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**Cranes — Classification —**

Part 2:  
**Mobile cranes**

*Appareils de levage à charge suspendue — Classification —  
Partie 2: Grues mobiles*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 6, *Mobile cranes*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

This third edition cancels and replaces the second edition (ISO 4301-2:2009), which has been technically revised.

The main change compared to the previous edition is the introduction of the cycle-based classification for mobile cranes equipment following ISO 4301-1:2016.

A list of all parts in the ISO 4301 series can be found on the ISO website.

## Introduction

Mobile 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 can be wide variations in their duty. The design of the crane should 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 mobile crane 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 mobile cranes.

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# Cranes — Classification —

## Part 2: Mobile cranes

### 1 Scope

This document establishes a general classification of mobile cranes and related crane mechanisms based on the service conditions, mainly expressed by the following:

- the total number of working cycles to be carried out during the specified design life of the crane;
- the load spectrum factor which represents the relative frequencies of loads to be handled;
- the average load displacements.

This document is applicable for the work spectrum between moderate to very heavy number of work cycles as described in [Table 2](#).

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4301-1, *Cranes — Classification — Part 1: General*

ISO 4306-1, *Cranes — Vocabulary — Part 1: General*

ISO 4306-2, *Cranes — Vocabulary — Part 2: Mobile cranes*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4301-1, ISO 4306-1 and ISO 4306-2 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 4 Classification

#### 4.1 General

For the purpose of classification, a crane working cycle is a sequence of movements which begins 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.

## 4.2 Classification of the crane

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 crane 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 crane working cycles is related to the frequency of use (e.g. daily) and the intended life (in years) of the crane. For convenience, the range of the total number of mobile crane working cycles has been divided into 9 classes of utilization (see [Table 1](#)), identical to the corresponding classes in ISO 4301-1:2016.

**Table 1 — Classes of utilization (U) of total numbers of mobile crane working cycles, C**

| Class of utilization | Total number of mobile crane working cycles, C |
|----------------------|--|
| U <sub>0</sub>       | $C \leq 1,6 \times 10^4$                       |
| U <sub>1</sub>       | $1,6 \times 10^4 < C \leq 3,15 \times 10^4$    |
| U <sub>2</sub>       | $3,15 \times 10^4 < C \leq 6,3 \times 10^4$    |
| U <sub>3</sub>       | $6,3 \times 10^4 < C \leq 1,25 \times 10^5$    |
| U <sub>4</sub>       | $1,25 \times 10^5 < C \leq 2,5 \times 10^5$    |
| U <sub>5</sub>       | $2,5 \times 10^5 < C \leq 5 \times 10^5$       |
| U <sub>6</sub>       | $5 \times 10^5 < C \leq 1 \times 10^6$         |
| U <sub>7</sub>       | $1 \times 10^6 < C \leq 2 \times 10^6$         |
| U <sub>8</sub>       | $2 \times 10^6 < C \leq 4 \times 10^6$         |

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 takes into account the number of times a load of a particular magnitude, in relation to the rated capacity of the crane, is lifted.

The load spectrum factor,  $K_p$ , shall be determined in accordance with ISO 4301-1:2016, 6.3.

Having determined the class of utilization U (see [Table 1](#)) and the state of loading (see ISO 4301-1:2016, Table 3), they can be combined into a single group classification for the crane as a whole.

The classification by group of mobile cranes shall be in accordance with [Table 2](#).

The minimum group classification for mobile cranes is shown in [Table 3](#).

Table 2 — Classes A for group classification for the whole mobile crane

| State of loading class $Q_p$ | Design value of load spectrum factor $K_p$ | Class of utilization (U) and total number of work cycles |                    |                   |                    |                   |                   |                   |                   |                   |
|------------------------------|--|--|--------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                              |  | $U_0$  | $U_1$              | $U_2$             | $U_3$              | $U_4$             | $U_5$             | $U_6$             | $U_7$             | $U_8$             |
|                              |  | $1,60 \times 10^4$                                       | $3,15 \times 10^4$ | $6,3 \times 10^4$ | $1,25 \times 10^5$ | $2,5 \times 10^5$ | $5,0 \times 10^5$ | $1,0 \times 10^6$ | $2,0 \times 10^6$ | $4,0 \times 10^6$ |
| $Q_{p0}$                     | 0,031 3                                    | —  | —                  | —                 | —                  | A1                | A2                | A3                | A4                | A5                |
| $Q_{p1}$                     | 0,062 5                                    | —  | —                  | —                 | A1                 | A2                | A3                | A4                | A5                | A6                |
| $Q_{p2}$                     | 0,125 0                                    | —  | —                  | A1                | A2                 | A3                | A4                | A5                | A6                | A7                |
| $Q_{p3}$                     | 0,250 0                                    | —  | A1                 | A2                | A3                 | A4                | A5                | A6                | A7                | A8                |
| $Q_{p4}$                     | 0,500 0                                    | A1   | A2                 | A3                | A4                 | A5                | A6                | A7                | A8                | —                 |
| $Q_{p5}$                     | 1,000 0                                    | A2   | A3                 | A4                | A5                 | A6                | A7                | A8                | —                 | —                 |

NOTE 1 For other crane classes, see ISO 4301-1.

NOTE 2 Moderate to very heavy number of work cycle.

Table 3 — Minimum group classification for mobile cranes

| Crane operating conditions                                   | Service conditions | Group classification of equipment as whole |
|--|--------------------|--|
| General hook duties – not used for continuous service        | Light use          | A1   |
|  | Intermittent use   | A2   |
|  | Intensive use      | A3   |
| Equipped with bucket, grapple or magnet                      | Regular            | A3   |
|  | Intermittent use   |  |
|  | Intensive use      | A4   |
| Heavy-duty (e.g. container handling or general dock service) | Regular            | A4   |
|  | Intermittent use   |  |
|  | Intensive use      | A5   |

Design number of full load cycles are listed in ISO 4301-1:2016, Table 5.

Average displacements are determined from the average process condition of the mobile crane.

Average displacements shall be selected and classified in accordance with ISO 4301-1:2016, 6.5.

### 4.3 Classification of components and mechanisms

#### 4.3.1 General

Typical components for which classification may be applied are drives for hoisting, slewing, luffing, telescoping and travelling. The classification may be different for individual components in a particular crane and may be different for the group classification for the whole mobile crane.

The total number of component working cycles may be derived from the working cycles of the crane. There are component working cycles that occur less frequently than the working cycles of the crane, such as the following:

- a) raising/lowering the boom of a mobile crane;
- b) assembly/disassembly of a mobile crane;

c) movement of a harbour crane from one working position to another.

The total number of such operations during the design life shall be specified, either by a value or as a portion or percentage of the total number of working cycles. For convenience, the classes of utilization given in [Table 1](#) shall be used for components.

The load spectrum factor,  $K_{cp}$ , is one of the parameters used to specify the duty of the crane components. It is determined individually for each component and it describes the variation of the load effects (stresses) in the component during the component working cycles.

For hoist drives, it describes the variable loadings of the hoist drive during the working movements. For travelling, it describes the different transported masses, payload and dead weights. The load spectrum factor characterizes the number of times a load effect of a particular magnitude occurs in relation to the maximum load effect in the component.

The provisions of ISO 4301-1:2016, 6.3, shall be applied accordingly, using  $K_{cp}$  instead of load spectrum factor  $K_p$ , and classes  $Q_{cp}$  instead of  $Q_p$ .

The classification may be different for individual components in a particular crane.

A guidance for classification of mobile cranes and their components is given in [Annex A](#).

#### 4.3.2 Group classification of mechanism

Having determined the class of utilization from [Table 1](#) and the state of loading from ISO 4301-1:2016, Table 3, they can be combined into a single group classification for the crane component. The group classification is determined from [Table 2](#), using the designation  $A_c$  instead of  $A$ .

#### 4.3.3 Average displacements

A guidance on determining average displacements is given in ISO 4301-1:2016, Annex A.

#### 4.3.4 Minimum duration of use with full load

For design purposes, the minimum duration of use with full load in hours of mobile crane mechanisms shall be in accordance with [Table 4](#).

Table 4 — Minimum duration of use with full load for mobile crane mechanisms in hours

| Crane operating conditions                                   | Service conditions       | Hoist   | Slew    | Luff  | Telescoping <sup>b</sup> | Travel<br>(at work site only) |                 |
|--|--------------------------|---------|---------|-------|--------------------------|-------------------------------|-----------------|
|  |                          |         |         |       |                          | Wheel mounted                 | Crawler mounted |
| General hook duties – not used for continuous service        | Light use                | 400 h   | 200 h   | 200 h | 100 h                    | 100 h                         | 100 h           |
|  | Intermittent use         | 800 h   | 400 h   | 400 h | 200 h                    | 100 h                         | 200 h           |
|  | Intensive use            | 1 600 h | 800 h   | 800 h | 400 h                    | 100 h                         | 200 h           |
| Equipped with bucket, grapple or magnet                      | Regular Intermittent use | 800 h   | 400 h   | 400 h | 200 h                    | 100 h                         | 200 h           |
|  | Intensive use            | 1 600 h | 800 h   | 800 h | 400 h                    | 100 h                         | 200 h           |
| Heavy-duty (e.g. container handling or general dock service) | Regular Intermittent use | 1 600 h | 800 h   | 400 h | 100 h <sup>a</sup>       | 100 h                         | 200 h           |
|  | Regular Intermittent use | 1 600 h | 800 h   | 400 h | 400 h                    | 100 h                         | 200 h           |
|  | Intensive use            | 3 200 h | 1 600 h | 800 h | 800 h                    | 100 h                         | 200 h           |

<sup>a</sup> The telescoping function is not performed with a suspended load.

<sup>b</sup> The values are for stepless telescoping systems only using cylinders and ropes. The workload of stepped telescoping systems using one cylinder with a pinning system cannot be expressed in hours due to the variety of the systems.

## Annex A (informative)

### Guidance for classification of mobile cranes and their components

The following method can be used to transform a time-based classification into a cycle-based classification (ISO 4301-1:2016, Annex B) [see [Formulae \(A.1\)](#) and [\(A.2\)](#)]:

$$t_{av} = 2 \times \frac{X_{av}}{v_{av}} \quad (A.1)$$

$$C_f = \left( \frac{T_f}{t_{av}} \right) \times \left( \frac{1}{\alpha} \right) \quad (A.2)$$

where

$t_{av}$  is the average duration of a cycle (h);

$X_{av}$  is the average displacement of the load;

$v_{av}$  is the average speed of the load;

$C_f$  is the design number of full load cycles;

$T_f$  is the total duration of use under full load (h);

$\alpha$  is the drive utilization (for the hoist on mobile cranes,  $\alpha = 0,5$  can be assumed if the load is only lifted and not lowered).

#### Example 1: Mobile crane with a hoist for windmill erection

##### Assumptions

- Lifetime of a crane: 20 years
- Working days per year: 200 days
- During the lifetime the crane works 4 000 days

##### Crane parameters

- $l$  is the hoist rope length, expressed in metres (m): 1 250
- $F$  is the hoist rope linepull, expressed in kilo newton (kN): 160
- $P$  is the hoist power, expressed in kilo watts (kW): 150
- $\eta$  is the hoist efficiency including reeving: 0,7
- $v$  is the hoist rope speed, expressed in metres per seconds (m/s) or metres per minutes (m/min)
- $t$  is the time of a lift, expressed in minutes (min) or hours (h)