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Mobile cranes — Determination of stability

Grues mobiles — Détermination de la stabilité

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Reference number
ISO 4305:1991(E)

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 4305 was prepared by Technical Committee ISO/TC 96, *Cranes*.

This second edition cancels and replaces the first edition (ISO 4305:1981), the table of which has been technically revised.

Annex A of this International Standard is for information only.

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Mobile cranes — Determination of stability

1 Scope

This International Standard specifies the conditions to be taken into consideration when verifying the stability of a mobile crane by calculation, assuming that the crane is operating on a firm and level surface (up to 1 % gradient).

It applies to mobile cranes as defined in ISO 4306-2, i.e. appliances mounted on wheels (tyres) or crawlers, with or without outriggers.

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 4302:1981, *Cranes — Wind load assessment*.

ISO 4306-1:1990, *Cranes — Vocabulary — Part 1: General*.

ISO 4306-2:1985, *Lifting appliances — Vocabulary — Part 2: Mobile cranes*.

ISO 4310:1981, *Cranes — Test code and procedures*.

3 Calculations of stability

3.1 General

The calculation shall verify that the crane is stable under the following conditions:

- the criteria specified in table 1;
- the criteria specified in table 2;
- backward stability (see 3.3);
- stability with out-of-service wind (see 3.4).

3.2 Criteria for stability

3.2.1 See table 1 and table 2.

3.2.2 Based on the criteria specified in table 1 and table 2, it is intended that the stability-limited crane ratings shall be usable in a minimum wind speed of 8,3 m/s. Under special conditions where this requirement imposes a restriction on rated capacity, the manufacturer shall clearly specify the maximum wind speed included in the stability calculation.

Table 1

Machine configuration/condition	Loading	Value to be taken into consideration ¹⁾
On outriggers/crawlers ²⁾	Applied load	$1,25P + 0,1F$
On wheels (tyres) ²⁾	Applied load	$1,33P + 0,1F$
On crawlers/wheels (tyres) when travel speed up to 0,4 m/s is permissible	Applied load	$1,33P + 0,1F$
On crawlers/wheels (tyres) when travel speed greater than 0,4 m/s is permissible	Applied load	$1,5P + 0,1F$
<p>1) In these formulae</p> <p>P is the rated capacity (hoist medium load) as specified by the crane manufacturer for the various configurations of the crane. It shall be for the hoist medium load of the crane as defined by ISO 4306-1 (see 3.5.1).</p> <p>F is the load from the mass of the jib and fly jib referred to the jib head or fly jib head. (See ISO 4310 for the determination of F.)</p> <p>The value to be taken into consideration is intended to simulate the dynamic forces arising during normal controlled operation.</p> <p>2) For these configurations, the crane condition is stationary and relates to the travel of the crane as a whole but is not related to hoisting, luffing, telescoping and slewing.</p>		

Table 2

Machine configuration/condition	Loading	Value to be taken into consideration ¹⁾
On outriggers/crawlers ²⁾	Applied load	$1,1P$
	Wind load	W
	Inertia forces	D
On wheels (tyres) ²⁾	Applied load	$1,17P$
	Wind load	W
	Inertia forces	D
On crawlers/wheels (tyres) when travel speed up to 0,4 m/s is permissible	Applied load	$1,17P$
	Wind load	W
	Inertia forces	D
On crawlers/wheels (tyres) when travel speed greater than 0,4 m/s is permissible	Applied load	$1,33P$
	Wind load	W
	Inertia forces	D
<p>1) In this column</p> <p>D are the inertia forces due to hoisting, telescoping, slewing, luffing or travel. For cranes having stepped controls, the actual values from inertia forces shall be used. For cranes having infinitely variable controls, the value of D shall be taken as 0.</p> <p>P is as defined in table 1.</p> <p>W is the effect of the in-service wind and shall be calculated in accordance with ISO 4302.</p> <p>2) For these configurations, the crane condition is stationary and relates to the travel of the crane as a whole but is not related to hoisting, luffing, telescoping and slewing.</p>		

3.3 Backward stability

To retain a reasonable margin, counterweighting shall be limited by the mass distribution given below, the appliance being in the following conditions:

- placed on a firm, level supporting surface (up to 1 % gradient);
- equipped with the shortest specified jib, set at its maximum recommended jib angle for that jib length;
- with hook, hook-block or other load-handling equipment resting on the ground;
- with outriggers free of the bearing surface for on-wheels (tyres) calculations;
- equipped with the longest specified jib, or jib and fly-jib combination set at its maximum recommended jib angle for that combination, and subjected to an in-service wind acting from the least favourable direction.

The specified mass distribution criteria shall be satisfied for each counterweight condition with the crane rotated to the least stable positions permitted by the manufacturer.

3.3.1 Crawler-mounted cranes

The total load on the tipping line on the side or end of the undercarriage supporting the least load shall not be less than 15 % of the total weight of the crane.

When applied to crawler cranes equipped with retractable crawler assemblies, the manufacturer shall provide on the crane cautionary information visible to the operator if the above criterion is not met when crawlers are retracted.

3.3.2 Wheel-mounted cranes

With the longitudinal axis of the rotating superstructure of the crane at 90° to the longitudinal axis of the carrier, the total load on the wheels (tyres) or

outriggers on the side of the carrier under the jib shall be not less than 15 % of the total weight of the crane.

With the longitudinal axis of the rotating superstructure of the crane in line with the longitudinal axis of the carrier, in either direction, the total load on the wheels (tyres) or outriggers under the lighter loaded end of the carrier shall be not less than 15 % of the total weight of the crane in the work area specified by the manufacturer, and not less than 10 % of the total weight of the crane in the area not specified as a work area.

The on-wheels (tyres) limitations must be met unless cautionary information visible to the operator is placed on the crane. This information shall state the operating conditions that require the outriggers to be set to maintain sufficient backward stability.

3.4 Stability with out-of-service wind (see ISO 4302)

The manufacturer shall stipulate the special precautions to be taken by the user when the crane is out of service and the working limits when subjected to wind.

3.5 Determination of stability

3.5.1 The value of P shall be such that, with loading conditions as given in table 1 and table 2, in neither case shall the overturning moment of the crane be greater than the stabilizing moment.

3.5.2 The calculations shall be made with the crane in the least favourable position. Moreover, all the loads, dead loads, counterweights, accessories, etc. which have an influence on the stability shall be taken into consideration as being in the least favourable condition as regards their value and their position.

3.5.3 Lines about which cranes on various mountings may tip and which are used to calculate the stabilizing moment are shown in annex A. These are indicative only and in practice are dependent on particular details of individual designs.

Annex A (informative)

Tipping line of mobile cranes

NOTE 1 Figure A.1 to figure A.5 are illustrative only. In practice, tipping lines are dependent on individual designs.

A.1 Cranes on wheels (tyres)

A.1.1 Crane on wheels (tyres) without suspension or with the suspension locked (see figure A.1 and figure A.2)

The tipping line is the line joining the points of con-

tact of the wheels. For axles mounted on twin tyres, the following two cases should be considered:

- a) in the case where the axle is fixed or blocked, the point of contact of the outer wheel;
- b) in the case where the wheel is on a rocking axle, the pivot axis of this rocking axle.

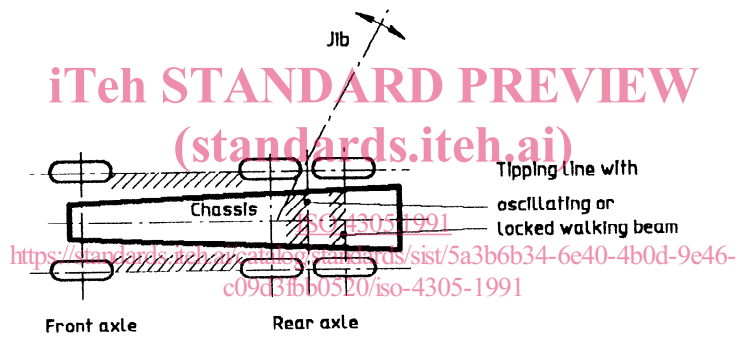


Figure A.1

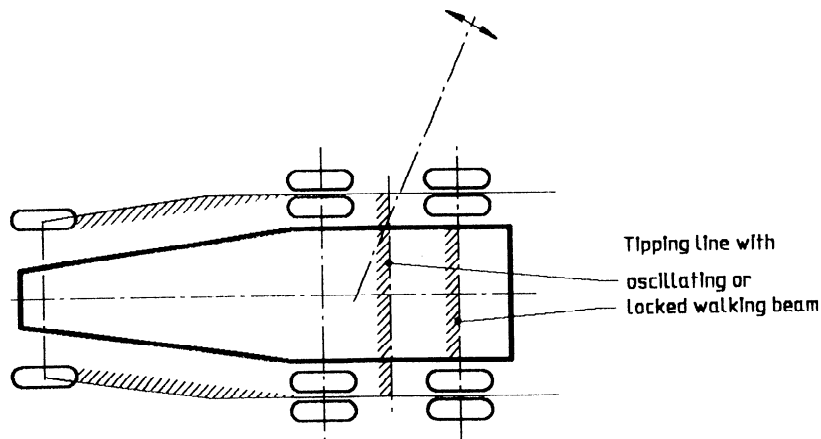


Figure A.2

A.1.2 Crane on wheels with the suspension unlocked (see figure A.3)

The tipping line is the line joining the points of application of the suspension.

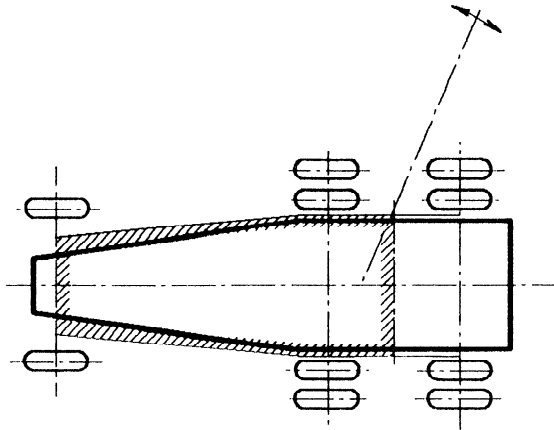


Figure A.3

A.2 Cranes on outriggers (see figure A.4)

The tipping line is the line joining the centres of the support but, if flexible supporting surfaces exist besides the outriggers (such as wheels with pneumatic tyres), then these may be taken into account.

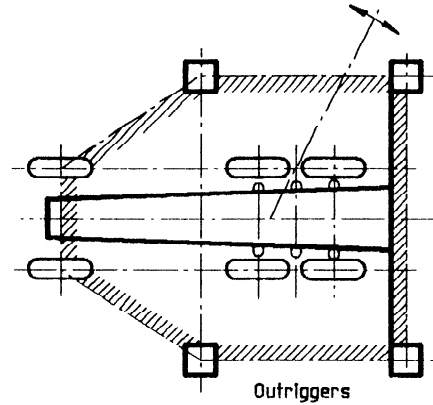


Figure A.4

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A.3 Cranes on crawlers (see figure A.5)

ISO 4305:1991 The tipping line is the line joining the axis of the sprocket wheels and the axis of the idler wheel.
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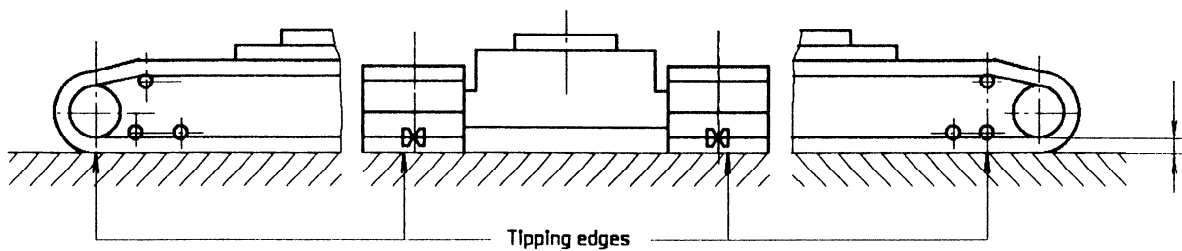


Figure A.5

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