure roof will not sustain the full crushing force, the force shall be applied until the roof is deflected to coincide with the plane joining the upper part of the protective structure with that part of the rear of the tractor capable of supporting the tractor when overturned.

The force shall then be removed, and the crushing beam repositioned over that part of the protective structure which would support the tractor when completely overturned. The crushing force $\mathbf{F_v}$ shall then be applied again.

3.2.1.1.5 Crushing at the front

The beam shall be positioned across the front uppermost structural member(s) and the resultant of crushing forces shall be located in the tractor's median plane. A force $\mathbf{F_v}$ shall be applied where:

$$F_v = 20\ M$$

The force $\mathbf{F_v}$ shall be maintained for five seconds after the cessation of any visually detectable movement of the protective structure.

Where the front part of the protective structure roof will not sustain the full crushing force, the force shall be applied until the roof is deflected to coincide with the plane joining the upper part of the protective structure with that part of the front of the tractor capable of supporting the tractor when overturned.

The force shall then be removed, and the crushing beam repositioned over that part of the protective structure which would support the tractor when completely overturned. The crushing force $\mathbf{F_v}$ shall then be applied again.

3.2.1.1.6 Additional impact tests

If cracks or tears which cannot be considered negligible appear during an impact test, a second, similar test, but with a height of fall of:

$$H' = (H \times 10^{-1})\ (12 + 4a)\ (1 + 2a)^{-1}$$

shall be performed immediately after the impact tests causing these tears or cracks to appear, **"a"** being the ratio of the permanent deformation (**Dp**) to the elastic deformation (**De**):

$$a = Dp / De$$

as measured at the point of impact. The additional permanent deformation due to the second impact shall not exceed 30 per cent of the permanent deformation due to the first impact.

In order to be able to carry out the additional test, it is necessary to measure the elastic deformation during all the impact tests.

3.2.1.1.7 Additional crushing tests

If during a crushing test, significant cracks or tears appear, a second, similar, crushing test, but with a force equal to $\mathbf{1.2\ F_v}$ shall be performed immediately after the crushing tests which caused these tears or cracks to appear.

3.2.1.2 Measurements to be made

3.2.1.2.1 Fractures and cracks

After each test all structural members, joints and fastening systems shall be visually examined for fractures or cracks, any small cracks in unimportant parts being ignored.

Any tears caused by the edges of the pendulum weight are to be ignored.

3.2.1.2.2 Entry into the zone of clearance

During each test the protective structure shall be examined to see whether any part it has entered a zone of clearance round the driving seat as defined in 1.5.

Furthermore, the clearance zone shall not be outside the protection of the protective structure. For this purpose, it shall be considered to be outside the protection of the structure if any part of it would come in contact with flat ground if the tractor overturned towards the direction from which the test load is applied. For estimating this, the front and rear tyres and track width setting shall be the smallest standard fitting specified by the manufacturer.

3.2.1.2.3 Elastic deflection (under side impact)

The elastic deflection is measured 900 mm above the reference point, in the vertical plane passing through the point of impact. For this measurement, apparatus similar to that illustrated in Figure 7.16 shall be used.

3.2.1.2.4 Permanent deflection

After the final crushing test, the permanent deflection of the protective structure is recorded. For this purpose, before the start of the test, the position of the main roll-over protective structure members in relation to the seat reference point shall be recorded.

3.2.2 Static Tests

3.2.2.1 Loading and crushing tests

3.2.2.1.1 Loading at the rear

3.2.2.1.1.1 The load shall be applied horizontally, in a vertical plane parallel to the tractor's median plane.

The load application point shall be that part of the roll-over protective structure likely to hit the ground first in a rearward overturning accident, normally the upper edge. The vertical plane in which the load is applied shall be located at a distance of 1/3 of the external width of the upper part of the structure from the median plane.

If the structure is curved or protruding at this point, wedges enabling the load to be applied thereon shall be added, without thereby reinforcing the structure.

3.2.2.1.1.2 The assembly shall be lashed to the ground as described in 3.1.6.3.

3.2.2.1.1.3 The energy absorbed by the protective structure during the test shall be at least:

$$E_{il} = 2.165 \times 10^{-7} M L^2$$

or

$$E_{il} = 0.574 \times I$$

3.2.2.1.1.4 For tractors with a reversible driver's position (reversible seat and steering wheel), the energy shall be whichever is the higher of the formula selected above or the following:

$$E_{il} = 500 + 0.5\ M$$

3.2.2.1.2 Loading at the front

3.2.2.1.2.1 The load shall be applied horizontally in a vertical plane parallel to the tractor's median plane. The point of application shall be that part of the protective structure likely to hit the ground first if the tractor overturns sideways while travelling forward, i.e. normally the upper edge. The point of application of the load shall be 1/6 of the width of the top of the protective structure inwards from a vertical plane parallel to the median plane of the tractor touching the outside extremity of the top of the protective structure.

If the structure is curved or protruding at this point, wedges enabling the load to be applied thereon shall be added, without thereby reinforcing the structure.

3.2.2.1.2.2 The assembly shall be lashed to the ground as described in 3.1.6.3.

3.2.2.1.2.3 The energy absorbed by the protective structure during the test shall be at least:

$$E_{il} = 500 + 0.5\ M$$

3.2.2.1.2.4 In case of tractors with a reversible driver's position (reversible seat and steering wheel):

- if the protective structure is a rear two-post rollbar the preceding formula shall also apply;
- for other types of protective structures, the energy shall be whichever is the higher of the above or either fo the following as selected:

$$E_{il} = 2.165 \times 10^{-7}\ ML^2$$

or

$$E_{il} = 0.574\ I$$

3.2.2.1.3 Loading from the side

3.2.2.1.3.1 The side loading shall be applied horizontally, in a vertical plane perpendicular to the tractor's median plane passing 200 mm in front of the seat reference point, the seat being at the mid position of the longitudinal seat adjustment. The load application point shall be that part of the roll-over protective structure likely to hit the ground first in a sideways overturning accident, normally the upper edge.

3.2.2.1.3.2 The assembly shall be lashed to the ground as described in 3.1.6.3.

3.2.2.1.3.3 The energy absorbed by the protective structure during the test shall be at least:

$$E_{is} = 1.75\ M$$

3.2.2.1.3.4 For tractors with a reversible driver's position (reversible seat and steering wheel), the load application point shall be in the plane at right angles to the median plane and passing at the midpoint of the segment joining the two seat reference points defined by the two different

positions of the seat. For protective structures having a two-post system, the load shall be applied on one of the two posts.

3.2.2.1.3.5 In case of tractors with a reversible driver's position (reversible seat and steering wheel) where the protective structure is a rear two-post rollbar, the energy shall be whichever is higher of the following:

$$E_{is} = 1.75\ M$$

or

$$E_{is} = 1.75\ M\ (B_6 + B)/2B$$

3.2.2.1.4 Crushing at the rear

All provisions are identical to those given in 3.2.1.1.4.

3.2.2.1.5 Crushing at the front

All provisions are identical to those given in 3.2.1.1.5.

3.2.2.1.6 Additional overload test (Figures 7.17 to 7.19)

An overload test shall be carried out in all cases where the force decreases by more than 3 per cent during the last 5 per cent of the deflection reached when the energy required is absorbed by the structure (see Figure 7.18).

The overload test involves the gradual increase of the horizontal load by increments of 5 per cent of the initial energy requirement up to a maximum of 20 per cent of energy added (see Figure 7.19).

The overload test is satisfactory if, after each increase by 5, 10, or 15 per cent in the energy required, the force decreases by less than 3 per cent for a 5 per cent increment and remains greater than $\mathbf{0.8\ F_{max}}$.

The overload test is satisfactory if, after the structure has absorbed 20 per cent of the added energy, the force exceeds $\mathbf{0.8\ F_{max}}$.

Additional cracks or tears and/or entry into or lack of protective of the zone of clearance due to elastic deflection are permitted during the overload test. However, after the removal of the load, the structure shall not enter the zone of clearance, which shall be completely protected.

3.2.2.1.7 Additional crushing tests

If cracks or tears which cannot be considered as negligible appear during a crushing test, a second, similar crushing, but with a force of $\mathbf{1.2\ F_v}$ shall be applied immediately after the crushing test which caused the cracks or tears to appear.

3.2.2.2 Measurements to be made

3.2.2.2.1 Fractures and cracks

After each test all structural members, joints and attachment systems shall be visually examined for fractures or cracks, any small cracks in unimportant parts being ignored.

3.2.2.2.2 Entry into the zone of clearance

During each test the protective structure shall be examined to see whether any part of it has entered a zone of clearance as defined in 1.5 above.

In addition, an examination shall be made to determine whether any part of the zone of clearance is outside the protective of the structure. For this purpose it is considered to be outside the protective of the roll-over protective structure if any part of it would have come in contact with the ground plane if the tractor had overturned in the direction from which the impact came. For this purpose the front and rear tyres and track setting are assumed to be the smallest specified by the manufacturer.

3.2.2.2.3 Elastic deflection under side loading

The elastic deflection is measured 900 mm above the seat reference point, in the vertical plane in which the load is applied. For this measurement, any apparatus similar to that illustrated in Figure 7.16 may be used.

3.2.2.2.4 Permanent deflection

After the final crushing test the permanent deflection of the protective structure is recorded. For this purpose, before the start of the test, the position of the main roll-over protective structure members in relation to the seat reference point shall be recorded.

3.3 Extension to other tractor models

When a protective structure fulfilling the acceptance conditions is designed to be used on other models of tractors, the impact or loading and crushing tests need not be carried out on each model of tractor provided such a protective structure and tractor comply with all the conditions referred to hereunder:

3.3.1 the station which performed the original test is the only station to be authorized to seek approval by extension whenever requested by the manufacturer;

3.3.2 the required energy shall not exceed the energy calculated for the original test by more than 5 per cent;

3.3.3 the method of attachment and the tractor components to which the attachment is made shall be identical or of equivalent strength;

3.3.4 any components which may provide support for the protective structure, such as mudguards and bonnet, shall be identical or judged to give at least the same support;

3.3.5 the position and critical dimensions of the seat in the protective structure and the relative position of the protective structure on the tractor shall be such that the clearance zone shall remain within the protective of the deflected structure throughout all tests;

3.3.6 the test report shall contain a reference to the original test report.

3.4 Minor modifications

If there are minor modifications on the tractor such as changes of vehicle colour, decals, make or model denominations for marketing purposes, or on the protective structure like design of non-structural sheet metal parts, the testing station that has carried out the original test can issue a "Minor Modification Certificate" on the national Designated Authority's responsibility, stating all changes and confirming that the results of the strength test are not affected. No test is necessary. This certificate shall be drafted according to the specimen provided for in the Code, as an annex to the original test report and subject to the same circulation requirements.

3.5 Labelling

3.5.1 OECD labelling is optional. If it is utilised, it shall contain at least the following information:

3.5.1.1 name and address of the manufacturer of the protective structure;

3.5.1.2 protective structure identification number (design or serial number);

3.5.1.3 tractor make, model(s) or series number(s) that the protective structure is designed to fit;

3.5.1.4 OECD Approval number of protective structure.

3.5.2 The label shall be durable and permanently attached to the protective structure so that it can be easily read and it shall be protected from environmental damage.

3.6 Seatbelt anchorage performance (optional)

3.6.1 Scope

Seat belts are one of the operator restraint systems used for securing the driver in motor vehicles.

This recommended procedure provides minimum performance and tests requirements for seat belt anchorage for agricultural and forestry tractors.

It applies to the anchorage of pelvic restraint systems.

3.6.2 Explanation of terms used in the performance testing

3.6.2.1 The *seat belt assembly* is any strap or belt device fastened across the lap or pelvic girdle area designed to secure a person in a machine.

3.6.2.2 The *extension belt* is intended as any strap, belt, or similar device that aids in the transfer of seat belt loads.

3.6.2.3 The *anchorage* is intended as the point where the seat belt assembly is mechanically attached to the seat system or tractor.

3.6.2.4 The *seat mounting* is intended as all intermediary fittings (such as slides, etc.) used to secure the seat to the appropriate part of the tractor.

3.6.2.5 The *Operator Restraint System* is intended as the total system composed of seat belt assembly, seat system, anchorages and extension which transfers the seat belt load to the tractor.

3.6.2.6 *Applicable Seat Components* comprise all components of the seat whose mass could contribute to loading of the seat mounting (to the vehicle structure) during a roll-over event.

3.6.3 Test procedure

Only static tests for anchorages are given in this procedure.

The anchorages shall be capable of withstanding the loads applied to the seat belt system using a device as shown in Figure 7.20. The seat belt anchorages shall be capable of these test loads applied with the seat in the mid-position of longitudinal adjustment and at one other adjustment position, if such a position is considered by the test station to be the worst case, to ensure that the test condition is met. For a suspended seat, the seat shall be set to the midpoint of the suspension travel, unless this is contradictory to a clearly stated instruction by the seat manufacturer. Where special instructions exist for the seat setting, these shall be observed and specified in the report.

The seat shall be in position during the tests and fixed to the mounting point on the tractor using all intermediary fittings (such as suspension, slides, etc.) specified for the complete tractor. No additional non-standard fittings contributing to the strength of the construction may be used.

After the load is applied to the seat system, the load application device shall not be repositioned to compensate for any changes that may occur to the load application angle.

3.6.3.1 Forward loading

A tensile force shall be applied in a forward and upward direction at an angle of 45º ± 2º to the horizontal, as shown in Figure 7.21. The seat belt anchorages shall be capable of withstanding a force of 4 450 N. In the event that the force applied to the seat belt assembly is transferred to the vehicle chassis by means of the seat, the seat mounting shall be capable of withstanding this force plus an additional force equal to four times the force of gravity on the mass of all applicable seat components, applied 45º ± 2º to the horizontal in a forward and upward direction, as shown in Figure 7.21.

3.6.3.2 Rearward loading

A tensile force shall be applied in a rearward and upward direction at an angle of 45º ± 2º to the horizontal, as shown in Figure 7.22. The seat belt anchorages shall be capable of withstanding a force of 2 225 N. In the event that the force applied to the seat belt assembly is transferred to the vehicle chassis by means of the seat, the seat mounting shall be capable of withstanding this force plus an additional force equal to two times the force of gravity on the mass of all applicable seat components, applied 45º ± 2º to the horizontal in a rearward and upward direction, as shown in Figure 7.22.

Both tensile forces shall be equally divided between the seat belt anchorages.

3.6.4. Test result

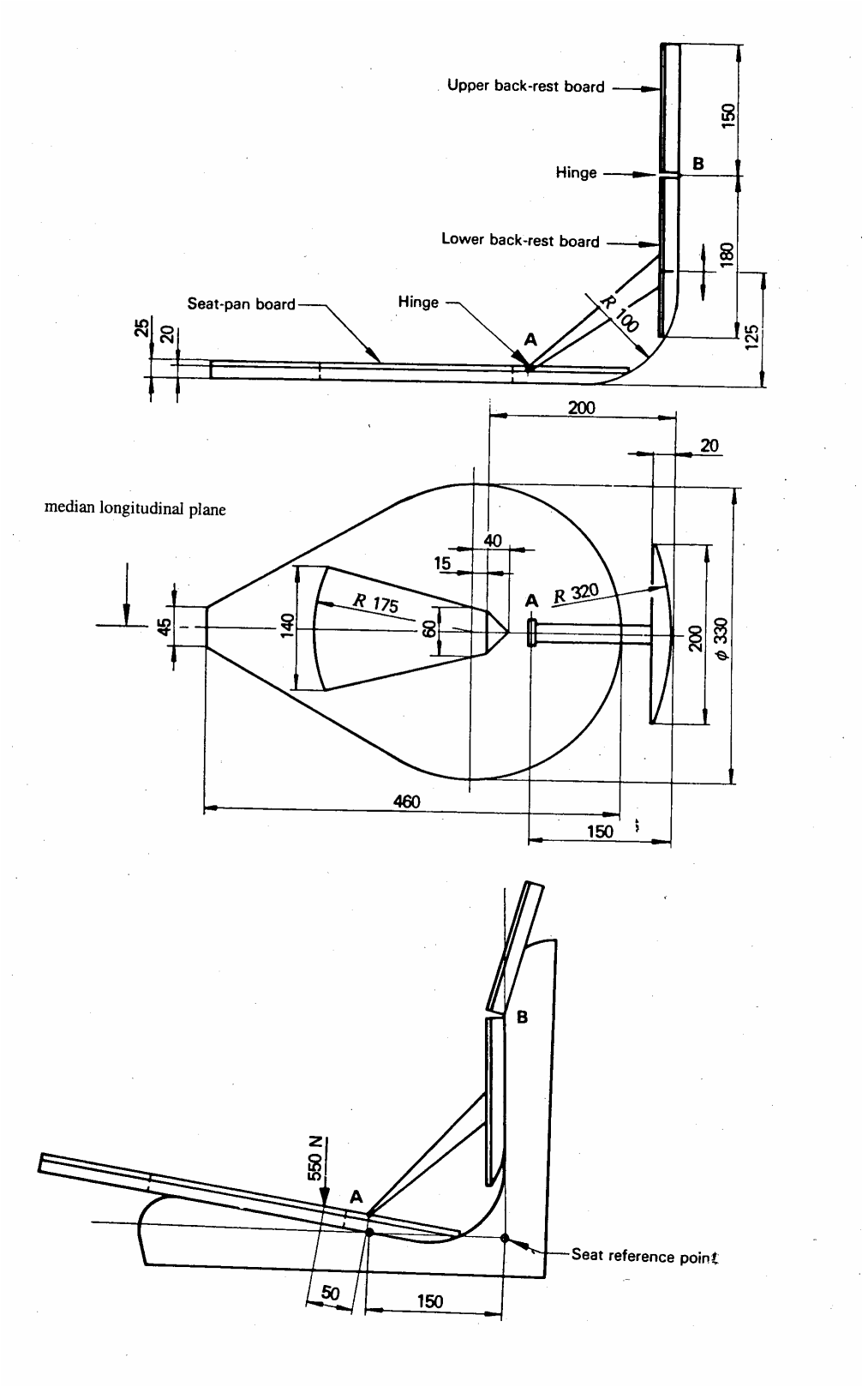
Condition of acceptance

Permanent deformation of any system component and anchorage area is acceptable under the action of the forces specified in 3.6.3.1 & 3.6.3.2. However, there shall be no failure allowing release of the seat belt system, seat assembly, or the seat adjustment locking mechanism.

The seat belt buckle shall open with a maximum force of 140 N following the load applications.

The seat adjuster or locking device need not be operable after application of the test load.

Dimensions in mm



Figures 7.1, 7.2 and 7.3

Apparatus for determination of seat reference point

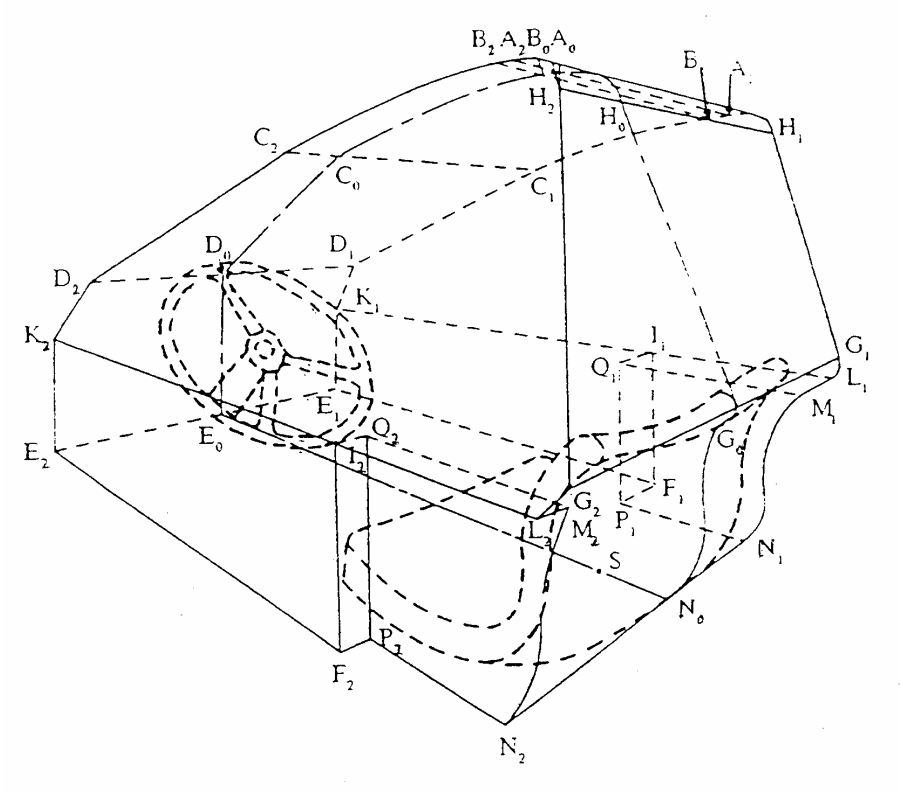


Figure 7.4: **Zone of clearance**
3/4 rear perspective view

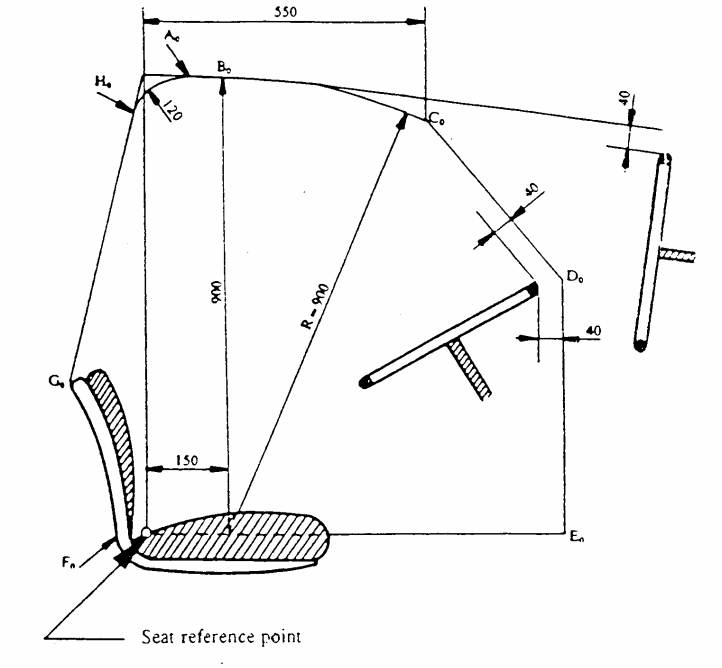
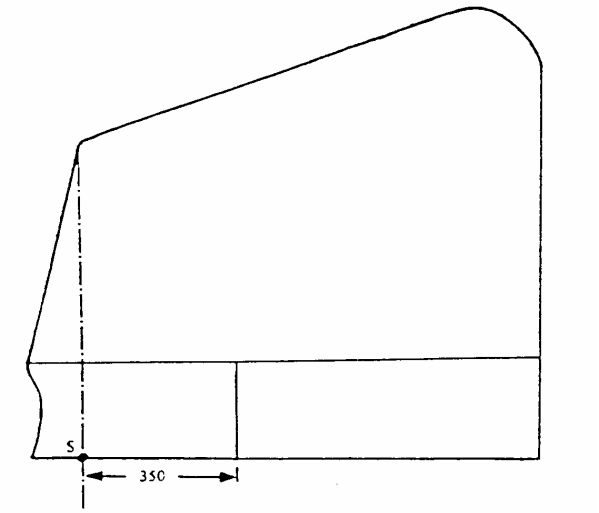


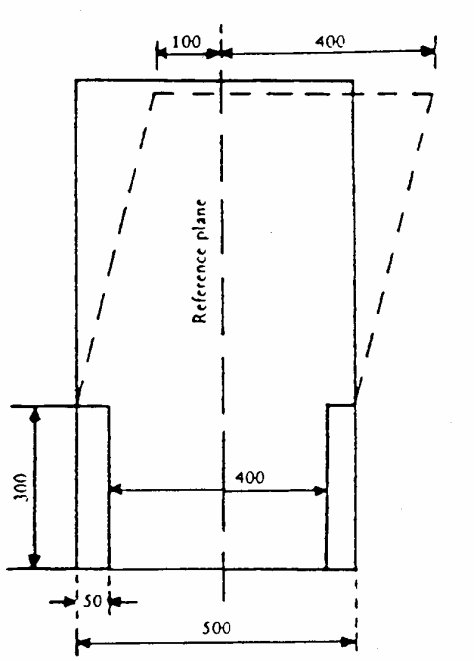
Figure 7.5 **Zone of clearance**
Cross-section through the reference plane



Side view

Figure 7.6

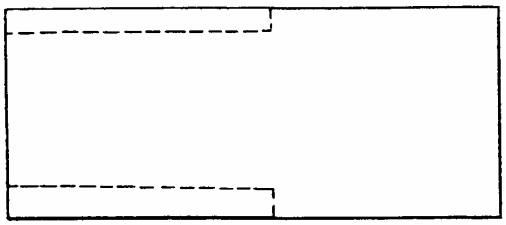
Zone of clearance



Rear view

Figure 7.7

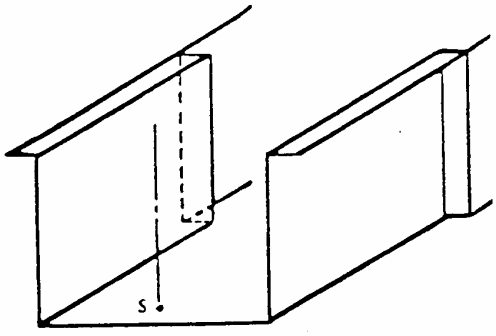
Zone of clearance



Seen from above

Figure 7.8

Zone of clearance



Lower part, 3/4 rear view

Figure 7.9

Zone of clearance

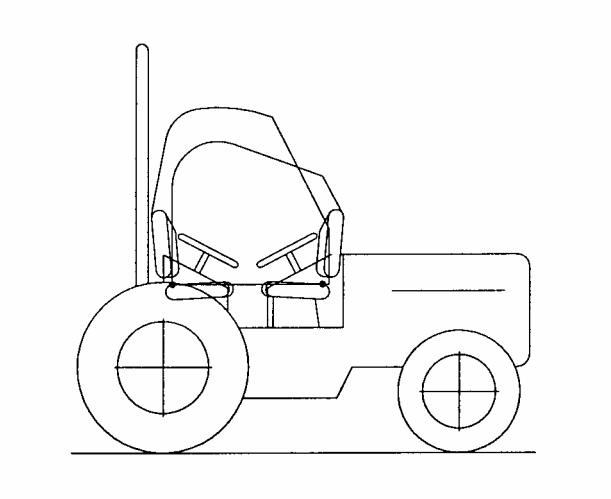


Figure 7.10a

**Clearance zone for tractors with reversible seat position:
two-post rollbar**

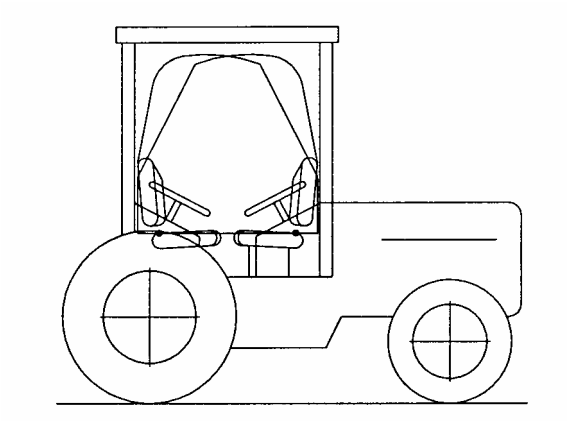


Figure 7.10b

**Zone of clearance for tractors with reversible seat position:
other types of ROPS**

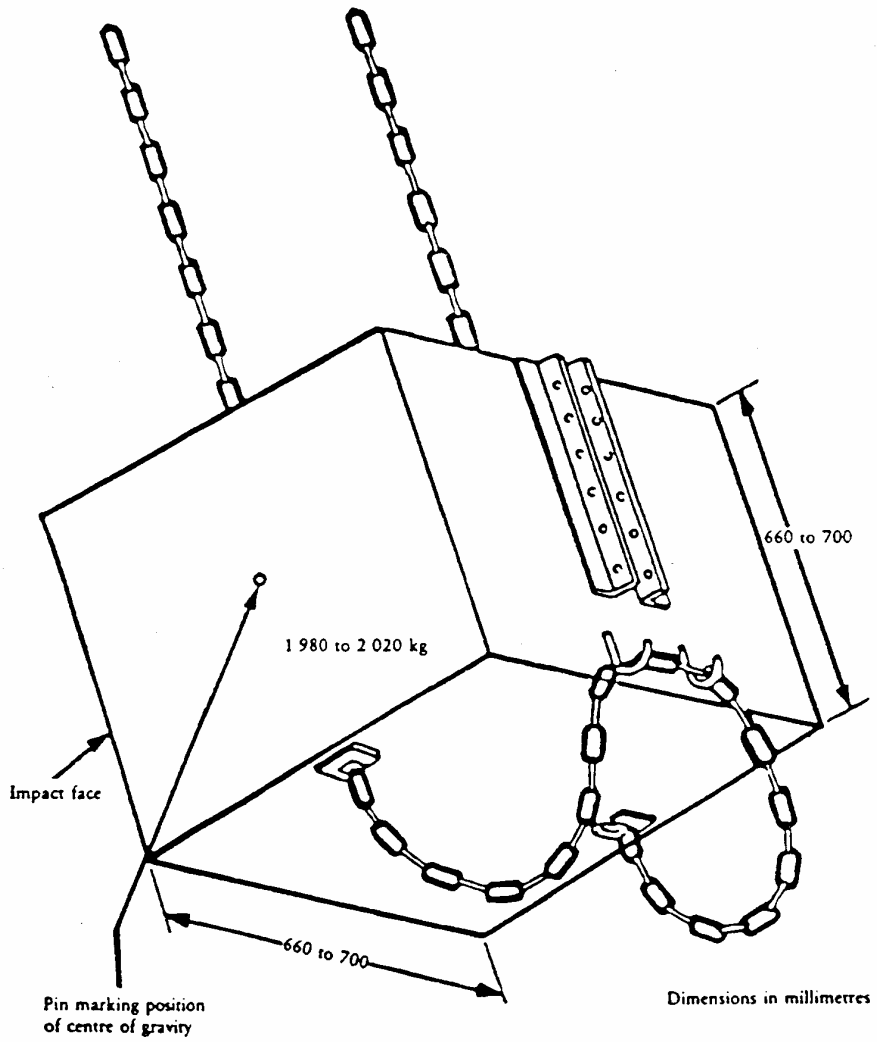


Figure 7.11

Pendulum block and its suspending chains or wire ropes

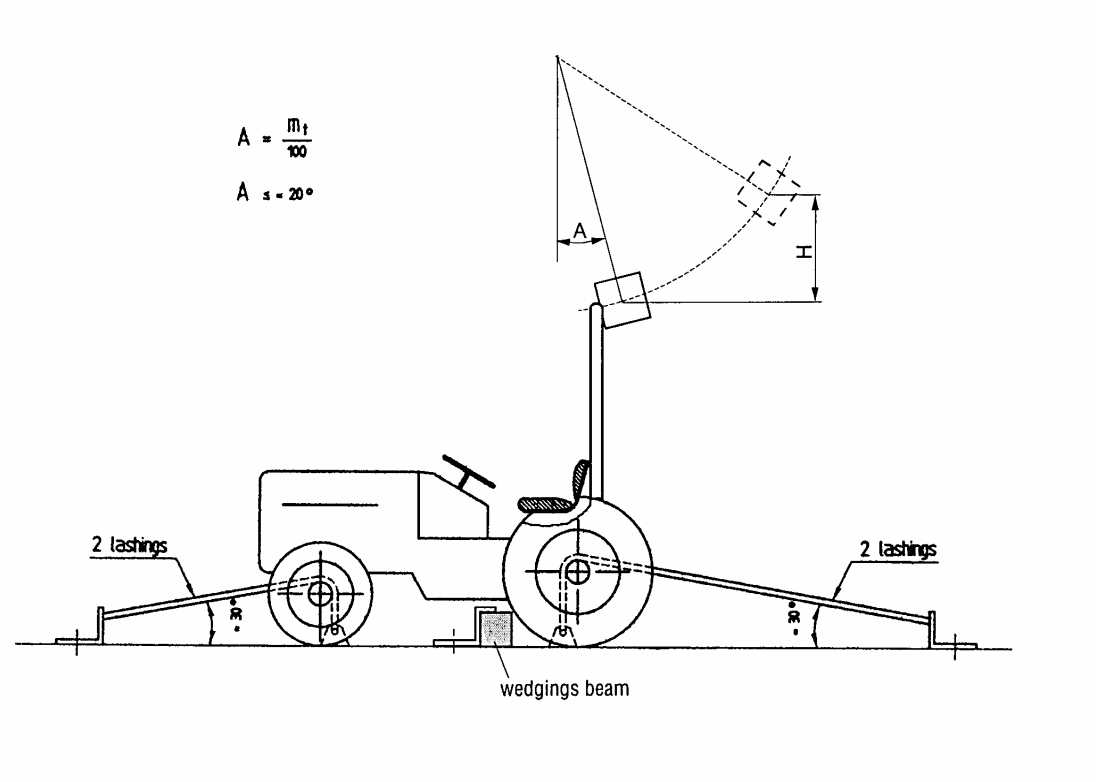


Figure 7.12 **Example of tractor lashing (rear impact)**

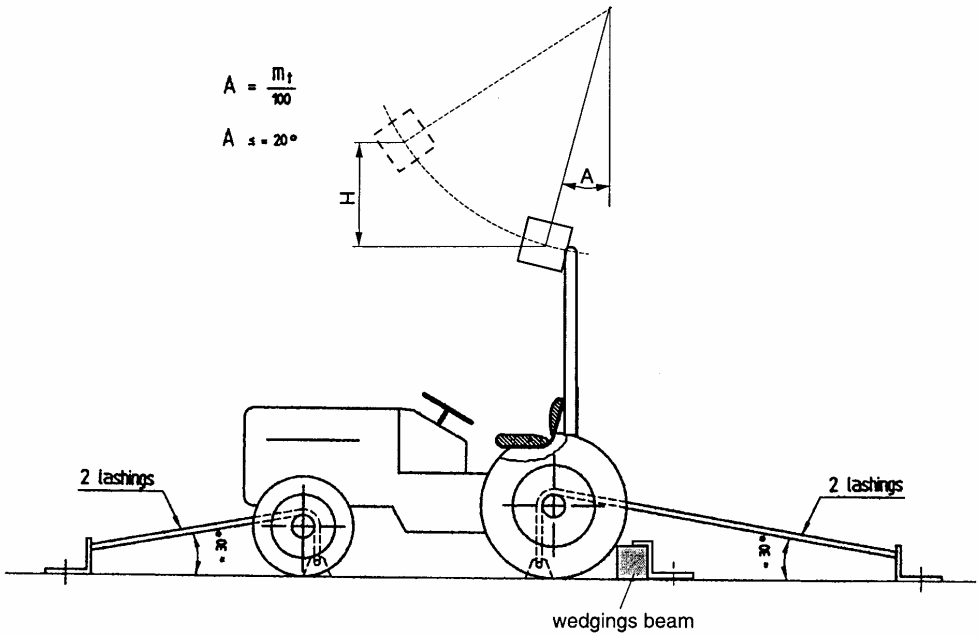


Figure 7.13 **Example of tractor lashing (front impact)**

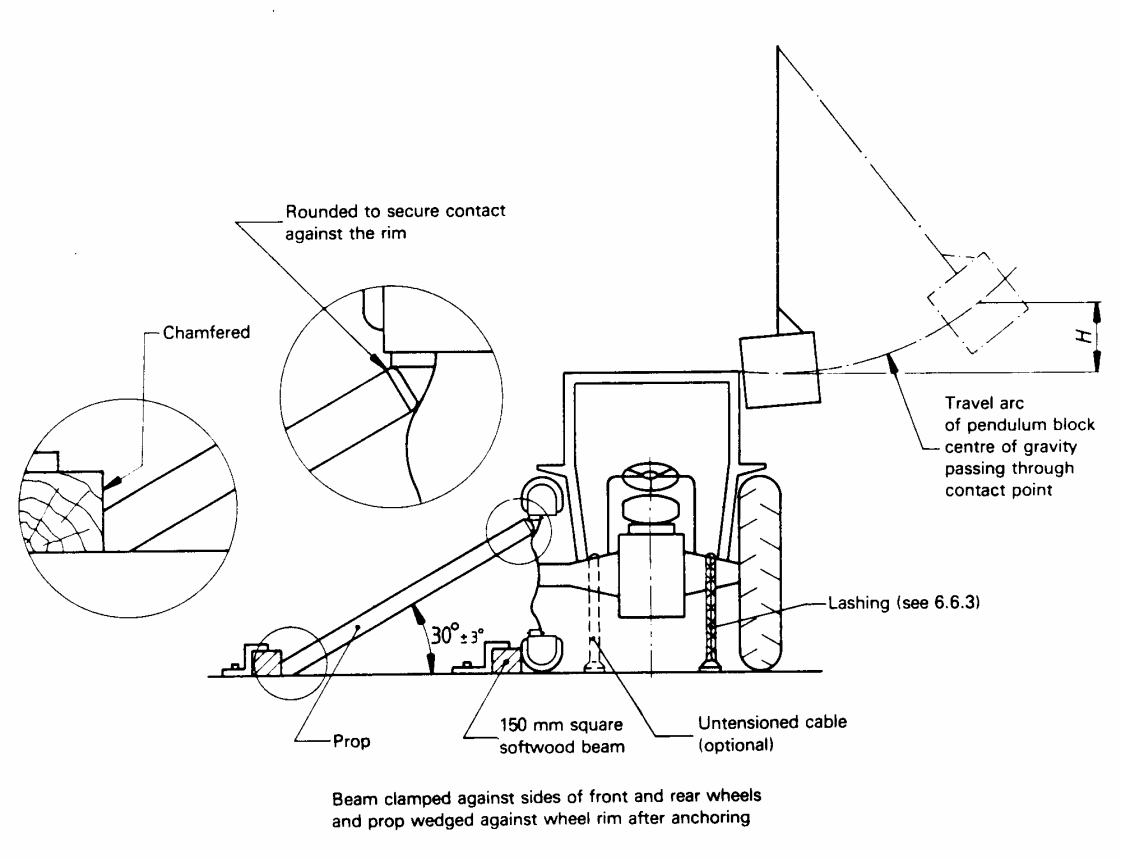


Figure 7.14 **Example of tractor lashing (side impact)**

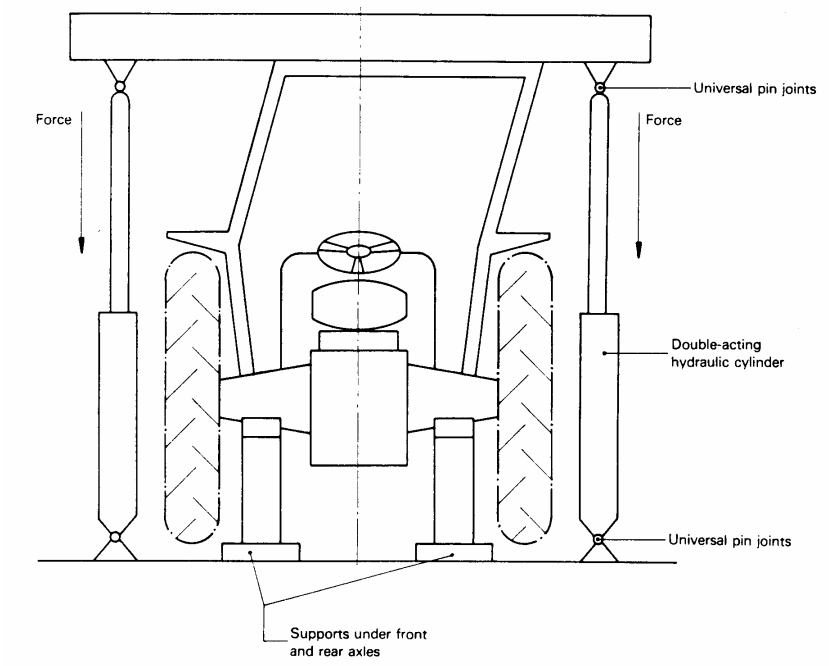
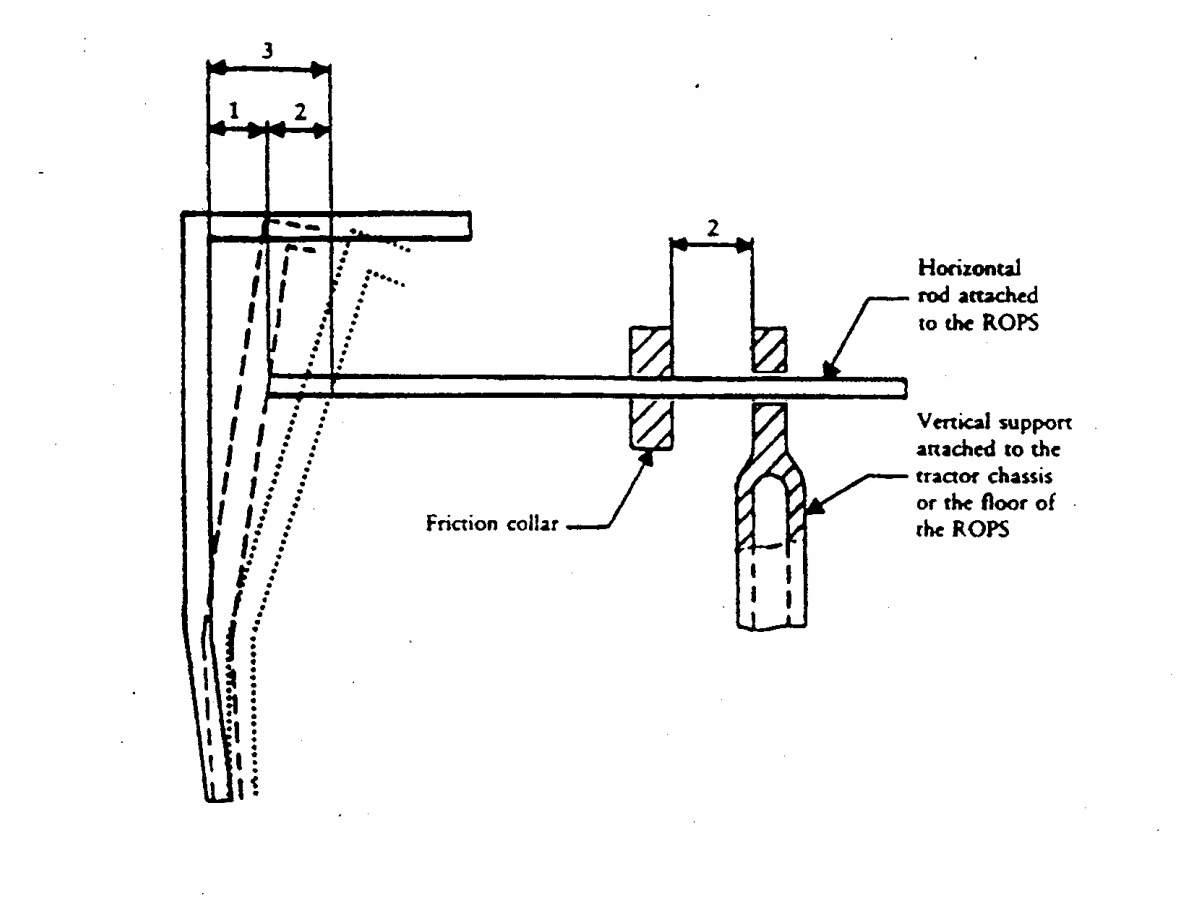


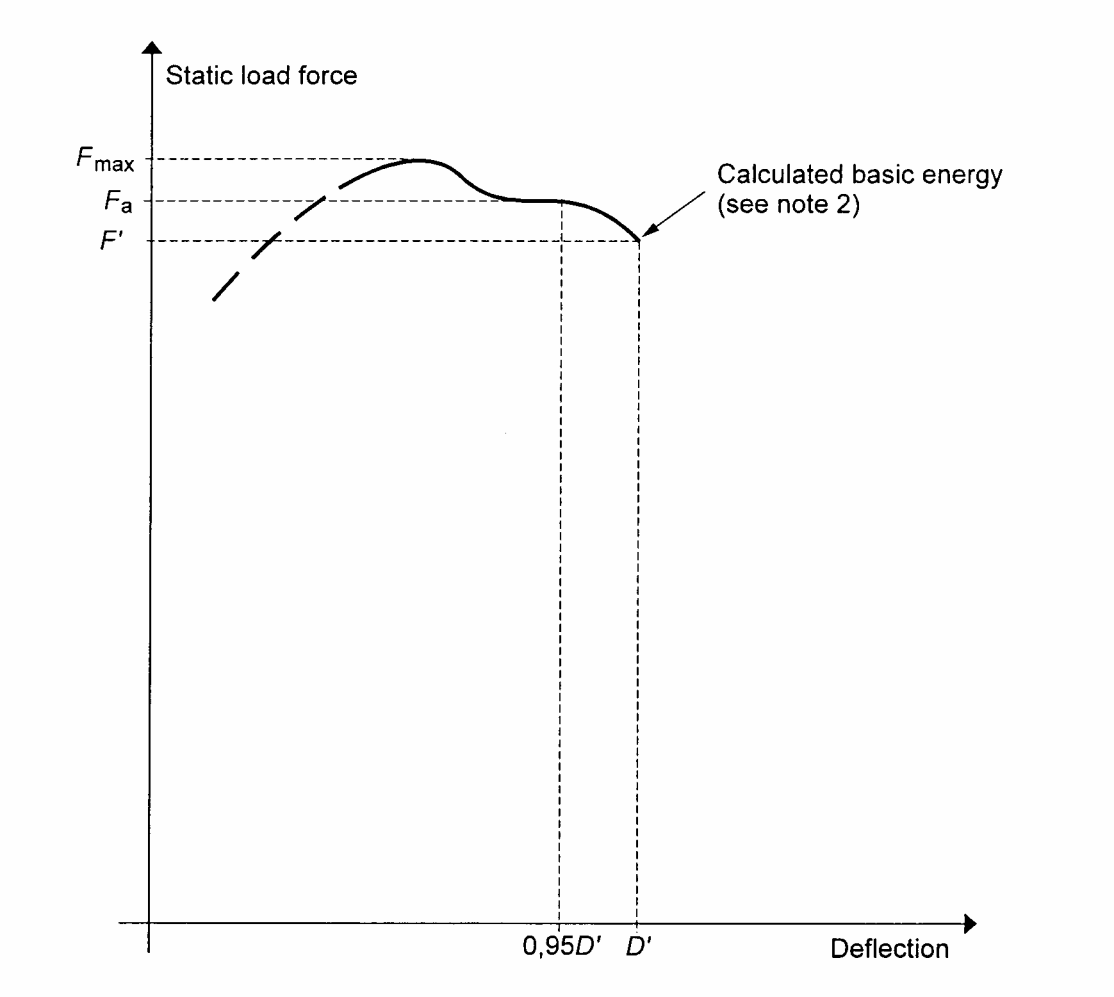
Figure 7.15 **Example of crushing rig of the tractor**



1. Permanent deflection
2. Elastic deflection
3. Total deflection (permanent plus elastic)

Figure 7.16

Example of apparatus for measuring elastic deflection

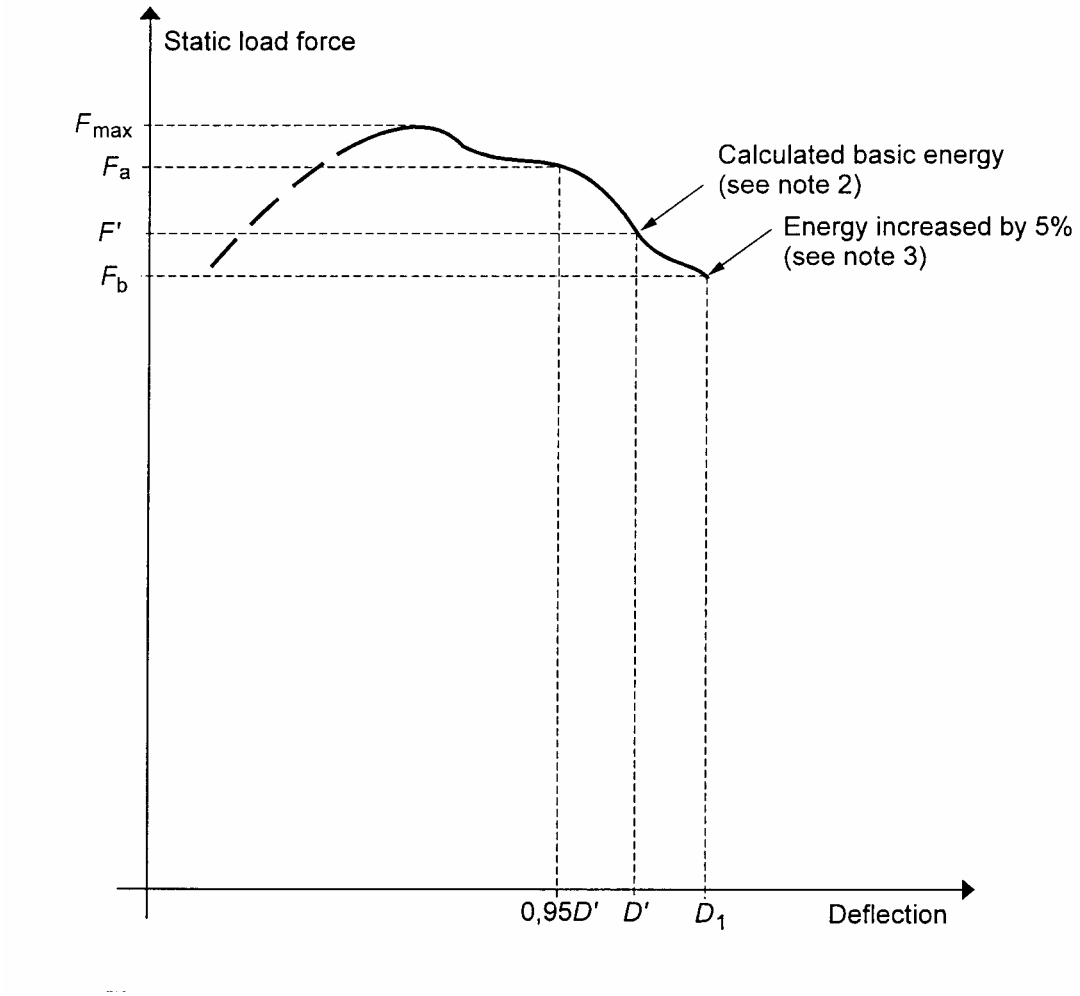


Notes:

1. Locate F_a in relation to 0,95 D'
2. Overload test not necessary as $F_a \leq 1{,}03\ F'$

Figure 7.17

Force / deflection curve
Overload test not necessary

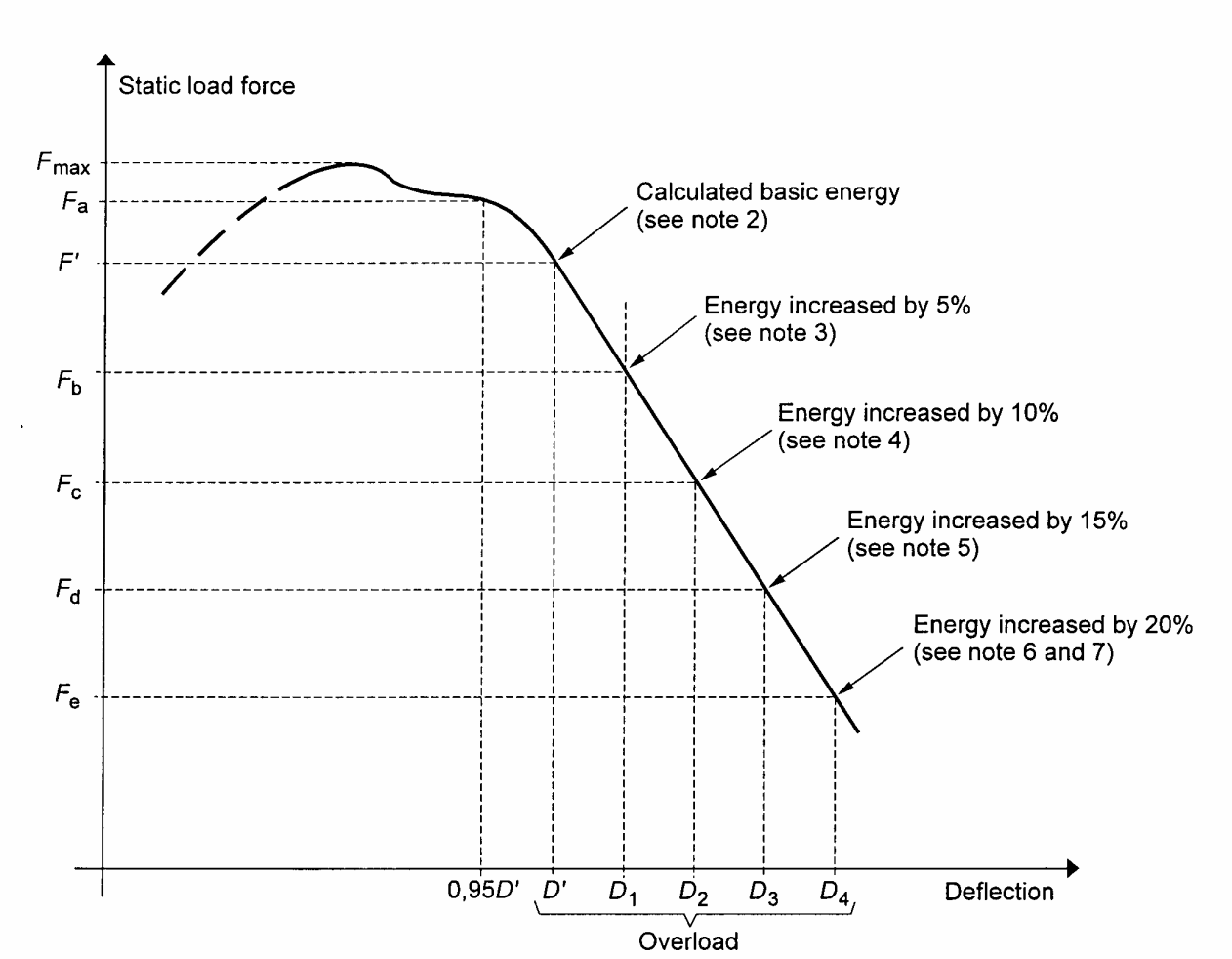


Notes:

1. Locate F_a in relation to 0,95 D'
2. Overload test necessary as $F_a > 1{,}03$ F'
3. Overload test performance satisfactory as Fb > 0,97F' and Fb > 0,8F max.

Figure 7.18

Force / deflection curve
Overload test necessary



Notes:

1. Locate F_a in relation to 0,95 D'
2. Overload test necessary as $F_a > 1{,}03$ F'
3. $F_b < 0{,}97$ F' therefore further overload necessary
4. $F_c < 0{,}97\ F_b$ therefore further overload necessary
5. $F_d < 0{,}97\ F_c$ therefore further overload necessary
6. Overload test performance satisfactory, if Fe > 0,8 F max
7. Failure at any stage when load drops below 0,8 F max.

Figure 7.19

Force / deflection curve
Overload test to be continued

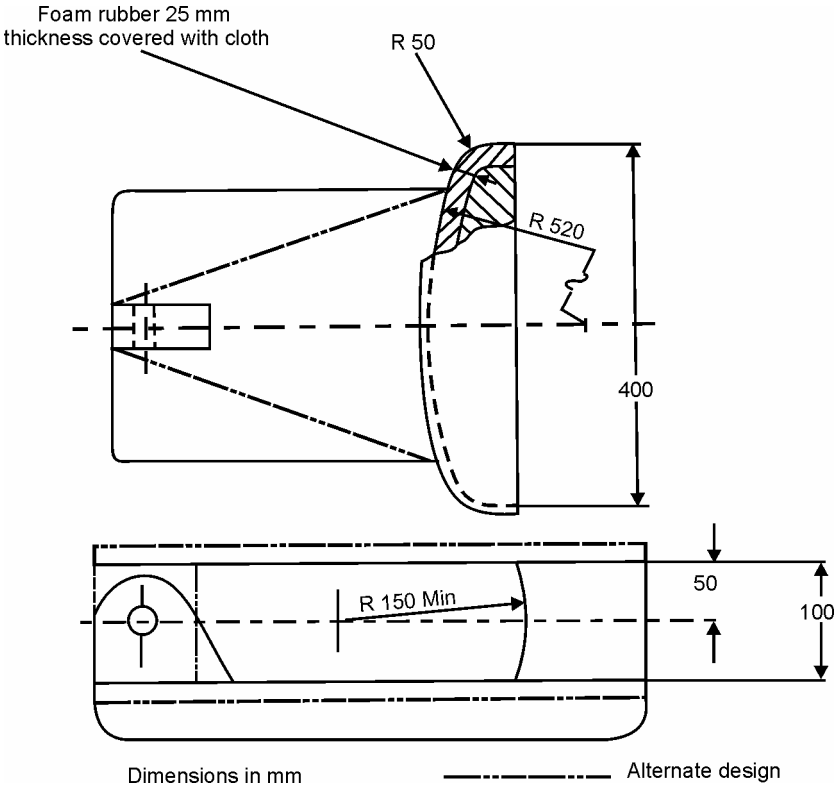


Figure 7.20

The load application device

(The dimensions not shown are optional to satisfy the test facility and do not influence the test results)

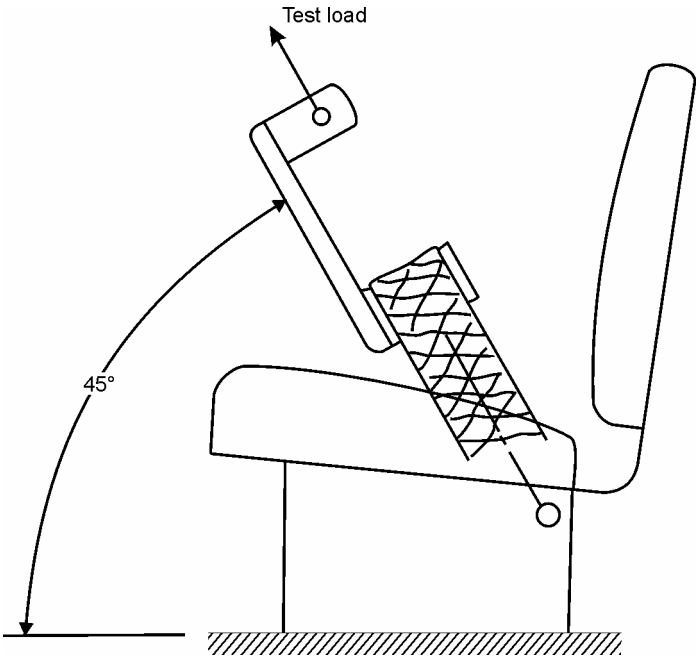


Figure 7.21

Load application in the upward and forward direction

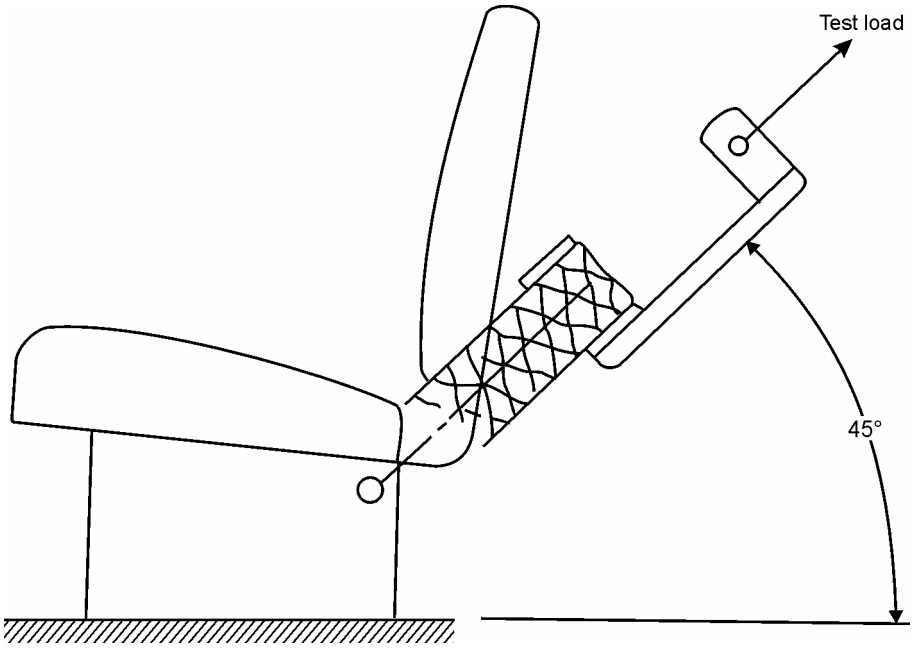


Figure 7.22

Load application in the upward and rearward direction

SPECIMEN TEST REPORT

Note: Units shown below, which appear in ISO 1000:1992; Amd1:1998, shall be stated and followed by national units in parentheses, if necessary.

– Protective structure manufacturer's name and address:
– Submitted for test by:

– Make of the protective structure:
– Model of the protective structure:
– Type of the protective structure: *Cab, Frame, Rear rollbar, Cab with integated frame, etc*

– Date and location of test:

1. SPECIFICATIONS OF TEST TRACTOR

1.1 Identification of tractor to which the protective structure is fitted for the test

1.1.1 - Make of the tractor: (*)
- 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)

(*) possibly different from tractor manufacturer's name

1.1.2 Numbers

- 1st Serial No. or prototype:
- Serial No.:

1.1.3 Other specifications *(if applicable)*

- Model denomination(s) for other countries:
- Transmission type or gears x ranges:
- Speed version: *30 or 40 km/h:*
- Manufacturer identification or Technical type number:

1.2 Mass of unballasted tractor with protective structure fitted and without driver

Front	kg
Rear	kg
Total	kg

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

1.3 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: $kg.m^2$

1.4 Test tyre dimensions and track settings

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

1.5 Truck seat

– Truck with a reversible driver's 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 reference point (SRP):

(description of seat 1 and SRP position)

(description of seat 2 and SRP position)

(description of seat __ and SRP position)

- Seat belt anchorage: Type
- Seat mounting on the tractor: Type
- Other seat components: Type
- Seat operating position in the test: Description

Masses used for calculating the loads

Seat	Make/Model/Type
Components	Mass (Kg)
Driver seat:	
Seat belt assembly:	
Other seat components:	
Total:	

2. SPECIFICATIONS OF PROTECTIVE STRUCTURE

2.1 Photographs from side and rear showing mounting details including mudguards

2.2 General arrangement drawing of the side and the rear of the structure including position of the seat reference points (SRP) and details of mountings

2.3 Brief description of the protective structure comprising:

- type of construction;
- details of mountings;
- details of cladding and padding;
- means of access and escape.

2.4 Tiltable/not tiltable structure

2.5 Dimensions

Dimensions should be measured with seatpan and backrest loaded and adjusted according to Definition 1.4 of the Code.

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 reference points shall be measured in each case (SRP 1, SRP 2, etc.).

2.5.1 Height of roof members above the seat reference point: mm

2.5.2 Height of roof members above the tractor footplate: mm

2.5.3 Interior width of the protective structure
900 mm above the seat reference point: mm

2.5.4 Interior width of the protective structure vertically above the seat
reference point at the level of centre of the steering wheel: mm

2.5.5 Distance from the centre of the steering wheel
to the right-hand side of the protective structure: mm

2.5.6 Distance from the centre of the steering wheel
to the left-hand side of the protective structure: mm

2.5.7 Minimum distance from the steering wheel rim to the protective structure: mm

2.5.8 Width of the doorways
- at the top: mm
- in the middle: mm
- at the bottom: mm

2.5.9 Height of the doorways
- above foot platforms: mm
- above highest mounting steps: mm
- above lowest mounting steps: mm

2.5.10 Overall height of the tractor with the protective structure fitted: mm

2.5.11 Overall width of the protective structure (if mudguards are included, this is to stated): mm

2.5.12 Horizontal distance from the seat reference point to the rear of the protective structure at a height of 900 mm above the seat reference point: mm

2.6 Details of materials used in the construction of the protective structure and steel specifications

Steel specifications shall be in conformity with ISO 630:1995.

2.6.1 Main frame: (parts - material - sizes)
- Is steel rimmed, semi-killed, killed?
- steel standard and reference:

2.6.2 Mountings: (parts - material - sizes)
- Is steel rimmed, semi-killed, killed?
- steel standard and reference:

2.6.3 Assembly and mounting bolts: (parts - sizes)

2.6.4 Roof : (parts - material - sizes)

2.6.5 Cladding: (parts - material - sizes)

2.6.6 Glass: (type - grade - sizes)

2.7. Details of tractor manufacturer's reinforcements on original parts

3. TEST RESULTS

3.1 Impact/Loading and crushing tests

3.1.1 Conditions of tests

Impact tests/loading tests were made:
- to the rear left/right,
- to the front right/left,
- to the side right/left.

Mass used for calculating energies and loading forces: kg
Wheelbase used for calculating energy at the rear: mm
Moment of inertia used for calculating energy at the rear: $kg.m^2$

Energies and forces applied to the front frame:

- rear: kJ
- front: kJ
- side: kJ
- crushing forces: kN
- during additional overload test: kJ

Force applied to the rear frame: kN

3.1.2 Permanent deflections measured after the tests

3.1.2.1 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

3.1.2.2 Difference between total instantaneous deflection and residual deflection (elastic deflection) during:

– sideways impact test (dynamic test): mm

or,

– sideways loading test (static test): mm

3.1.3 Indication and results of any additional test

Statement:

The acceptance conditions relative to protection of the zone of clearance are fulfilled. The structure is a roll-over protective structure in accordance with the Codes.

3.2 Seat belt anchorage performance

3.3.1 Loading in the forward and upward direction

Driver seat	Make/Model/Type	
GRAVITY FORCE (Fg = seat mass x 9,81) N	REQUIRED FORCE (4450N+4Fg) N	APPLIED FORCE N

3.3.2. Loading in the rearward and upward direction

Driver seat	Make/Model/Type	
GRAVITY FORCE (Fg = seat mass x 9,81) N	REQUIRED FORCE (2225+2Fg) N	APPLIED FORCE N

3.3.3 Curves, drawings and photos

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

Drawings and/or photos of the seat mounting and seat belt anchorages have to be added.

Statement:

During the test, no structural failure or release of seat, seat adjuster mechanism or other locking service occurred. The seat and safety belt anchorage tested fulfil the requirement of the OECD procedure.

3.3 Tractor(s) to which the protective structure is fitted

OECD Approval Number :										
Make	Model	Type	Other specifi-cations	Mass			Tiltable	Wheel-Base	Minimum track	
				Front	Rear	Total			Front	Rear
		2/4 WD, etc	*where applicable*	kg	kg	kg	Yes/ No	mm	mm	

3.4 Curves (static test only)

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

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

4. MINOR MODIFICATION CERTIFICATE

- OECD approval number according to Code 7:
- Station test n° for the original report:

- Date and location of test:
- Date of approval:
- Modification number: MOD
- The previous Modification Certificate (MOD._____..) remains / does not remain valid.

4.1 Specification of the Protective Structure

- Frame or Cab:
- Manufacturer:
- Submitted for test by:
- Make:
- Model:
- Type:
- Serial Number from which modification applies:

4.2 Denomination of Tractor(s) to which the Protective Structure is fitted

OECD Approval Number :										
Make	Model	Type	Other specifi-cations	Mass			Tiltable	Wheel-Base	Minimum track	
				Front	Rear	Total			Front	Rear
		2/4 WD, etc	*where applicable*	kg	kg	kg	Yes/ No	mm	mm	

4.3 Details of Modifications

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

_____

_____

_____

4.4 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 the national Designated Authority by the Station which 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: