INTERNATIONAL STANDARD

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Tower cranes — Stability requirements

Grues à tour — Exigences relatives à la stabilité

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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 12485 was prepared by Technical Committee ISO/TC 96, *Cranes,* Subcommittee SC 7, *Tower cranes.*

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1 Scope

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of the 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 4306-3:1991, *Cranes — Vocabulary — Part 3: Tower cranes.*

ISO 8686-3:—[1)], *Cranes — Design principles for loads and load combinations — Part 3: Tower cranes.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 4306-3 apply.

4 Stability

4.1 Calculations

4.1.1 A crane is said to be stable when the algebraic sum of the stabilizing moments is greater than or equal to the sum of the overturning moments.

4.1.2 Calculations shall be made to verify the stability of the crane by computing the sum of the overturning moments using the values given in table 1.

1) To be published.

In all calculations, the position of the crane and its components, and the effect of all loads and forces, shall be considered in their least favourable combination, direction and effect.

4.1.3 For cranes designed to travel with load, the forces induced by the maximum allowable vertical track variation as specified by the manufacturer shall be taken into account, in addition to other loads specified in condition II of table 1.

Table 1 — Crane stability — Load factors

	Condition	Loading	Load factor to be considered
IN SERVICE	I. Basic stability	Loads induced by the dead weight	1,0
		Applied load	1,6 P
		Wind load	0
		Inertia forces	0
	II. Dynamic stability	Loads induced by the dead weight	1,0
		Applied load	1,35 P
		Wind load	1,0 W_1
		Inertia forces	1,0 D
	III. Backward stability (sudden release of load)	Loads induced by the dead weight	1,0
		Applied load	−0,2 P
		Wind load	1,0 W_1
		Inertia forces	0
OUT OF SERVICE	IV. Extreme wind loading	Loads induced by the dead weight	1,0
		Applied load	1,0 P_1
		Wind load	1,2 W_2
		Inertia forces	0
	V. Stability during erection or dismantling	Loads induced by the dead weight	1,0
		Applied load	1,25 P_2
		Wind load	1,0 W_3
		Inertia forces	1,0 D

where

D are the inertia forces from drives in accordance with ISO 8686-3; $\Phi_5 = 1$

P is the net load;

P_1 is the mass of the fixed load lifting attachment;

P_2 is the mass of the part being installed/removed during erection or dismantling;

W_1 is the in-service wind effect in accordance with ISO 4302;

W_2 is the out-of-service wind effect in accordance with ISO 4302 (gusting effects are included);

W_3 is the in-service wind effect W_1 or the effect of the wind limit for erection work in accordance with the instruction handbook of the manufacturer.

4.1.4 Where required, excitation effects appropriate to the particular site or zone shall be considered as an additional loading condition.

4.1.5 In the calculations shown in table 1, consideration shall be given to the loads induced by the mass of the crane and its components, including any lifting attachments which are a permanent part of the crane in its working condition.

4.2 Backward stability in service conditions

Backward stability is covered by condition III.

4.3 Application of wind loads

4.3.1 In-service wind forces shall always be applied in the least favourable direction.

4.3.2 Out-of-service wind forces shall be applied in the least favourable direction for those cranes which are not free to rotate with the wind. For those cranes which are designed to rotate with the wind, the force shall be applied on the superstructure in the direction contemplated, and in the least favourable direction on the lower structure.

5 Crane base

The crane manufacturer shall specify the forces imposed by the crane on the ground or supporting structure. The information given by the manufacturer should state all applicable conditions for which the forces have been stipulated (including out-of-service wind). Where the crane base provides all or part of the stability of the crane, the manufacturer shall specify the requirement applicable to the crane base.

Where the crane is required to operate on an inclined surface, the manufacturer shall take the specified conditions into account.

6 Temporary additional stability devices

Tower cranes shall be stable in their operating configuration (conditions I to IV in table 1) without use of temporary additional devices.

Temporary additional devices may be used to satisfy condition V in table 1, erection or dismantling.

Detachable ballast may be used to satisfy the case of condition IV in table 1. However, this condition shall be met without this extra ballast, using a factor of 1,1 W_2.

7 Deformation

Where it can be shown, under the least favourable conditions of loading on the most destabilizing configuration, that the increase in tower moment from considering effects of deflections (second-order theory) is no more than 10 %, then stability calculations may be carried out ignoring deflections (first-order theory) for ease of calculation.

However, when this is done, the overturning moments for each condition in table 1 shall be increased in proportion to the increase from second-order effects found above.

8 Resistance to drifting caused by wind

The resistance to drifting caused by wind shall be proven by calculation for all tower cranes on rails operating in the open air under the conditions in table 2.

Table 2 — Drifting caused by wind

Condition	Loading	Load factor to be considered
II. Dynamic stability	Loads induced by the dead weight	1,0
	Applied load	1,35 P
	Wind load	1,2 W_1
	Inertia forces	1,0 D
IV. Extreme wind loading	Loads induced by the dead weight	1,0
	Applied load	1,0 P_1
	Wind load	1,2 W_2
	Inertia forces	0

Where rail clamps or similar measures are necessary to avoid out-of-service drifting, the operator's manual shall advise that they have to be applied, when the in-service wind limit has been reached.

The resistance to travel due to friction and the coefficients of friction shown in table 3 shall apply.

Table 3 — Resistance to travel and coefficients of friction

Ratio: **Resistance to travel** / **Radial load**		**Coefficient of friction between track and**	
Plain bearings	**Antifriction bearings**	**the braked wheel**	**the rail clamp** a)
0,02	0,005	0,14	0,25

a) Higher coefficients of friction may be allowed for if it can be shown that these are present at all surface conditions and qualities (e.g. oil, dirt, ice).

ICS 53.020.20

Descriptors: lifting equipment, cranes (hoists), tower cranes, specifications, operating requirements, loads (forces), stability, general conditions.

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