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ISO 4301-3

Second edition
2021-05

Cranes — Classification —

Part 3: Tower cranes

Appareils de levage à charge suspendue — Classification —

Partie 3: Grues à tour

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Contents

Page

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ISO 4301-3:2021
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Foreword

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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).

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This document was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 7, *Tower cranes*.

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This second edition cancels and replaces the first edition (ISO 4301-3:1993), which has been technically revised.

The main changes compared to the previous edition are as follows:

— new approach for the classification of tower cranes and its components has been introduced, based on ISO 4301-1:2016;

— the classification has been limited on three different types of tower cranes for construction works, as defined in ISO 4306-3:2016.

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

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.

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Cranes — Classification —

Part 3: Tower cranes

1 Scope

This document provides the classification of tower cranes for construction work as defined in ISO 4306-3, and gives specific requirements for steel supporting structure, mechanisms, ropes and further components basing on standard service conditions, mainly expressed by the following:

— the number of working cycles;

— the load spectrum factor;

— the average displacements; and

— additional values for factors to be used at the structural or mechanical calculation.

Tower cranes for construction work are exclusively equipped with a hook as load-handling device.

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For tower cranes intended to be used for other purposes and/or equipped with other load handling devices, other values according to the specified usage of the tower crane may result.

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2 Normative references

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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 4301-1:2016, *Cranes — Classification — Part 1: General*

ISO 4306-3, *Cranes — Vocabulary — Part 3: Tower cranes*

ISO 20332:2016, *Cranes — Proof of competence of steel structures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4301-1:2016 and ISO 4306-3 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 https://www.electropedia.org/

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4 Symbols

For the purposes of this document, the symbols given in ISO 4301-1:2016, ISO 20332:2016 and Table 1 apply.

Table 1 — Main symbols

Symbol	Description
A	Classes for group classification of cranes
A_c	Classes for group classification of components and mechanisms
C	Total number of working cycles
D_l	Classes for average linear displacements[a]
D_a	Classes for average angular displacements
K_p	Load spectrum factor of crane
K_{cp}	Load effect spectrum factor of component and mechanism
k_m	Stress spectrum factor of detail under consideration
l_r	Number of ropes used during design life of crane
Q	Classes Q for group classification of load or stress spectrum factor[b]
S	Classes S for group classification of stress history parameter
U	Classes U for group classification of total number of working or stress cycles

[a] For unambiguous use of the classes D, the subscript l has been added to indicate all kinds of linear motions. ISO 4301-1:2016, 6.5.2 and Table 6, apply.

[b] To allow for a general use of the Q-classes for group classification of load and stress spectrum factors the subscript p used in ISO 4301-1:2016 has been omitted.

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5 Classification of tower cranes

5.1 General

According to ISO 4306-3, tower cranes can be divided into three different types based on their general design:

— tower cranes erected from parts;

— self-erecting tower cranes;

— mobile self-erecting tower cranes.

Even if Tables 2 to 4 show similar or identical classifications today, these crane types should be displayed separately in order to identify known differences and to allow for taking future findings into account.

Therefore, it is essential to classify the crane type as a whole to specify the intended design life at first. The classification of the cranes' structural parts, mechanisms, ropes or components is then derived from this basic assumption considering statistical effects with the usage of those.

In addition, not only the A-class is specified, but also the minimum load spectrum factor (expressed by the Q-class) together with the corresponding total number of working cycles (expressed by the U-class) of the crane. These parameters describe the permissible design space and limit the use of a load spectrum factor deemed too low at the crane design (see Figure 1).

The crane classifications given in Tables 2 to 4 are appropriate for defining the minimum design requirements for the proof of fatigue strength of tower cranes for construction work and its components according to the state of the art. However, in a few special cases, it can be necessary to adjust the

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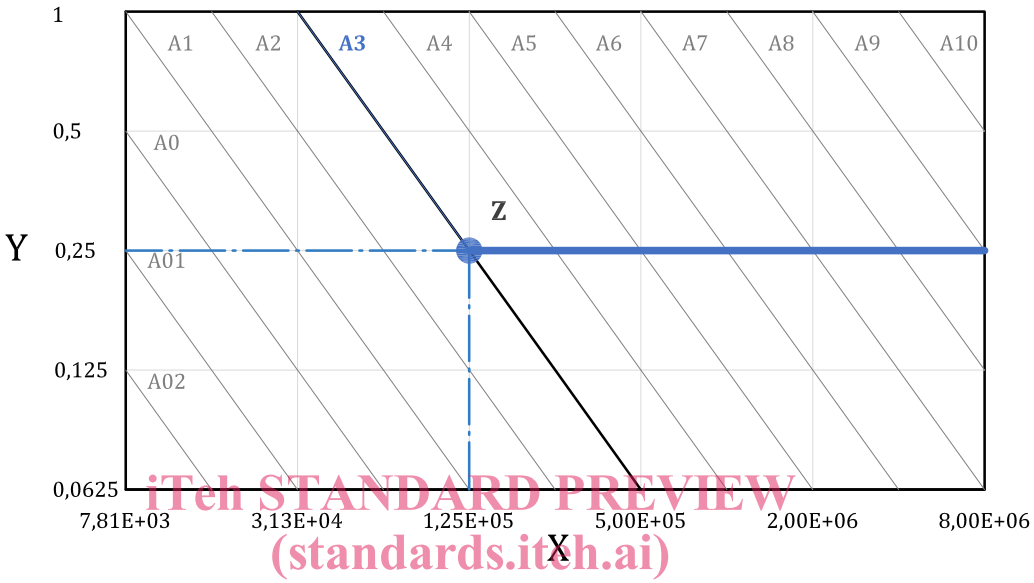
classification of the crane or its components given in this document for some types or sizes of tower cranes, due to a deviation of their service parameter compared to average values. Self-erecting tower cranes with a rated load moment greater than 1 000 kNm can be affected by such an adjustment for example.

It shall be emphasized that only the crane classification is to be considered as a minimum design requirement. The classification of the cranes structural parts, mechanisms, ropes or components is a result derived from this, in which various parameters of the crane design are incorporated. This information is thus a recommendation only.



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Key

X number of work cycles C

Y load spectrum factor Kp

Z admissible design space

ISO 4301-3:2021
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Figure 1 — Admissible design space for tower cranes erected from parts

In case of better knowledge of the service conditions of the structural detail or component under consideration, a specific classification or average displacement can be calculated. Therefore, statistical effects can also be taken into account, e.g. usage and position of a tower section inside a tower build of a tower crane erected from parts. However, this value shall always be correlated with the classification of the crane as a whole.

The average displacement in Tables 2 to 4 is considered to be the same at all levels of loading. If there are significant differences in the displacements at different load levels, e.g. short displacements under high loads and longer displacements under low loads, this may be taken into account at the estimation of the stress spectrum factor of the part or detail under verification.

Auxiliary mechanisms or ropes used for assembly or maintenance operations have a wide range of operating conditions. Especially for mobile self-erecting tower cranes, a critical review of these components is required, due to the frequency of assemblies. Hence, only the minimum component classification is given together with the U- and Q-class, but no average displacement. This value shall be specified by the designer.

A general overview on the system of group classifications including design values of spectrum factors and class limits is given in Annex A.

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5.2 Classification of tower cranes erected from parts

Table 2 gives the minimum design requirement for the classification of tower cranes erected from parts together with the recommended classification of its structural parts, mechanisms, ropes and components.

Table 2 — Classification of tower cranes erected from parts

	Design class	Spectrum class	Cycle class	Displacement class	Remark
Crane	A3	Q3	U3		
Structural crane part					
General	S2	Q3	U4		
Parts of the jib mainly loaded by hoist load	S1	Q3	U3		
Mechanisms					
Hoisting mechanism	A_c3	Q3	U3	D_l6	
Luffing mechanism	A_c3	Q3	U3	D_a1	
Slewing mechanism	A_c4	Q4	U3	D_a2	
Trolley travelling mechanism	A_c2	Q2	U3	D_l5	
Crane travelling mechanism	A_c2	Q4	U1	D_l4	
Crane travelling mechanism (quasi-stationary use)[c]	A_c0	Q4	U01	D_l4	
Auxiliary mechanism	A_c0	Q4	U01	[a]	
Ropes					
Hoisting rope	A_c3	Q3	U3	D_l6	$l_r = 4$[b]
Luffing rope	A_c3	Q3	U3	D_l5	$l_r = 4$[b]
Trolley travelling rope	A_c2	Q2	U3	D_l5	$l_r = 4$[b]
Erection rope	A_c0	Q4	U01	[a]	$l_r = 2$[b]
Stationary rope	A_c3	Q3	U3		
Rail wheels					
Rail wheels trolley travelling	A_c3	Q3	U3		
Rail wheels crane travelling	A_c3	Q3	U3		
Hook	A_c3	Q3	U3		

[a] Displacement class to be defined by the manufacturer.

[b] Recommended number of ropes used during design life of the crane.

[c] This crane travelling mechanism classification is related to infrequent use, e.g. only to change the position of the crane.

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Table 2 gives requirements for two crane travelling mechanisms for different purposes. This information shall be given to the user.

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5.3 Classification of self-erecting tower cranes

Table 3 gives the minimum design requirement for the classification of self-erecting tower cranes together with the recommended classification of its structural parts, mechanisms, ropes and components.

Table 3 — Classification of self-erecting tower cranes

	Design class	Spectrum class	Cycle class	Displacement class	Remark
Crane	A2	Q2	U3		
Structural crane part					
General	S1	Q2	U4		
Parts of the jib, tower and tie bars mainly loaded by hoist load	S0	Q2	U3		
Mechanisms					
Hoisting mechanism	A_c2	Q2	U3	D_l5	
Slewing mechanism	A_c3	Q3	U3	D_a2	
Trolley travelling mechanism	A_c1	Q1	U3	D_l5	
Crane travelling mechanism	A_c2	Q4	U1	D_l4	
Crane travelling mechanism (quasi-stationary use)[c]	A_c0	Q4	U01	D_l4	
Auxiliary mechanism	A_c0	Q4	U01	[a]	
Ropes					
Hoisting rope	A_c2	Q2	U3	D_l5	$l_r = 4$[b]
Trolley travelling rope	A_c1	Q1	U3	D_l5	$l_r = 4$[b]
Erection rope	A_c0	Q4	U01	[a]	$l_r = 2$ [b]
Stationary rope	A_c2	Q2	U3		
Rail wheels					
Rail wheels trolley travelling	A_c2	Q2	U3		
Rail wheels crane travelling	A_c2	Q2	U3		
Hook	A_c2	Q2	U3		

[a] Displacement class to be defined by the manufacturer.

[b] Recommended number of ropes used during design life of the crane.

[c] This crane travelling mechanism classification is related to infrequent use, e.g. only to change the position of the crane.

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https://standards.iteh.ai/catalog/standards/sist/61b5e72d-2fb2-40ff-bb58-695b36b34e2d/iso-4301-3-2021

Table 3 gives requirements for two crane travelling mechanisms for different purposes. This information shall be given to the user.

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5.4 Classification of mobile self-erecting tower cranes

Table 4 gives the minimum design requirement for the classification of mobile self-erecting tower cranes together with the recommended classification of its structural parts, mechanisms, ropes and components.

Table 4 — Classification of mobile self-erecting tower cranes

	Design class	Spectrum class	Cycle class	Displacement class	Remark
Crane	A2	Q3	U2		
Structural crane part					
General	S1	Q3	U3		
Parts of the jib, tower and tie bars mainly loaded by hoist load	S0	Q3	U2		
Mechanisms					
Hoisting mechanism	A_c2	Q3	U2	D_l5	
Slewing mechanism	A_c3	Q4	U2	D_a2	
Trolley travelling mechanism	A_c1	Q2	U2	D_l5	
Auxiliary mechanism	A_c1	Q4	U0	[a]	
Ropes					
Hoisting rope	A_c2	Q3	U2	D_l5	$l_r = 4$ [b]
Trolley travelling rope	A_c1	Q2	U2	D_l5	$l_r = 4$ [b]
Erection rope	A_c1	Q4	U0	[a]	$l_r = 2$ [b]
Stationary rope	A_c2	Q3	U2		
Rail wheels					
Rail wheels trolley travelling	A_c2	Q3	U2		
Hook	A_c2	Q3	U2		

[a] Displacement class to be defined by the manufacturer.

[b] Recommended number of ropes used during design life of the crane.

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