INTERNATIONAL STANDARD

ISO 8686-3

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Cranes — Design principles for loads and load combinations —

Part 3:
Tower cranes

Appareils de levage à charge suspendue — Principes de calcul des charges et des combinaisons de charge —

Partie 3: Grues à tour

Reference number
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Contents

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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 8686-3 was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 7, *Tower cranes.*

ISO 8686 consists of the following parts, under the general title *Cranes — Design principles for load and load combinations:*

— *Part 1: General*

— *Part 2: Mobile cranes*

— *Part 3: Tower cranes*

— *Part 4: Jib cranes*

— *Part 5: Overhead travelling cranes and portal bridge cranes*

Cranes — Design principles for loads and load combinations —

Part 3:
Tower cranes

1 Scope

This part of ISO 8686 establishes the application of ISO 8686-1 for tower cranes, as defined in ISO 4306-3, and gives specific values for factors to be used.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8686. At the time of the publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8686 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 4306-3:1991, *Cranes — Vocabulary — Part 3 : Tower cranes.*

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

ISO 8686-1:1989, *Cranes — Design principles for loads and load combinations — Part 1 : General.*

ISO 12485:—[1], *Cranes — Stability requirements of tower cranes.*

3 Definitions

For the purposes of this part of ISO 8686, the definitions given in ISO 8686-1 apply.

4 Symbols and abbreviated terms

The symbols used are described in ISO 8686-1:1989, table 1.

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[1] To be published.

5 General

The proof of competence of components shall be determined by either the limit state method or the allowable stress method as set out in ISO 8686-1.

Tower cranes which are subject to tipping and drifting shall be designed in accordance with ISO 12485.

6 Loads and applicable factors

Table 1 specifies factors Φ_n for dynamic effects which are used for load combinations listed in table 2, and also makes reference to ISO 8686-1 and other relevant International Standards.

The line numbers listed in the first column of table 1 are those shown in column 3 of table 2.

For those parts of the crane whose masses significantly decrease the resulting load effects and which have to be considered as "favourable", reduced partial load factors shall be applied.

Where the masses and their centres of gravity are determined by experiment (weighing), the factors in accordance with favourable effects 1.2.1 of table 2, line 1, shall be used.

Where the masses and their centres of gravity are calculated based on final piece lists, the factors in accordance with favourable effects 1.2.2 of table 2, line 1, shall be used.

Table 1 — Factor Φ_n for dynamic effects

Line No. in table 2	Factor Φ_n	Clause references in ISO 8686-1	Guidance on values of factors Φ_n and load factors References to other International Standards
1	Φ_1	6.1.1	$\Phi_1 = 1 \pm a$ $a = 0{,}1$ $\Phi_1 = 1$ for design against tipping
2	Φ_2	6.1.2.2	Hoisting class HC 1 with a mininum value of 1,05
	Φ_3	6.1.2.3	
3	Φ_4	6.1.3.2	$\Phi_4 = 1{,}1$ is recommended for building site cranes — Other values may be used when the rail tracks tolerances (as agreed between user and manufacturer) vary from standard
4 and 5	Φ_5	6.1.4 and annex D	When using rigid body kinetic models: $\Phi_5 = 1{,}2$ if the acceleration or braking forces are changed with stepless control systems without backlash $\Phi_5 = 1{,}5$ in other control systems where drive forces are acting on the crane practically free of backlash $\Phi_5 = 2$ where considerable backlash exists Other values for Φ_5 may be used when substantiated
6		6.1.5	Partial load factors shall be considered where appropriate
7		6.2.1.1	In-service wind in accordance with ISO 4302
8		6.2.1.2	Snow and ice loads need only be considered in special cases and then in accordance with regional conditions
9		6.2.1.3	Loads due to temperature variations need only be considered where appropriate according to regional and local conditions
10		6.2.2	Loads caused by skewing are negligible when using common undercarriages, otherwise requirements of ISO 8686-1:1989, annex F apply
11	Φ_2	6.1.2.2.2	Hoisting class HC 1
12		6.3.1	Regional out-of-service wind load-conditions in accordance with ISO 4302
13	Φ_6	6.3.2	Static test load = 1,25 × (Net load carried out in accordance with ISO 4310) Dynamic test load $\Phi_6 = 0{,}5 \times (1+\Phi_2)$
14	Φ_7	6.3.3	Buffer forces need not be considered where the travelling velocity at contact with the buffer or end stop is less than 0,7 m/s
15		6.3.4	Tilting forces shall not be considered
16	Φ_5	6.3.5	Loads caused by emergency cut-out shall have a maximum value of the factor Φ_5 of 2,0
17		6.3.6	Load caused by failure of mechanism or components shall be considered where appropriate
18		6.3.7	Excitation effects shall be considered where appropriate

Table 2 — Loads and load combinations — Tower cranes

1	2			3	4					5						6								
					Load combinations A					Load combinations B						Load combinations C								
Categories of loads	List of the loads f_i			Line No.	Partial load factors	A1	A2	A3	A4	Partial load factors	B1	B2	B3	B4	B5	Partial load factors	C1	C2	C3	C4	C5	C6	C7	C8
Regular (see 6.1)	Gravitation, acceleration, impacts	1. Mass of the crane	1.1 Unfavourable effects		1,22					1,16						1,1								
			1.2.1 Favourable effects	1	1,16	Φ_1	Φ_1	1		1,1	Φ_1	Φ_1	1			1,05	Φ_1	1	Φ_1	1		1		1
			1.2.2 Favourable effects		1,1					1,05						1,0								
		2. Mass of the gross load		2	1,34	Φ_2	Φ_3	1		1,22	Φ_2	Φ_3	1			1,1		η		1		1		1
		3. Masses of crane and hoist load travelling on uneven surface		3	1,22				Φ_4	1,16				Φ_4	Φ_4									
	Acceleration From drives	4. Masses of crane and gross load	4.1 Hoist drives excludes	4		Φ_5	Φ_5				Φ_5	Φ_5							Φ_5					
			4.2 Hoist drives includes	5	1,34			Φ_5	Φ_5	1,22			Φ_5	Φ_5		1,1								
	Displacements	5. See 6.1.5		6	1,16	1	1	1	1	1,1	1	1	1	1	1	1,05	1	1	1	1		1		1
Occasional (see 6.2)	Effects of climate	1. In-service wind loads		7						1,16	1	1	1	1	1									
		2. Snow and ice loads		8						1,22	1	1	1	1	1	1,1		1						
		3. Temperature variations		9						1,16	1	1	1	1	1	1,05		1						
	Skewing	4. See 6.2.2		10						1,16					1									
Exceptional (see 6.3)	1. Hoisting a grounded load			11												1,1	Φ_2							
	2. Out-of service wind loads			12												1,1		1						
	3. Test loads			13												1,1			Φ_6					
	4. Buffer forces			14												1,1				Φ_7				
	5. Tilting forces			15												1,1								
	6. Emergency cut-out			16												1,1						Φ_5		
	7. Failure of mechanism			17												1,1								
	8. Vibration of the crane's foundation			18												1,1								1
	Safety factor for calculating allowable stresses γ_f			19		1,48					1,34						1,22							
	Resistence coefficient γ_m			20	1,1					1,1						1,1								