IS 13834-1 (1994): Cranes - Classification, Part 1: General [MED 14: Cranes, Lifting Chains and Related Equipment]

BLANK PAGE

IS 13834 (Part 1) : 1994
ISO 4301-1 : 1986
(Reaffirmed 2003)

भारतीय मानक

क्रेन – वर्गीकरण

भाग 1 सामान्य

Indian Standard

CRANES — CLASSIFICATION

PART 1 GENERAL

UDC 621·87-18

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

January 1994 **Price Group 2**

Cranes, Lifting Chains and Its Related Equipment Sectional Committee, HMD 14

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 4301-1 : 1986 'Cranes and lifting appliances — Classification — Part 1 : General' issued by International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendations of 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 2 Mobile cranes

Part 3 Tower cranes

Part 4 Jib cranes

Part 5 Overhead travelling cranes and portal bridge 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 Standard' 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 a point (.) as a decimal marker.

TEXTUAL ERROR

When adopting the text of the International Standard, the textual error given below was discovered.

Reference to Error	*Text to be Modified*	*Modified Text*
Page 1 Clause 0 Para 3	— Part 4 Portal and pedestal cranes	— Part 4 Jib cranes

Indian Standard

CRANES — CLASSIFICATION

PART 1 GENERAL

0 Introduction

Cranes play a part in the handling of materials by raising and moving loads the mass of which is within their nominal capacity. There may, however, be wide variations in the duty, both for a single crane type, for example overhead travelling cranes, and between different crane types, for example between a builder's tower crane and a heavy-lift dockside crane. The design of the crane has to take account of conditions of service, in order to reach an appropriate level of safety and useful life which is in line with the purchaser's requirements. Classification is the system used to provide a means of establishing rational bases for the design of structures and machinery. It also serves as a reference framework between purchaser and manufacturer, by the use of which a particular appliance may be matched to the service for which it is required.

Classification, as defined in this part of ISO 4301, considers only the operating conditions which are independent of the type of crane and the way it is driven. Future International Standards will define which parts of the classification range are applicable to the various types of lifting appliances (i.e. overhead cranes, mobile cranes, tower cranes, hoists, etc.).

This part of ISO 4301 is one of a series covering classification of cranes and lifting appliances. The series will consist of the following parts :

- Part 1 : General.
- Part 2 : Mobile cranes.
- Part 3 : Tower cranes.
- Part 4 : Portal and pedestal cranes.
- Part 5 : Overhead travelling and portal bridge cranes.

1 Scope and field of application

This part of ISO 4301 establishes a general classification of cranes based on the number of operating cycles to be carried out during the expected life of the crane and a load spectrum factor which represents a nominal state of loading.

This part of ISO 4301 does not imply that the same method of stress calculation or testing will apply to all types of lifting appliances which come within the scope of ISO/TC 96.

2 Use of classification

Classification has two applications in practice, which although related can be regarded as separate objectives.

2.1 Classification of the appliance as a whole

The classification is first applied by the purchaser and the manufacturer of a crane, between whom agreement is necessary on the duty of the crane. The classification thus agreed constitutes the overall classification of the crane as a whole; it is intended for contractual and technical reference purposes and not for design purposes. The method of determining this classification is set out in clause 3.

2.2 Classification for design

The second purpose of classification is to provide a basis for the designer of the crane to build up his analysis of the design and to verify that it is capable of achieving the desired life under the estimated conditions of service specified for the particular application. As a person skilled in crane technology, the designer takes the estimated load spectrum data, either provided by the purchaser or predetermined by the manufacturer (as is the case in the design of serial equipment), and incorporates it into the assumptions on which his analysis is based, having regard to all other factors which influence the proportioning of components.

A load spectrum estimate form on which the appropriate data can be listed will be developed in a future International Standard.

3 Group classification of the crane as a whole

The two factors to be taken into consideration for the purposes of determining the group to which a crane belongs are the class of utilization and the state of loading.

3.1 Class of utilization

The user expects a certain number of operating cycles from the crane during its useful life, and this number of cycles is one basic parameter of classification. In certain specific tasks for which lifting appliances are used, for example bulk unloading by grab, the number of cycles can readily be derived from a knowledge of the total number of working hours and the number of operating cycles per hour. In other cases, for example mobile cranes, the number is less easy to determine because the crane is used in a variety of duties, and it becomes necessary to estimate suitable values on the basis of experience. The overall number of operating cycles is the sum total of all operating cycles during the specified life of the lifting appliance.

Determination of an appropriate life requires consideration of economic, technical and environmental factors, and should have regard to the influence of obsolescence.

The probable overall number of operating cycles is related to the frequency of use of the crane; for convenience the total range of the possible number of operating cycles has been divided into ten classes of utilization in table 1. For the purposes of classification, it is considered that an operating cycle commences when a load is ready for hoisting and ends at the moment when the crane is ready to hoist the next load.

Table 1 — Class of utilization of cranes

Class of utilization	Maximum number of operating cycles	Remarks
U_0	$1{,}6 \times 10^4$	Irregular use
U_1	$3{,}2 \times 10^4$	
U_2	$6{,}3 \times 10^4$	
U_3	$1{,}25 \times 10^5$	
U_4	$2{,}5 \times 10^5$	Regular light use
U_5	5×10^5	Regular intermittent use
U_6	1×10^6	Irregular intensive use
U_7	2×10^6	Intensive use
U_8	4×10^6	
U_9	Greater than 4×10^6	

3.2 State of loading

The second basic parameter of classification is the state of loading, which is concerned with the number of times a load of a particular magnitude, in relation to the capacity of the crane, is lifted. Four nominal values of load spectrum factor (K_p) are listed in table 2, each numerically representative of a corresponding nominal state of loading.

Where details of the numbers and masses of loads to be lifted during the design life of the crane are not known, the selection of an appropriate nominal state of loading shall be agreed between the manufacturer and purchaser.

Alternatively, where precise details are available of the magnitudes of the loads and the number of times these will be handled during the design life of the crane, the load spectrum factor for the crane as a whole may be calculated as follows.

The load spectrum factor for the crane, K_p, is given by the equation

$$K_p = \sum \left[\frac{C_i}{C_T} \left(\frac{P_i}{P_{max}} \right)^m \right] \quad \ldots (1)$$

where

C_i represents the average number of load cycles which occur at the individual load levels,

$= C_1, C_2, C_3 \ldots C_n$;

C_T is the total of all the individual load cycles at all load levels,

$= \Sigma C_i$

$= C_1 + C_2 + C_3 \ldots + C_n$;

P_i represents the individual load magnitudes (load levels) characteristic of the duty of the crane,

$= P_1, P_2, P_3 \ldots P_n$;

P_{max} is the heaviest load that may be handled by the crane (rated load);

$m = 3$

Expanded, equation (1) becomes :

$$K_p = \frac{C_1}{C_T}\left(\frac{P_1}{P_{max}}\right)^3 + \frac{C_2}{C_T}\left(\frac{P_2}{P_{max}}\right)^3 + \frac{C_3}{C_T}\left(\frac{P_3}{P_{max}}\right)^3 + \ldots + \frac{C_n}{C_T}\left(\frac{P_n}{P_{max}}\right)^3 \quad \ldots (2)$$

The nominal load spectrum factor for the crane is then established by matching the calculated load spectrum factor to the closest (higher) nominal value of K_p in table 2.

Table 2 — Nominal load spectrum factor for cranes, K_p

State of loading	Nominal load spectrum factor K_p	Remarks
Q1 — Light	0,125	Cranes which hoist the safe working load very rarely and, normally, light loads
Q2 — Moderate	0,25	Cranes which hoist the safe working load fairly frequently and, normally, moderate loads
Q3 — Heavy	0,50	Cranes which hoist the safe working load frequently and, normally, heavy loads
Q4 — Very heavy	1,00	Cranes which are regularly loaded close to the safe working load

3.3 Determination of group classification of the crane as a whole

Having determined the class of utilization from table 1 and the state of loading from table 2, the classification of the crane is determined from table 3.

The application of group classification to the design of specific types of lifting appliance will be dealt with in future International Standards.

Table 3 — Group classification of the crane as a whole

State of loading	Nominal load spectrum factor K_p	Class of utilization and maximum number of operating cycles									
		U_0	U_1	U_2	U_3	U_4	U_5	U_6	U_7	U_8	U_9
Q1 — Light	0,125			A1	A2	A3	A4	A5	A6	A7	A8
Q2 — Moderate	0,25		A1	A2	A3	A4	A5	A6	A7	A8	
Q3 — Heavy	0,5	A1	A2	A3	A4	A5	A6	A7	A8		
Q4 — Very heavy	1,0	A2	A3	A4	A5	A6	A7	A8			

4 Group classification of a mechanism as a whole

4.1 Class of utilization of a mechanism

The class of utilization of a mechanism is characterized by the assumed total duration of use in hours : ten nominal classes are given in table 4.

The maximum total duration of use may be derived from the assumed average daily utilization time in hours, the number of working days per year, and the number of years of expected service.

For this purpose, a mechanism is considered to be in use only when it is in motion.

Table 4 — Class of utilization of mechanisms

Class of utilization	Total duration of use h	Remarks
T_0	200	Irregular use
T_1	400	
T_2	800	
T_3	1 600	
T_4	3 200	Regular light use
T_5	6 300	Regular intermittent use
T_6	12 500	Irregular intensive use
T_7	25 000	Intensive use
T_8	50 000	
T_9	100 000	

The total durations of use in the second column are to be considered as theoretical conventional values only, which serve as a basis for the design of parts of mechanisms for which the utilization time is a criterion for the choice of the part (for example ball-bearings, gears and shafts). They cannot, in any circumstances, be considered as guaranteed.

4.2 State of loading of the mechanism

The state of loading specifies to what extent a mechanism is subjected to its maximum loading or only to reduced loading. There are four different nominal states of loading as shown in table 5.

The load spectrum factor for the mechanism, K_m, is given by the equation

$$K_m = \Sigma\left[\frac{t_i}{t_T}\left(\frac{P_i}{P_{max}}\right)^m\right] \quad \ldots (3)$$

where

t_i represents the average duration of use of the mechanism at the individual load levels,

$= t_1, t_2, t_3 \ldots t_n;$

t_T is the total of all the individual durations at all load levels,

$= \Sigma\, t_i$

$= t_1 + t_2 + t_3 + \ldots + t_n;$

P_i represents the individual loading magnitudes (loading levels) characteristic of the duty of the mechanism,

$= P_1, P_2, P_3 \ldots P_n;$

P_{max} is the greatest loading magnitude applied to the mechanism;

$m = 3$

Expanded, equation (3) becomes :

$$K_m = \frac{t_1}{t_T}\left(\frac{P_1}{P_{max}}\right)^3 + \frac{t_2}{t_T}\left(\frac{P_2}{P_{max}}\right)^3 + + \frac{t_3}{t_T}\left(\frac{P_3}{P_{max}}\right)^3 + \ldots + \frac{t_n}{t_T}\left(\frac{P_n}{P_{max}}\right)^3 \quad \ldots (4)$$

The nominal load spectrum factor for the mechanism is then established by matching the calculated load spectrum factor to the closest (higher) nominal value of K_m given in table 5.

4.3 Determination of group classification of the mechanism as a whole

Having determined the class of utilization and the state of loading, the group classification of a mechanism can be determined from table 6.

The application of group classification to the design of specific types of mechanisms will be covered in future International Standards.

Table 5 — Nominal load spectrum factor for mechanisms, K_m

State of loading	Nominal load spectrum factor K_m	Remarks
L1 — Light	0,125	Mechanisms subjected very rarely to the maximum load and, normally, to light loads
L2 — Moderate	0,25	Mechanisms subjected fairly frequently to the maximum load but, normally, to rather moderate loads
L3 — Heavy	0,50	Mechanisms subjected frequently to the maximum load and, normally, to loads of heavy magnitude
L4 — Very heavy	1,00	Mechanisms subjected regularly to the maximum load

Table 6 — Group classification of the mechanism as a whole

State of loading	Nominal load spectrum factor K_m	Class of utilization of mechanisms									
		T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
L1 — Light	0,125			M1	M2	M3	M4	M5	M6	M7	M8
L2 — Moderate	0,25		M1	M2	M3	M4	M5	M6	M7	M8	
L3 — Heavy	0,50	M1	M2	M3	M4	M5	M6	M7	M8		
L4 — Very heavy	1,00	M2	M3	M4	M5	M6	M7	M8			

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 stadardization, marking and quality certification of goods and attending to connected matters in the country.

Revision 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'. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No. HMD 14 (0118)

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 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43, 53 16 40 53 23 84
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

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

Printed at Printwell Printers, Aligarh, India