भारतीय मानक

भार और भार संयोजन के लिए क्रेन के डिजाईन संबंधी सिद्धान्त

भाग 5 शिरोपरी परिवहन और पोर्टल ब्रिज क्रेन

Indian Standard

CRANES—DESIGN PRINCIPLES FOR LOADS AND LOAD COMBINATIONS

PART 5 OVERHEAD TRAVELLING AND PORTAL BRIDGE CRANES

ICS 53.020.20

© BIS 1995

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110 002

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 8686-5:1992 'Cranes — Design principles for loads and load combinations — Part 5 : Overhead travelling and portal bridge cranes', issued by International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendations of the Cranes, Lifting Chains and Its Related Equipment Sectional Committee and approval of the Heavy Mechanical Engineering Division Council.

This standard is being published in five parts. Other parts of this standard are as follows:

Part 1   General

Part 2   Mobile cranes

Part 3   Tower cranes

Part 4   Jib cranes

The text of ISO standard has been approved for publication as Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standards' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma(,) has been used as a decimal marker while in Indian Standards, the current practice is to use full stop(.) as a decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	Corresponding Indian Standard	Degree of Equivalence
ISO 4306-1:1990	IS 13473 (Part 1) : 1992 Cranes — Vocabulary : Part 1 General	Identical
ISO 8686-1 : 1989	IS/ISO 8686-1 : 1989 Cranes — Design principles for loads and load combinations : Part 1 General.	Identical

The concerned technical committee has reviewed the provisions of ISO 4302 : 1981, ISO 4310 : 1981 and ISO 8306 : 1985 referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'.

Indian Standard

CRANES—DESIGN PRINCIPLES FOR LOADS AND LOAD COMBINATIONS

PART 5 OVERHEAD TRAVELLING AND PORTAL BRIDGE CRANES

1 Scope

This part of ISO 8686 establishes the application of ISO 8686-1 to overhead travelling and portal bridge cranes as defined in ISO 4306-1, and gives specific values for the 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 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 4310 : 1981, *Cranes — Test code and procedures.*

ISO 8306 : 1985, *Cranes — Overhead travelling cranes and portal bridge cranes — Tolerances for cranes and tracks.*

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

3 Definitions

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

4 Symbols

The symbols used in this part of ISO 8686 are defined in ISO 8686-1.

5 Application of ϕ factors

5.1 The numerical values for different ϕ factors are given in table 1.

Table 1 — Loads and load combinations

1	2		3 Load combinations A					4 Load combinations B						5 Load combinations C									6
Categories of loads	Loads, f_i		Partial load factors γ_p	A1	A2	A3	A4	Partial load factors γ_p	B1	B2	B3	B4	B5	Partial load factors γ_p	C1	C2	C3	C4	C5	C6	C7	C8	Line No.
Regular (see ISO 8686-1 : 1989, 6.1)	Gravitation, acceleration, impacts	1) Mass of the lifting appliance	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	1	1
		2) Mass of the gross load	1,34	ϕ_2	ϕ_3	1	—	1,28	ϕ_2	ϕ_3	1	—	—	1,22	—	η	—	1	1	1	1	1	2
		3) Masses of lifting appliance and hoist load, travelling on an uneven surface	1,16	—	—	—	ϕ_4	1,1	—	—	—	ϕ_4	ϕ_4	1,05	—	—	—	—	—	—	—	—	3
	Acceleration from drives	4) Masses of lifting appliance and gross load a) Hoist drives excluded	1,55	ϕ_5	ϕ_5	—	—	1,48	ϕ_5	ϕ_5	—	—	—	1,41	—	—	ϕ_5	—	—	—	—	—	4
		b) Hoist drives included		—	—	ϕ_5	ϕ_5		—	—	ϕ_5	ϕ_5	—		—	—	—	—	—	—	—	—	5
	Displacements	5) See ISO 8686-1 : 1989, 6.1.5	1,16	1	1	1	1	1,1	1	1	1	1	1	1,05	1	1	1	1	1	1	1	1	6
Occasional (see ISO 8686-1 : 1989, 6.2)	Effects of climate	1) In-service wind loads						1,16	1	1	1	1	1	1,1	—	—	—	1	—	—	—	—	7
		2) Snow and ice loads						1,34	1	1	1	1	1	1,28	—	1	—	—	—	—	—	—	8
		3) Temperature variations						1,1	1	1	1	1	1	1,05	—	1	—	—	—	—	—	—	9
	Skewing	4) See ISO 8686-1 : 1989, 6.2.2						1,16	—	—	—	—	1	—									10
Exceptional (see ISO 8686-1 : 1989, 6.3)	1) Hoisting a grounded load (see ISO 8686-1 : 1989, 6.1.2.2.2)													1,22	$\hat{\phi}_2$	—	—	—	—	—	—	—	11
	2) Out-of-service wind loads													1,22	—	1	—	—	—	—	—	—	12
	3) Test loads													1,22	—	—	ϕ_6	—	—	—	—	—	13
	4) Buffer forces													1,41	—	—	—	ϕ_7	—	—	—	—	14
	5) Tilting forces													1,41	—	—	—	—	1	—	—	—	15
	6) Emergency cut-out													1,41	—	—	—	—	—	ϕ_5	—	—	16
	7) Failure of mechanism or components													1,41	—	—	—	—	—	—	ϕ_5	—	17
	8) External excitation of the lifting appliance foundation													1,41	—	—	—	—	—	—	—	1	18
	Strength coefficient γ_f		1,48					1,34						1,22									19
	Resistance coefficient γ_m		1,1					1,05						1									20
	Coefficient for high-risk applications γ_n (see ISO 8686-1 : 1989, 7.3.6)																						21

5.2 The ϕ_n factors for dynamic effects which are used for load combinations shown in table 1 are given in table 2.

Table 2 — ϕ_n factors

Table 1 line No.	ϕ_n	Reference to ISO 8686-1:1989	Values for factors ϕ_n, or values for loads, or relevant International Standards
1	ϕ_1	6.1.1	$\phi_1 = 1 \pm a, a = 0,1$
2	ϕ_2	6.1.2.2	ISO 8686-1 : 1989, hoisting classes
	ϕ_3	6.1.2.3	ISO 8686-1
3	ϕ_4	6.1.3.2 and annex D	The value of ϕ_4 shall be estimated as shown in ISO 8686-1 : 1989, annex D, if there are steps or gaps between the rails
4 and 5	ϕ_5	6.1.4 and annex E	When using rigid body kinetic models: $\phi_5 = 1,2$ if the acceleration and braking forces are changed with stepless control systems without backlash $\phi_5 = 1,5$ in other control systems where the drive forces are acting on the crane practically free of backlash $\phi_5 = 2$ where considerable backlash exists
6		6.1.5	When a displacement remains within the limiting value specified in ISO 8306, its effect can be neglected in the stress analysis
7		6.2.1.1	ISO 4302
8		6.2.1.2	Regional snow- and ice-load conditions
9		6.2.1.3	Ambient and localized temperature variations
10		6.2.2	ISO 8686-1 : 1989, annex F, may be used for guidance
11	$\hat{\phi}_2$	6.1.2.2.2	ISO 8686-1 : 1989, hoisting classes
12		6.3.1	ISO 4302
13	ϕ_6	6.3.2	ISO 8686-1 and ISO 4310
14	ϕ_7	6.3.3	ISO 8686-1
15		6.3.4	ISO 8686-1
16	ϕ_5	6.3.5	$\phi_5 = 2$
17	ϕ_5	6.3.6	$\phi_5 = 2$
18		6.3.7	ISO 8686-1

6 Hoisting classes

Some examples for the selection of hoisting classes according to ISO 8686-1 : 1989, 6.1.2.1, are given in table 3.

Table 3 — Examples

Type of crane	Hoisting class
Manual cranes	HC$_1$
Power station cranes Erection cranes Workshop cranes	HC$_2$/HC$_3$
Ship unloaders Stockyard cranes } with lifting beams, hooks or spreaders	HC$_3$
Ship unloaders Stockyard cranes } with grabs or magnets	HC$_3$/HC$_4$
Ladle cranes Open-hearth furnace charging cranes Ingot charging cranes Soaking pit cranes	HC$_3$/HC$_4$
Stripper cranes Forge cranes	HC$_4$

The examples given in table 3 represent typical applications, structural designs and hoist control systems. More flexible load bearing systems and more sophisticated speed control systems may allow the selection of a lower hoisting class than indicated in table 3. There may be cases where a higher hoisting class is appropriate.

7 Combination of acceleration effects

In the case of overhead travelling and portal bridge cranes, the load is moved by hoisting (H), travelling (Lt), traversing (Ct) and, possibly, by slewing (Sl) mechanisms. (See figure 1.)

The acceleration effects of these mechanisms acting simultaneously on the crane depend on the control systems and service conditions of the crane and whether a load is hoisted from the ground or a suspended load is hoisted.
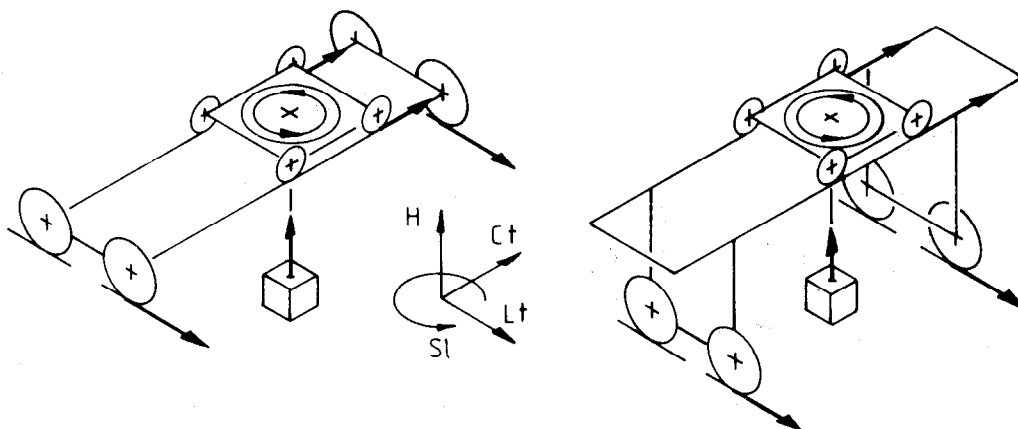

Figure 1

Taking the above into account, the accelerations given in table 4 are assumed to be acting simultaneously.

The gross loads shall be multiplied within the individual load combinations by the following factors:

— load combinations A1 and B1: ϕ_2

— load combinations A2 and B2: ϕ_3

— load combinations A3 and B3: $\left(1 + \phi_5 \times \dfrac{\Delta F}{mg}\right)$

— load combinations A4 and B4: ϕ_4

— load combination C3: ϕ_6

Drive forces can change significantly in a short time interval. Thus the accelerations shall be calculated

a) for starting the movement,

b) for braking the steady-state movement, and

c) for braking the movement during the starting process, or
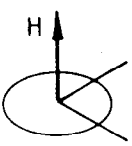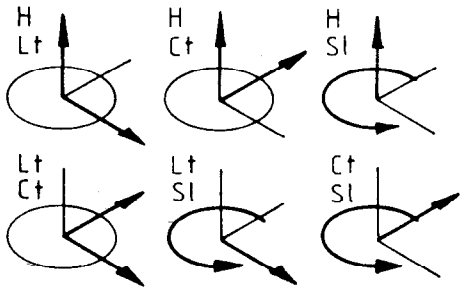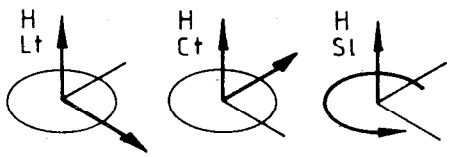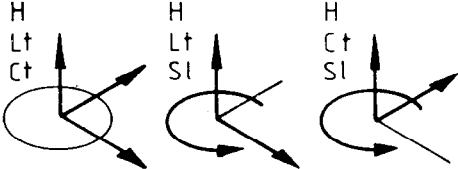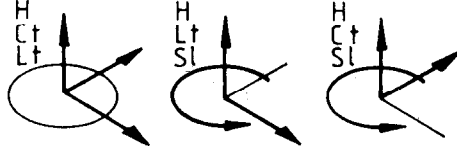
d) for accelerating the movement during the braking process (positioning).

Thus the calculated rigid body acceleration forces shall be multiplied by the factor ϕ_5 in accordance with ISO 8686-1 : 1989, 6.1.4.

When considering the positioning effects, only one such effect is combined with other movements.

In load combination C6 or C7, only the dynamic effects of the "emergency cut-out" or of the "failure of mechanism or components" shall be considered without other dynamic effects, assuming the case of starting during steady-state motion.

Table 4 — Combination of acceleration effects

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

This Indian Standard has been developed from Doc : No. HMD 14 (0338).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :　　　　　　　　　　　　　　　　　　　　　Telephone

Central　: Manak Bhavan, 9 Bahadur Shah Zafar Marg
　　　　　　NEW DELHI 110002
{ 331 01 31
{ 331 13 75

Eastern　: 1/14 C. I.T. Scheme VII M, V. I. P. Road, Maniktola
　　　　　　CALCUTTA 700054
{ 37 84 99, 37 85 61
{ 37 86 26, 37 86 62

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022
{ 60 38 43
{ 60 20 25

Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113
{ 235 02 16, 235 04 42
{ 235 15 19, 235 23 15

Western　: Manakalaya, E9 MIDC, Marol, Andheri (East)
　　　　　　BOMBAY 400093
{ 632 92 95, 632 78 58
{ 632 78 91, 632 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.