

INTERNATIONAL
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**Road vehicles — Towing vehicle coupling
device to tow caravans or light trailers —
Mechanical strength test**

*Véhicules routiers — Dispositifs d'attelage montés sur les véhicules
tractant des caravanes ou des remorques légères — Essai de résistance
mécanique*

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Reference number
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Foreword

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

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.

International Standard ISO 3853 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 4, *Caravans and light trailers*.

This second edition cancels and replaces the first edition (ISO 3853:1977), of which it constitutes a technical revision.

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Road vehicles — Towing vehicle coupling device to tow caravans or light trailers — Mechanical strength test

1 Scope

This International Standard specifies a simplified procedure for testing the mechanical strength of coupling devices fitted to towing vehicles for towing caravans or light trailers of categories O₁ and O₂.¹⁾

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1103:1976, *Road vehicles — Caravans and light trailers — Coupling ball — Dimensional characteristics*.

ISO 1176:1990, *Road vehicles — Masses — Vocabulary and codes*.

ISO 7237:1993, *Caravans — Masses and dimensions — Vocabulary*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 1176 for towing vehicles and ISO 7237 for caravans, and the following definitions apply.

3.1 coupling device: Device including towing bracket and ball.

NOTE 1 Current terms are shown in figure 1.

3.2 static load, F_{stat} : Permissible load on the coupling device transmitted by the coupling ball.

3.3 reference line: Approximately horizontal line through the centre of the coupling device, given by the car manufacturer for the laden car, and within set limits.

1) Definitions in accordance with UN-ECE classification of road vehicles:

Category O₁: single-axed trailers, other than semi-trailers, with a maximum mass not exceeding 750 kg.

Category O₂: trailers with a maximum mass not exceeding 3 500 kg, other than trailers of category O₁.

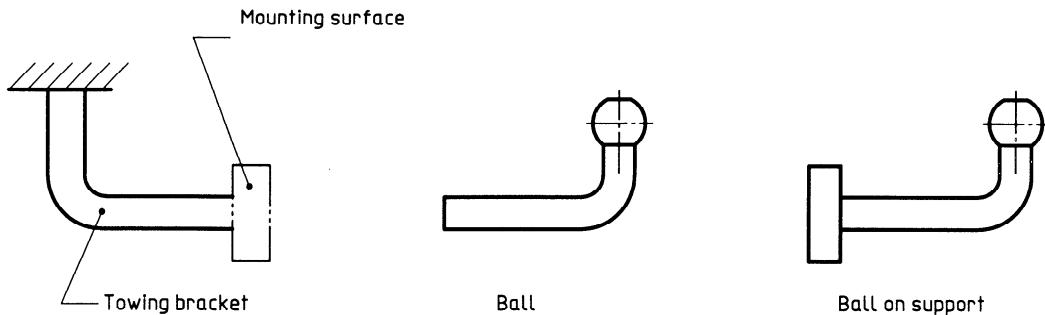


Figure 1 — Coupling device nomenclature

4 Symbols

For the purposes of this International Standard, the following symbols apply.

m_M is the maximum design total mass of the towing vehicle (see ISO 1176, code ISO-M07)

m_R is the maximum manufacturer's total mass of the towed vehicle for specific operating conditions (see ISO 7237:1993, definition 4.1.3)

D is the value, in newtons, determined by the following equation corresponding to the longitudinal force between the towing vehicle and the trailer:

$$D = g \times \frac{m_M \times m_R}{m_M + m_R}$$

where g is the acceleration due to gravity, i.e. a conventional value of $9,806.65 \text{ m/s}^2$

F_{res} is the resulting test force, expressed in newtons

α is the test angle at which the test force F_{res} is set in relation to the reference line, expressed in degrees of angle

F_{stat} is the maximum permissible static load of the trailer on the towing vehicle coupling point (see ISO 1176:1990, definition 4.2.4). This value is determined by the towing vehicle manufacturer

h is the vertical distance between the ball centre and the mounting device centre

l is the horizontal distance between the ball centre and the ball support attachment point or ball attachment point

5 General conditions

5.1 The test shall be carried out with coupling devices whose dimensions comply with ISO 1103.

The devices submitted to the test shall have all design details which might influence the strength criteria fitted or included (e.g. electrical socket plates, any marking, etc.).

5.2 The test periphery ends at the anchorage or fitting points. The geometric location of the coupling ball and the fixing points of the coupling device related to the reference line shall be indicated by the vehicle manufacturer and quoted in the test report.

5.3 The strength tests in clause 6 are dynamic tests to be performed on a test bench (e.g. a resonance pulser).

5.4 The test loads do not take account of the side (transverse) loads generated, for example, by tandem axle trailers and certain types of stabilizers.

5.5 The test angles are derived from the force distribution diagram in figure 2, which is the result of road tests with various combinations of passenger cars and trailers.

To simplify the test procedure, two different test angles were chosen to take account of vertical static load and dynamic load.

If the ball centre is below the line parallel to the reference line which contains the highest of the nearest fixing points (see figure 3), the test shall be carried out with angle $\alpha = +15^\circ \pm 1^\circ$ [see figure 4 a)].

If the ball centre is above the line parallel to the reference line which contains the highest of the nearest fixing points (see figure 3), the test shall be carried out with angle $\alpha = -15^\circ \pm 1^\circ$ [see figure 4 b)].

If the permissible static load is greater than $0,12D$, the test angle shall be 20° .

5.6 The strength test applies to the load-carrying parts of coupling devices made of steel and cast steel. For devices made of other materials, it should be decided whether the tests are appropriate or if other tests are necessary.

6 Strength test for coupling device

6.1 Mounting on test bench

The towing bracket shall be mounted on a rigid test bench. The fixing arrangements for the towing bracket on the test bench shall be the same as for its attachment to the towing vehicle or shall have identical characteristics.

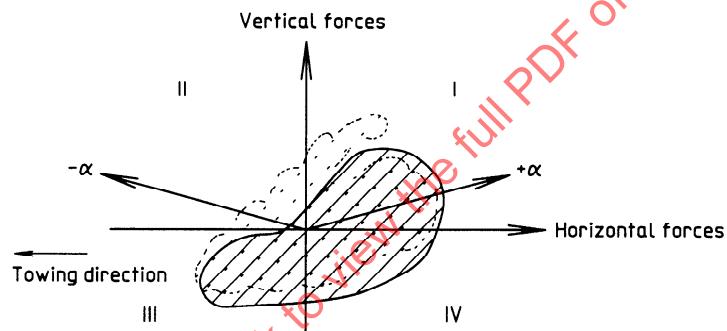


Figure 2 — Force distribution diagram

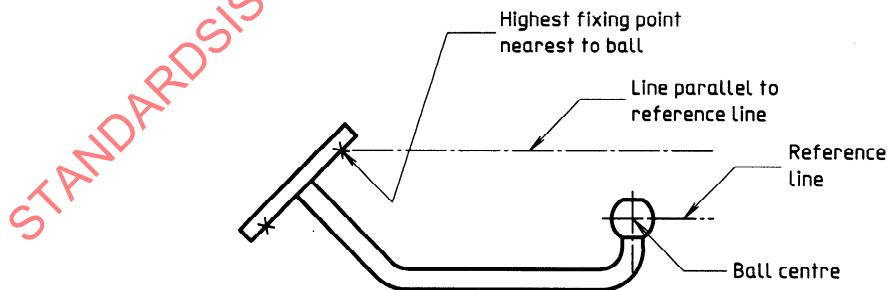
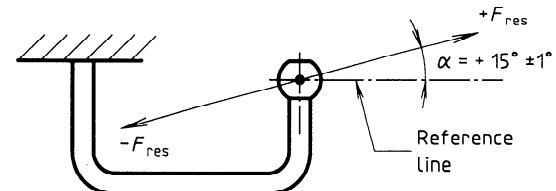
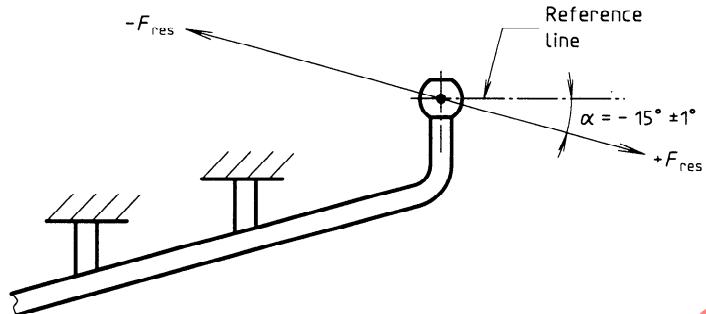


Figure 3 — Criteria for test angles



a) Ball centre above line parallel to reference line passing through highest of nearest fixing points



b) Ball centre below line parallel to reference line passing through highest of nearest fixing points

Figure 4 — Load application diagrams

6.2 Anchorage points and reference line

All relative positions of the anchorage points respective to the reference line, for which the towing vehicle manufacturer shall provide all the necessary information to the towing device manufacturer, shall be repeated on the test bench.

In cases where the towing vehicle manufacturer has not defined the anchorage points or the reference line, the coupling device manufacturer may choose the anchorage points and reference line which suits him, provided that the coupling device manufacturer accepts all responsibility resulting from this unrestricted choice. In particular the coupling device manufacturer remains responsible for the maximum permissible towed mass (see ISO 1176, code ISO-M16), specified normally by the towing vehicle manufacturer and for the correct coupling ball position.

6.3 Test method

The assembly mounted on the test bench under the conditions in 6.1 and 6.2 shall be subjected to an alternating stress tensile test machine. When fixing the component at the test bench and inducing a force, ensure that additional movement²⁾ or other forces³⁾ are as small as possible.

The test load shall be applied approximately sinusoidally at a selected frequency, not exceeding 35 Hz, chosen to be well separated from resonance frequencies of the test setup including the towing device.

The value of the test load, F_{res} , shall show an amplitude of $0,6D \pm 3\%$. The number of cycles shall be 2×10^6 .

NOTE 2 As the part of the testing machine that connects the force transducer with the ball of the device may have a considerable mass, a part of the measured force will be the inertia force to accelerate this mass. Optionally a compensation for the inertia forces may be entered, e.g. by measurement of the acceleration of the ball.

2) This can be achieved for example by means of a double joint, installed at a minimum distance of 300 mm.

3) For example, mass acceleration forces.

7 Specific conditions for different types of coupling device

7.1 One-piece ball coupling

The strength test for the devices shown in figure 5 shall be carried out according to the requirements of clause 6. This applies also to devices with interchangeable detachable balls and of coupling balls alone. In the case of the coupling ball alone, account is taken only of the result relating to the ball.

7.2 Ball coupling of parts which can be dismantled

7.2.1 Four categories of ball coupling are defined:

- towing bracket + ball (see figure 6);
- towing bracket + ball on integral support (see figure 7);
- towing bracket + ball (see figure 8);
- towing bracket (see figure 9).

7.2.2 The strength test for coupling devices that can be dismantled shall be carried out in accordance with the requirements of clause 6.

7.2.3 Dimensions h and l , with a manufacturing tolerance of ± 5 mm, shall be shown in the test report and shall be in accordance with ISO 1103.

7.2.4 The test of the towing bracket (see figure 9) shall be carried out with a ball mounted on a support if necessary. Account is taken only of the results relating to the towing bracket between the fixing points and the mounting surface of the ball support.

7.2.5 Where coupling devices have variable dimensions h and l , the position of the ball shall be in accordance with ISO 1103.

Several ball positions shall be tested in a simplified test programme where the variation of the distance for the ball is within

$$\Delta h = h_{\max} - h_{\min} = 100 \text{ mm};$$

$$\Delta l = l_{\max} - l_{\min} = 130 \text{ mm}.$$

The strength tests for such towing brackets, shown in figure 10, shall be carried out in accordance with the requirements of clause 6.

To cover all possible positions of the balls, two towing brackets shall be tested:

- one with a ball at h_{\max} and l_{\max} ;
- one with a ball at h_{\min} and l_{\min} .

7.2.6 When specified, the dimensions of the mounting surface of the ball support with the test bench or the towing bracket shall be those given in ISO 1103.

8 Strength criteria

For the whole duration of the tests carried out according to the requirements of this International Standard, the coupling devices and their constituent parts (bracket, ball, support, fixings) shall not exhibit any permanent deformation or visible external deterioration and there shall be no breakage.

The presence of defects shall be detected with the naked eye using conventional contrast agents. In case of doubt, detailed examination is necessary.

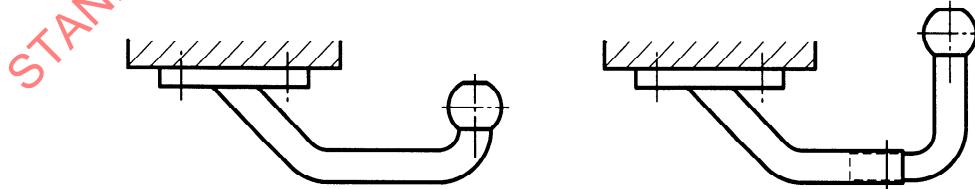


Figure 5 — One-piece ball coupling

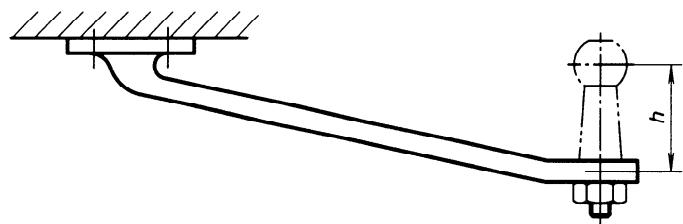


Figure 6 — Towing bracket + ball

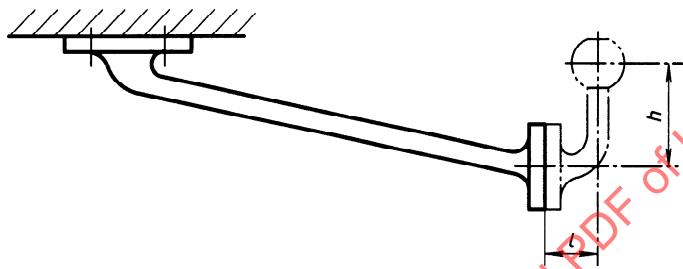


Figure 7 — Towing bracket + ball on integral support

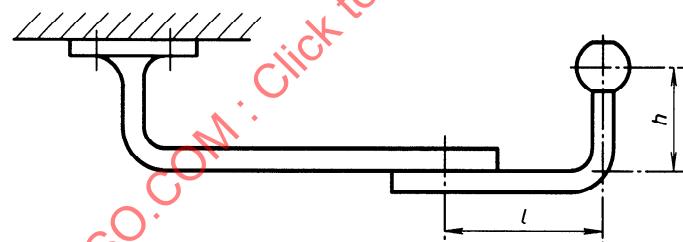


Figure 8 — Towing bracket + ball

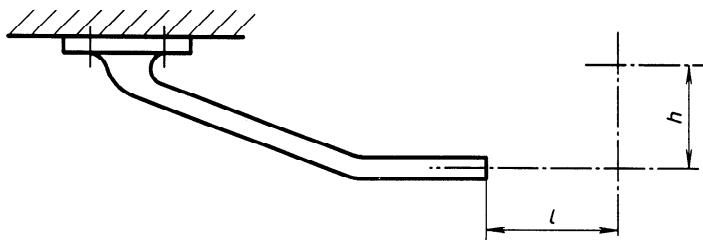


Figure 9 — Towing bracket

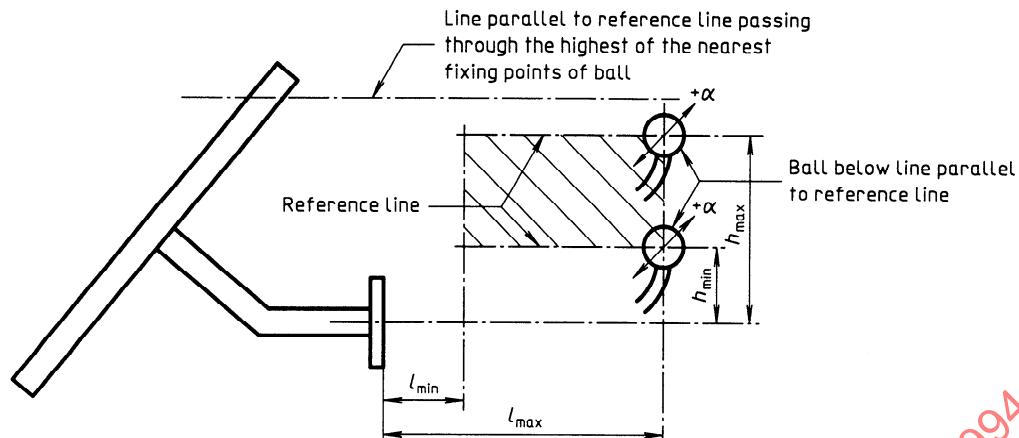
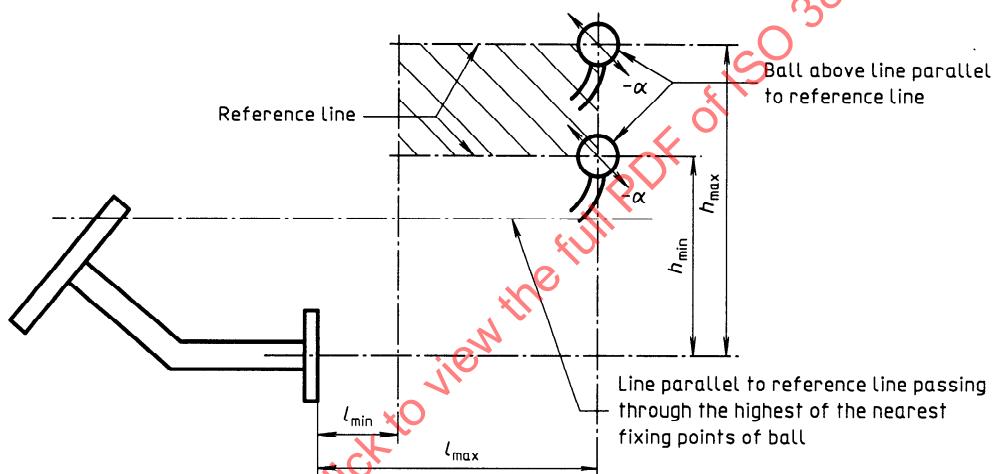
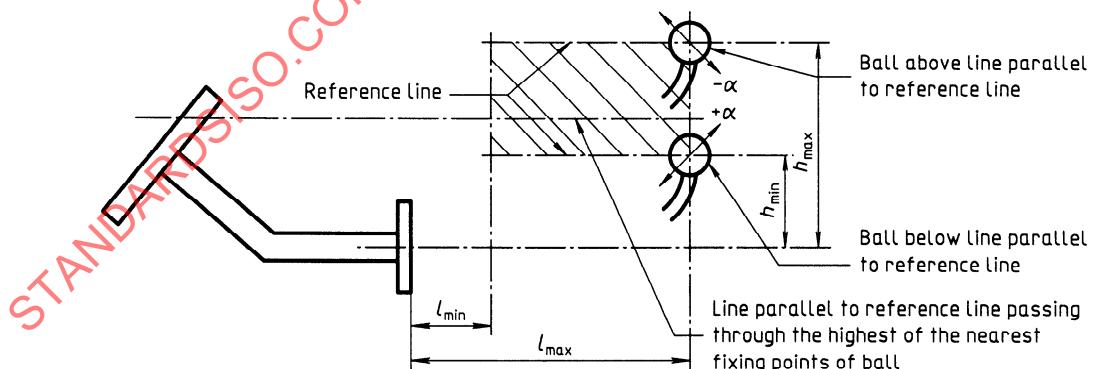
a) h_{\max} below parallel line to reference line (test angle: $\alpha = +15^\circ \pm 1^\circ$)b) h_{\min} above line parallel to reference line (test angle: $\alpha = -15^\circ \pm 1^\circ$)c) h_{\max} above parallel line to reference line (test angle: $\alpha = -15^\circ \pm 1^\circ$) h_{\min} below line parallel to reference line (test angle: $\alpha = +15^\circ \pm 1^\circ$)

Figure 10 — Towing bracket + support for different ball positions

9 Welded towing device

The welding procedure (including welding machine, welder qualification, welded materials, welding consumables) shall be in accordance with recognized practice.

10 Marking

Marking specified in ISO 1103 shall include at least the following:

- a) the name and address of the coupling device manufacturer, or vehicle manufacturer if also the manufacturer of the coupling device;
- b) the homologation number or the test number when there is no homologation;
- c) the values for h and l for coupling balls, where they can be dismantled, with fixed dimensions of h and l ;
- d) the values for l_{\max} , h_{\max} and h_{\min} and l_{\min} for coupling devices with variable dimensions of h and l .

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