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# Agricultural vehicles — Mechanical hook-type connections on towing vehicles — Test methods and requirements

*Véhicules agricoles — Liaisons mécaniques de type crochet sur véhicules tracteurs — Méthodes d'essai et exigences*

Reference number
ISO 12368:2001(E)

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12368 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

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# Agricultural vehicles — Mechanical hook-type connections on towing vehicles — Test methods and requirements

## 1 Scope

This International Standard specifies a dynamic test method for mechanical hook-type connections and hook coupling devices, as well as a static test of their keeper plates. It is applicable to hooks meeting the requirements of ISO 6489-1 used on towing vehicles with an unladen mass of up to 10 t. Towing vehicles with a greater unladen mass are nevertheless treated as 10 t towing vehicles, especially with regard to their reference mass.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6489-1, *Agricultural vehicles — Mechanical connections between towed vehicles and towing vehicles — Part 1: Dimensions of hitch-hooks*

ISO 20019:—[1)], *Agricultural vehicles — Mechanical connections on towed vehicles — Dimensions for hitch rings*

89/173/EEC, *Council of Europe Directive of 21 December 1988 on the approximation of the laws of the Member States relating to certain components and characteristics of wheeled agricultural or forestry tractors*

## 3 Terms and definitions

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

**3.1**
**unladen mass**
mass of the unladen towing vehicle in working order with tanks and radiators full, including any protective structure, track equipment or additional front-wheel-drive components required for normal use, but not including operator, optional ballast weights, additional wheel equipment, special equipment or loads

**3.2**
**reference mass**
$m_R$
mass, not less than the unladen mass, selected by the manufacturer for calculation of the force to be used in the test

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**3.3**
**hook coupling device**
hook, together with its keeper plate, locking mechanism and all load-carrying components needed for its installation on a towing vehicle chassis

**3.4**
**keeper plate**
part that ensures that the hitch ring cannot become detached from the hook

See ISO 20019.

**3.2**
**vertical static load**
*S*
maximum permissible static load at the hook, as declared by the manufacturer, applied vertically to a hitch ring

See ISO 20019.

# 4 Test equipment

## 4.1 Strength

The test equipment and the means of ensuring that the hook coupling device is fixed firmly to the bedplate shall be such that they do not deflect significantly in relation to the hook coupling device under loading.

## 4.2 Load application

### 4.2.1 Hook coupling device

The means of applying a force to the hook coupling device (see Figure 1) shall comply with the following requirements.

a) The dynamic force application frequency shall not exceed 5 Hz unless it can be demonstrated that the natural frequency is not affecting the load pattern.

b) The force shall be applied by means of a hitch ring whose maximum dimensions are in accordance with ISO 20019.

c) The force applied shall, during the whole test, be kept to within ± 2 % of the maximum force limits set as calculated.

d) The loading direction shall, during the whole test, be kept to within ± 3° of the original set direction downwards and ± 1,5° from the set sideways inclination.

### 4.2.2 Keeper plate

The means of applying a force to the keeper plate (see Figure 2) and hook shall comply with the following requirements.

a) The static force shall be applied by means of a hitch ring whose dimensions are in accordance with ISO 20019.

b) The force applied shall be within ± 2 % of the calculated force, and the upward inclination within ± 3°.


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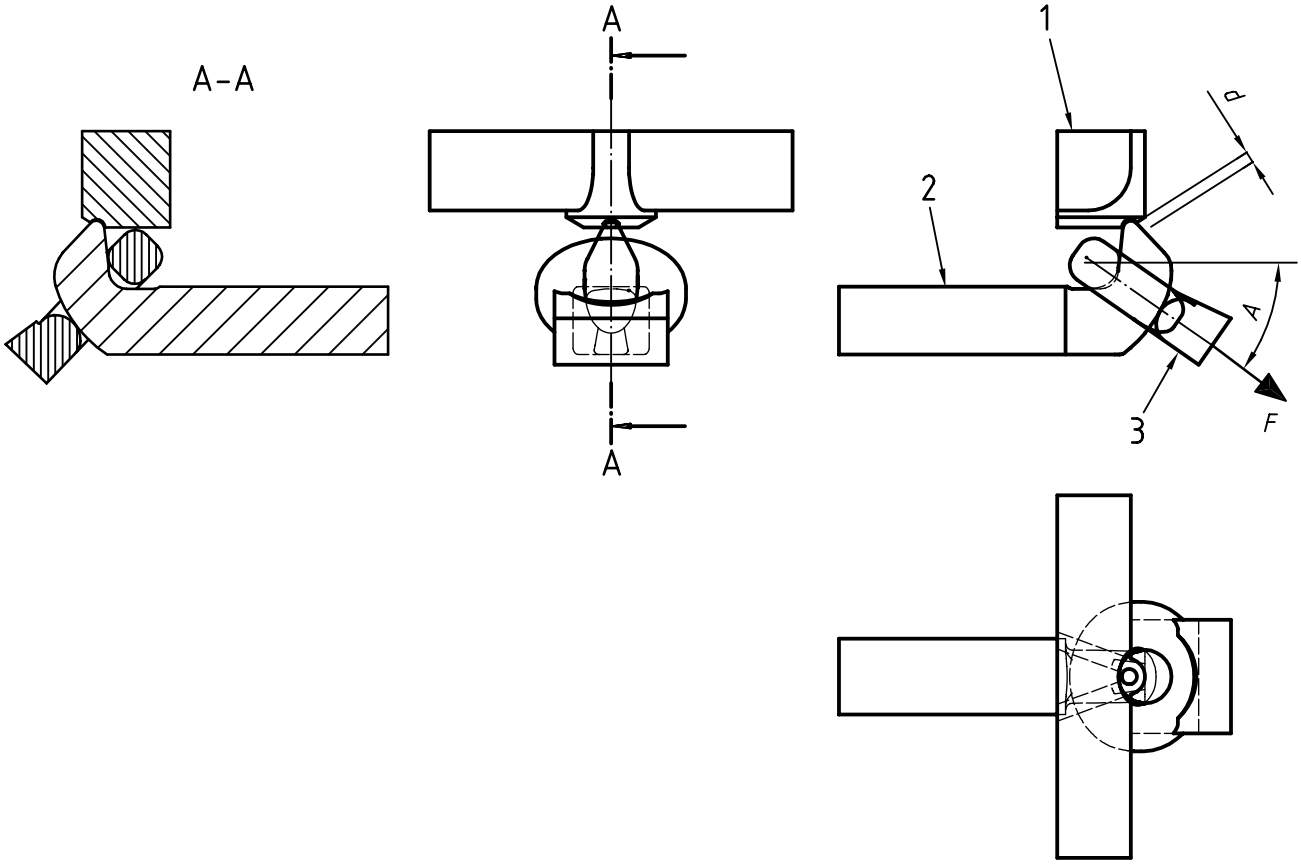


**Key**

1 Keeper plate
2 Hook
3 Ring

**Figure 1 — Hook coupling device dynamic test load application**

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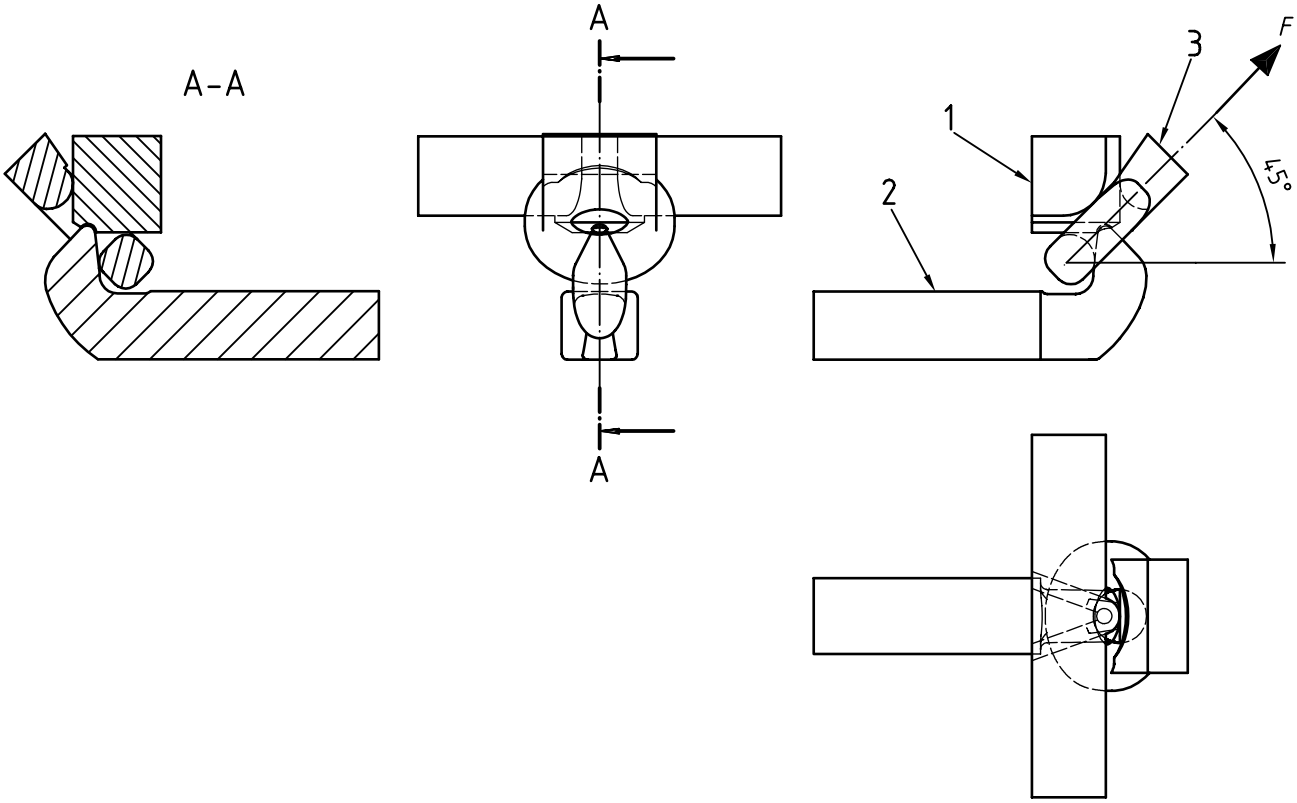


**Key**

1 Keeper plate
2 Hook
3 Ring

**Figure 2 — Keeper plate static test load application**

## 5 Preparation of hook coupling device

The hook coupling device shall be to production specification and fitted on the test bed or towing vehicle chassis with all parts, and only those parts, needed for installation on a towing vehicle.

The assembly shall be secured to the bedplate so that the members connecting the assembly and the bedplate do not deflect significantly. The assembly shall not receive any support under loading other than that due to the initial attachment.

## 6 Test conditions

The hook coupling device, in the locked position, shall be dynamically tested with a pulsating tensile force of the magnitude and direction specified in clauses 7 and 8.

After completion of the dynamic test, the keeper plate shall be tested with a static tensile force according to clause 9.

The tests shall be conducted at an ambient temperature of at least 10 °C.


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# 7 Determination of test force and load direction

## 7.1 Test force

The determination of the test force, $F$, is valid for

— towing vehicle/trailer assemblies whose combined total mass does not exceed 40 t, and

— a ratio between the unladen mass of the towing vehicle and the maximum laden mass of the towing vehicle equal to 1,5 (as adopted in 89/173/EEC, Annex IV).

The test force, $F$, expressed in newtons, is determined using the following equation:

$$F = (F_h^2 + F_v^2)^{1/2}$$

where

$F_h$ is a horizontal force, in newtons:

$$F_h = 12 m_R$$

where $m_R$ is the reference mass in kilograms;

NOTE This is a simplified version of the formula for the horizontal force, $F_h$, found in 89/173/EEC.

$F_v$ is a vertical force, in newtons:

$$F_v = 15 S$$

where $S$ is the static vertical load, in kilograms (if a value is not available, use $S = 0{,}6 m_R$).

When selecting the value $S$, the limitation on the vertical static load given in ISO 6489-1 shall be taken into account.

## 7.2 Load direction

The downward angle of load direction, $A$, is defined as:

$$\tan A = \frac{F_v}{F_h}$$

In addition, the load direction shall be inclined 5° to the side of the longitudinal plane.

# 8 Dynamic test of hook coupling device

Load the hook coupling device with a pulsating tensile force, $F$, according to clause 4.

Before the test, check that hook coupling device conforms to the requirements given in clause 5; conduct the test under the conditions given in clause 6.

Calculate the test force and load direction using the formulae given in 7.1 and 7.2.

During the whole test, the force shall alternate between $0{,}05F$ and $1{,}0F$. For steel components, test for $1 \times 10^6$ load cycles.

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NOTE The endurance limit of steel fabricated and welded assemblies is generally agreed to be $2 \times 10^6$ load cycles. The verification of the strength of the hook coupling device after completing $1 \times 10^6$ load cycles is possible due to an acceleration factor applied to the test load equal to 1,26 times the normally permissible stress for vehicle coupling devices.

## 9 Static test of hook and keeper plate

The test force 0,5 $F$ shall be applied upwards and rearwards at an angle of 45° to the horizontal and maintained for a period of 1 min using a hitch ring of the dimensions specified in ISO 20019, within the hook contact area.

If the shape of the keeper plate is such that it is not possible to apply the load with a single ram at 45°, the load may be applied with two rams, providing that the resultant loads are at 45°.

NOTE By loading at 45°, a wedging action will be created between keeper plate and hook, as well as loading the keeper plate.

## 10 Conditions of acceptance

### 10.1 Hook coupling device

After completing the test, inspect the hook coupling device for cracks and tears. Perform this inspection using the colour penetration, or a similar, crack-indication method.

If the hook coupling device breaks before the completion of the required number of load cycles, note the number reached, together with the reason the test was stopped.

### 10.2 Keeper plate and hook

At no time during the test shall the distance, $d$, between the keeper plate and the hook (see Figure 1), exceed 10 mm.

## 11 Extension to other towing-vehicle models

In the case of a hook coupling device which complies with this International Standard and which is designed to be used on other towing-vehicle models, the tests specified in clauses 8 and 9 are not required to be carried out for each model of towing vehicle, provided that

a) the mass of the towing vehicle does not exceed the reference mass used in the test by more than 5 %, and

b) the means of attachment and the components of the towing vehicle to which attachment is made are identical, or of equivalent strength, to the ones tested.

In such cases, the test report shall contain a reference to the previous report.

## 12 Labelling

If a label is required it shall contain at least the following information:

a) name and address of the manufacturer of the hook coupling device;

b) hook coupling device identification number;

c) reference mass;

d) static vertical load.


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The label shall be durable and permanently attached to the hook coupling device such that it can be read, and shall be located in such a way as to be reasonably well protected from damage.

## 13 Test report

The test report shall contain at least the following:

a) name of manufacturer and identification number of the hook coupling device;

b) reference to the product drawing or drawings of the hook coupling device and specification of the materials used for its components;

c) make, model and series of each towing vehicle the hook coupling device is designed to fit;

d) reference mass and static vertical load used for determining the test parameters;

e) results of tests and observations.

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