DRAFT INTERNATIONAL STANDARD

ISO/DIS 4301-1

ISO/TC **96**/SC **10** Secretariat: **DIN**

Voting begins on:
2015-01-26

Voting terminates on:
2015-04-26

Cranes and lifting appliances — Classification —

Part 1:
General

Grues et appareils de levage — Classification —

Partie 1: Généralités

ICS: 53.020.20

Reference number
ISO/DIS 4301-1:2014(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4301-1 was prepared by Technical Committee ISO/TC 96, *Cranes - Safety*, Subcommittee SC 10, *Design principles and requirements*.

This second edition cancels and replaces the first edition (ISO 4301-1:1986), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 4301 consists of the following parts, under the general title *Cranes and lifting appliances — Classification*:

— *Part 1: General*

— *Part 2: Mobile cranes*

— *Part 3: Tower cranes*

— *Part 4: Jib cranes*

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

Introduction

Cranes play a part in the handling of materials by raising and moving loads the mass of which is within their rated capacity. However there may be wide variations in their duty. The design of the crane has to take account of the duty in terms 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 serves as a reference framework between purchaser and manufacturer, by which a particular appliance can be matched to the intended service. It also is the system used to provide a means of establishing rational bases for the design of structures and machinery.

Cranes and lifting appliances — Classification —

Part 1: General

1 Scope

ISO 4301 establishes a general classification of cranes and mechanisms based on the service conditions mainly expressed by the total number of working cycles to be carried out during the specified design life of the crane, a load spectrum factor which represents the relative frequencies of loads to be handled and the average displacements of movements.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 4301. 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 4301 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4306 all published parts, *Lifting appliances — Vocabulary*

ISO 20332:2008, *Cranes — Proof of competence of steel structures*

3 Definitions

The definitions given in ISO 4306 apply.

4 Symbols

The main symbols used in this standard are given in Table 1.

Table 1 — Main symbols

Symbol	Description
A	Classes for group classification
C	Total number of working cycles
D	Average displacements of movements
K_p	Load spectrum factor
P	Individual load magnitudes (load levels) crane
Q_p	Classes Q of load spectrum factors Kp
U	Classes of total numbers of working cycles C

5 Use of classification

5.1 General

Classification has two applications in practice (see 5.2 and 5.3), which although related can be regarded as separate objectives.

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

5.2 Classification of crane duty

The classification is first applied by the purchaser and the manufacturer of a crane and/or load lifting attachments, between whom agreement is necessary on the duty of the crane. The classification thus agreed is intended for contractual and technical reference purposes. It is also used to specify the service conditions of cranes, load lifting attachments or components which are designed for serial manufacture, and allows such items to be selected in accordance with their intended use.

5.3 Use of classification in the design

The second purpose of classification is to provide a basis for the designer to build up his analysis of the design and to verify that the crane or component is capable of achieving the intended life under the specified service conditions of the particular application.

As a person skilled in crane technology, the designer takes the specified service conditions, either provided by the purchaser or predetermined by the manufacturer (as is the case in the design of serial equipment), and incorporates them into the assumptions on which his analysis is based, having regard to all other factors which influence the proportioning of components.

Crane operation gives rise to stress histories in crane structures, bendings in wire ropes or rolling contacts between wheels and rails. These histories may be classified for the particular component. The method of determining this classification is set out in the appropriate standards, e.g. for structures in ISO 20332.

6 Classification of crane duty for the crane as a whole

6.1 General

Crane duties are determined by the following parameters:

a) The total number of working cycles during the design life;

b) The relative frequencies of loads to be handled (load spectrum, state of loading);

c) The average displacements of movements.

When the classified ranges of parameters are used, the design shall be based on the maximum values of the parameters within the specified classes. Use of an intermediate value for a parameter is permissible, but in that case this design value shall be determined and indicated instead of the class.

6.2 Total number of working cycles

For the purpose of classification, a working cycle is a sequence of movements which commences when the crane is ready to hoist the load, and ends when the crane is ready to hoist the next load within the same task. A task can be characterized by a specific combination of crane configuration and sequence of intended movements.

In certain specific tasks for which cranes 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 total number of working cycles C is the sum total of all working cycles during the design life of the crane.

The total number of working cycles during the design life of a crane can be separated into the numbers of working cycles corresponding to several typical tasks.

The total number of working cycles is related to the frequency of use of the crane; for convenience the total range of the total number of working cycles has been divided into 10 classes of utilization in Table 2.

Table 2 — Classes U of total numbers of working cycles C

Class of utilization	Total number of working cycles C
U_0	$C \leq 1{,}6 \times 10^4$
U_1	$1{,}6 \times 10^4 < C \leq 3{,}2 \times 10^4$
U_2	$3{,}2 \times 10^4 < C \leq 6{,}3 \times 10^4$
U_3	$6{,}3 \times 10^4 < C \leq 1{,}25 \times 10^5$
U_4	$1{,}25 \times 10^5 < C \leq 2{,}5 \times 10^5$
U_5	$2{,}5 \times 10^5 < C \leq 5 \times 10^5$
U_6	$5 \times 10^5 < C \leq 1 \times 10^6$
U_7	$1 \times 10^6 < C \leq 2 \times 10^6$
U_8	$2 \times 10^6 < C \leq 4 \times 10^6$
U_9	$4 \times 10^6 < C \leq 8 \times 10^6$

6.3 State of loading

The load spectrum factor K_p is one of the parameters used to specify the duty of the crane by describing the different net loads to be handled during the working movements. The load spectrum factor is concerned with the number of times a load of a particular magnitude, in relation to the load capacity of the crane is handled.

Six nominal values of load spectrum factor are listed in Table 3, each numerically representative of a corresponding nominal state of loading.

Where details of the numbers and masses of loads to be handled 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 a task may be calculated as follows.

The load spectrum factor K_p, is given by the equation

$$\bar{X}_{ang} \tag{1}$$

where

C_i represents the average number of load cycles which occur at the individual load levels, = C_1, C_2, C_3 ... 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), = P_1, P_2, P_3 ... P_n;

P_{max} is the heaviest load (rated load for hoists) that may be handled by the crane or its mechanism;

m = 3.

Expanded, Formula (1) becomes:

$$K_p = \sum \left[\frac{C_i}{C_T} \left(\frac{P_i}{P_{max}} \right)^m \right] \tag{2}$$

Where there are several tasks r, a value K_p for all tasks is obtained from

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

where the subscript r indicates the value for the respective task r.

The 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 3.

Table 3 — Classes Q_p of load spectrum factors K_p

State of loading	Load spectrum factor K_p	Remarks on the use of crane
Q_p0	$K_p \leq 0{,}0313$	Cranes which hoist usually very light loads and the rated load very rarely
Q_p1	$0{,}0313 < K_p \leq 0{,}0625$	
Q_p2	$0{,}0625 < K_p \leq 0{,}125$	Cranes which hoist the rated load occasionally and, normally, light loads
Q_p3	$0{,}125 < K_p \leq 0{,}25$	Cranes which hoist the rated load fairly frequently and, normally, moderate loads
Q_p4	$0{,}25 < K_p \leq 0{,}50$	Cranes which hoist the rated load frequently and, normally, heavy loads
Q_p5	$0{,}50 < K_p \leq 1{,}00$	Cranes which are regularly loaded close to the rated load

6.4 Group classification

Having determined the class of utilization from Table 2 and the state of loading from Table 3, they can be combined into a single group classification for the crane as a whole. The group classification is determined from Table 4.