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**Cranes—Design principles for
loads and load combinations**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Health, Labour and Welfare, and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from Japan Crane Association (JCA)/Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

This Standard has been made based on **ISO 8686-1** : 1989 *Cranes—Design principles for loads and load combinations—Part 1 : General*, **ISO 8686-3** : 1998 *Cranes—Design principles for loads and load combinations—Part 3 : Tower cranes* and **ISO 8686-5** : 1992 *Cranes—Design principles for loads and load combinations—Part 5 : Overhead travelling and portal bridge cranes* for the purposes of making it easier to compare this Standard with International Standards; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Cranes—Design principles for loads and load combinations

Introduction This Japanese Industrial Standard has been prepared based on **ISO 8686-1** : 1989 *Cranes—Design principles for loads and load combinations—Part 1 : General* published in 1989 as the first edition, **ISO 8686-3** : 1998 *Cranes—Design principles for loads and load combinations—Part 3 : Tower cranes* published in 1998 as the first edition, and **ISO 8686-5** : 1992 *Cranes—Design principles for loads and load combinations—Part 5 : Overhead travelling and portal bridge cranes* published in 1992 as the first edition, with some modifications of the technical contents, and with some additions of provisions based on the crane construction standard and the mobile crane construction standard (hereafter referred to as “construction standard”) on the basis of Labor Safety and Sanitation Law.

This Standard has been established with the revision of **JIS B 8821** : 1994, to specify loads and load combinations separately as an independent standard. Portions given sidelines or dotted underlines are that in which the contents of the original International Standards have been modified and a list of modifications with the explanations is given in annex (informative).

1 Scope This Standard applies to the design of steel construction part of the crane (including mobile crane) specified in **JIS B 0146-1**. However, the use of the formulae and values other than those specified in this Standard is permitted if it can be proved by reasonable theory or experiment that they can provide at least equivalent levels of competence.

Remarks : The International Standards corresponding to this Standard are as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 8686-1 : 1989 *Cranes—Design principles for loads and load combinations—Part 1 : General* (MOD)

ISO 8686-3 : 1998 *Cranes—Design principles for loads and load combinations—Part 3 : Tower cranes* (MOD)

ISO 8686-5 : 1992 *Cranes—Design principles for loads and load combinations—Part 5 : Overhead travelling and portal bridge cranes* (MOD)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0146-1 *Cranes—Vocabulary—Part 1 : General*

JIS B 0146-2 *Cranes—Vocabulary—Part 2 : Mobile cranes*

JIS B 8821 *Specification for the design of crane structures*

JIS B 8830 *Cranes—Wind load assessment*

3 Definitions For the purposes of this Standard, the definitions given in **JIS B 0146-1** and **JIS B 0146-2** apply.

4 Type of loads

4.1 Symbols The symbols used in this Standard are as follows:

- a : effective wheelbase (m)
- F_c : centrifugal force (N)
- F_i : inertial force (N)
- g : acceleration of gravity (m/s²)
- L : span (m)
- Q : rated capacity and mass of part moving in horizontal direction (kg)
- R_s : slewing radius (m)
- R_w : wheel load (N)
- F_s : side directional force of wheel (N)
- V_c : peripheral speed (m/s)
- V_m : individual moving speed (m/s)
- W_h : hoisted load (kg)
- W_v : hoisted load and mass of moving part (kg)
- β : factor for obtaining inertial force
- δ : factor for obtaining horizontal moving load
- λ : factor of side directional force of wheel

4.2 Regular loads The loads generated on the crane during the regular operation; hoisted load and mass of the lifting appliance, the horizontal loads generated from acceleration and deceleration, and side directional force of wheel generated from skew motion of crane travelling on the rail.

4.2.1 Vertical dynamic loads The load generated from the hoisting load acting on the crane vertically. The hoisting load is the sum of rated capacity, the mass of hook block, grab bucket, lifting beam, lifting magnet and so on and the mass of lifting wire rope (add only if the lifting height is no less than 50 m).

4.2.2 Vertical static loads The load generated by the mass of the parts composing the appliance not included in the vertical dynamic load. The mass of travelling trolley and mass of loose bulk material in the hopper and on the crane are considered as vertical static loads.

4.2.3 Horizontal dynamic loads The loads generated by the forces such as inertia force, centrifugal force, side directional force of wheel generated by various movement, and the following items shall be regarded.

a) **Crane (excluding mobile crane)**

- 1) **Inertia force** The force generated by acceleration and deceleration such as traversing, travelling, luffing, slewing motion and so on, and shall be calculated by formula (1). In the case of wheel driving for traversing and travelling, 15 % of the driving wheel loads shall be the maximum value. And for slewing motion, the loads shall be regarded as being fixed at the top of jib.

$$F_i = W_v \cdot g \cdot \beta \quad \dots\dots\dots (1)$$

where, F_i : inertia force (N)

W_v : hoisting load and mass of moving part (kg)

g : acceleration of gravity (m/s²)

V_m : individual moving speed (m/s)

β : factor for obtaining inertial force (see figure 1)

$$\beta = 0.062 \sqrt{V_m} \quad \text{traversing and travelling}$$

$$\beta = 0.077 \sqrt{V_m} \quad \text{luffing}$$

$$\beta = 0.046 \sqrt{V_m} \quad \text{slewing}$$

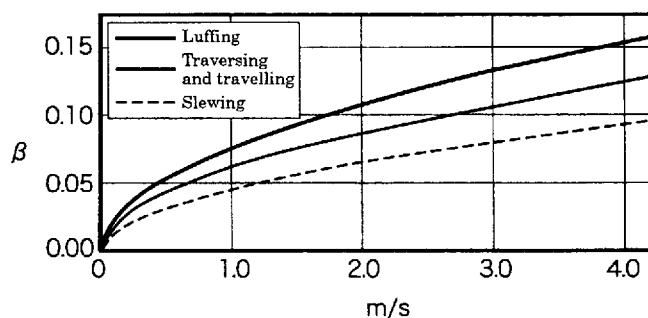


Figure 1 Factor for obtaining inertial force

- 2) **Centrifugal force** The force (component) working towards the outside in respect to the rotation generated by slewing motion, and shall be calculated by formula (2).

$$F_c = \frac{W_h \cdot V_c^2}{R_s} \quad \dots\dots\dots (2)$$

where, F_c : centrifugal force (N)

W_h : hoisting load (kg)

R_s : radius of slewing motion (m)

V_c : peripheral speed (m/s)

- 3) **Side directional force of wheel** The horizontal force generated by the ratio of span and effective wheelbase, working in the perpendicular direction to the wheel travelling direction, and shall be calculated by formula (3).

$$F_s = \lambda \cdot R_w \quad \dots\dots\dots (3)$$

where, F_s : side directional force of wheel (N)

R_w : wheel load (N)