



**SLOVENSKI STANDARD**  
**oSIST prEN 14439:2021**  
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**Dvigala (žerjavi) - Stolpna dvigala**

Cranes - Tower cranes

Krane - Turmdrehkrane

Appareils de levage à charge suspendue - Grues à tour

**Ta slovenski standard je istoveten z: prEN 14439**

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## Cranes - Tower cranes

Appareils de levage à charge suspendue - Grues à tour

Krane - Turmdrehkrane

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 147.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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## European foreword

This document (prEN 14439:2021) has been prepared by Technical Committee CEN/TC 147 “Cranes - Safety”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 14439:2006+A2:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

CEN/TC 147/WG 12 “Tower Cranes” has developed a revision of this document, which differs from EN 14439:2006+A2:2009 as follows:

- integration and rules for application of EN 13001 series of standards;
- revision of 4.2 Design requirements on the load bearing structure;
- revision of 4.4.4 Access;
- integration and rules for application of EN ISO 13849-1;
- integration of mobile self-erecting tower cranes, including introduction of a new dedicated Annex B;
- revision of Annex E Additional requirements for climbing systems.

To select a suitable set of crane standards for a given application see Annex G.

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**prEN 14439:2021 (E)****Introduction**

This is a harmonized European Standard to provide one means for tower cranes to conform with the relevant Essential Health and Safety Requirements of the Machinery Directive 2006/42/EC modified.

This European Standard is a type C standard as stated in EN ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered are indicated in the scope of this document.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for cranes that have been designed and built according to the provisions of this type C standard.



## 1 Scope

This document specifies safety requirements:

- for tower cranes;
- for climbing systems for tower cranes erected from parts.

This document applies to tower cranes for construction works, which are either erected by parts or self-erecting cranes, including mobile self-erecting tower cranes. Tower cranes for construction works are exclusively equipped with a hook as load-handling device.

Applications when the crane is equipped with a grab or when there is a sudden release of the load, are not covered by this document. This document is not applicable to mobile cranes, mobile harbour cranes, crawler cranes, slewing jib cranes, bridge and gantry cranes, offshore cranes, floating cranes, loader cranes, hand operated cranes or railway cranes.

This document deals with tower cranes to be operated at ambient temperature above  $-20\text{ }^{\circ}\text{C}$ .

This document deals with significant hazards, hazardous situations and events relevant to tower cranes, it is used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer. This document specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards (see Annex A).

The significant hazards covered by this document are identified in Annex A.

This document covers hazards related to the lifting of persons using a climbing system for tower cranes as defined in Clause 3.6, 3.7 and 3.8. The lifting of persons by the tower crane itself is not included.

The requirements related to Electromagnetic compatibility (EMC), the specific hazards due to external influence on electrical equipment, potentially explosive atmospheres and ionising radiation are not covered by this document.

To improve readability, additional requirements for climbing systems are given in Annex E of this document. Additional and specific requirements for mobile self-erecting tower cranes are given in Annex G of this document.

This document is not applicable to tower cranes and climbing systems which are manufactured before the date of publication by CEN of this document.

## 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.

EN 795:2012, *Personal fall protection equipment — Anchor devices*

EN 12077-2:1998+A1:2008, *Cranes safety — Requirements for health and safety — Part 2: Limiting and indicating devices*

EN 12644-1:2001+A1:2008, *Cranes — Information for use and testing — Part 1: Instructions*

prEN 13000:2020, *Cranes — Mobile cranes*

EN 13001-1:2015, *Cranes — General design — Part 1: General principles and requirements*

EN 13001-2:2014, *Crane safety — General design — Part 2: Load actions*

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EN 13001-3-1:2012+A2:2018, *Cranes — General Design — Part 3-1: Limit States and proof of competence of steel structures*

EN 13001-3-3:2014, *Cranes — General design — Part 3-3: Limit states and proof of competence of wheel/rail contacts*

EN 13001-3-4:2018, *Cranes — General design — Part 3-4: Limit states and proof of competence of machinery — Bearings*

EN 13001-3-5:2014, *Cranes — General design — Part 3-5: Limit states and proof of competence of forged hooks*

EN 13001-3-6:2018, *Cranes — General design — Part 3-6: Limit states and proof of competence of machinery — Hydraulic cylinders*

EN 13135:2013+A1:2018, *Cranes — Safety — Design — Requirements for equipment*

EN 13557:2003+A2:2008, *Cranes — Controls and control stations*

EN 13586:2004+A1:2008, *Cranes — Access*

EN 14502-2:2005+A1:2008, *Cranes — Equipment for the lifting of persons — Part 2: Elevating control stations*

EN 17076:2020, *Tower cranes — Anti-collision systems — Safety requirements*

EN 60204-32:2008, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32)*

EN 61496 (all parts), *Safety of machinery — Electro-sensitive protective equipment*

EN 62745:2017, *Safety of machinery — Requirements for cableless control systems of machinery (IEC 62745)*

EN ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 7010:2020, *Graphical symbols — Safety colours and safety signs — Registered safety signs (ISO 7010:2019, Corrected version 2020-06)*

EN ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11203:2009, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level (ISO 11203:1995)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13856 (all parts), *Safety of machinery — Pressure-sensitive protective devices*

EN ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*

EN ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection (ISO 14119:2013)*

EN ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

ISO 3864 (all parts), *Graphical symbols — Safety colours and safety signs*

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

ISO 4301-3:2021, *Cranes — Classification — Part 3: Tower cranes*

ISO 4306-1:2007, *Cranes — Vocabulary — Part 1: General*

ISO 4306-3:2016, *Cranes — Vocabulary — Part 3: Tower cranes*

ISO 7296-3:2006, *Cranes — Graphical symbols — Part 3: Tower cranes*

ISO 7752-3:2013, *Cranes — Control layout and characteristics — Part 3: Tower cranes*

ISO 8566-3:2010, *Cranes — Cabins and control stations — Part 3: Tower cranes*

ISO 12488-1:2012, *Cranes — Tolerances for wheels and travel and traversing tracks — Part 1: General*

ISO 16625:2013, *Cranes and hoists — Selection of wire ropes, drums and sheaves*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in in EN ISO 12100, ISO 4306-1 and ISO 4306-3 and the following apply.

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

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

#### 3.1

##### **rated capacity**

maximum net load that the crane is designed to lift for a given crane configuration, radius and operating conditions

Note 1 to entry: The rated capacity is composed of the pay load plus the mass of the non-fixed load-lifting attachment(s).

**prEN 14439:2021 (E)****3.1.1****standard load chart**

rated capacity for a given crane configuration under normal operating conditions, allowing all mechanisms to operate with their maximum performance and maximum wind loading, to determine the maximum dynamic load effect

**3.1.2****special load chart**

increased rated capacity for a given crane configuration under special operating conditions, considering reduced performance of the mechanisms and reduced wind loading, but reaching the same dynamic load effect than with the standard load chart at the same crane configuration

**3.2****tower crane**

power-driven slewing jib type crane intended for the lifting of loads, with the jib located at the top of a tower which stays approximately vertical in the working position

Note 1 to entry: A tower crane is equipped with means for raising and lowering suspended loads and for the movement of such loads by changing the load-lifting radius, travelling of the load, slewing or travelling of the complete appliance. Some tower cranes perform several, but not necessarily all of these movements.

**3.2.1****tower crane erected from parts**

tower crane assembled from component parts where the design of the crane allows the crane to remain in the erected position in out-of-service conditions and to be dismantled for movement to another site

**3.2.2****self-erecting tower crane**

tower crane which is transported to site and mostly assembled without use of a separate lifting appliance, where the design of the crane allows the crane to remain in the erected position in out-of-service conditions and to be lowered for transportation to another site

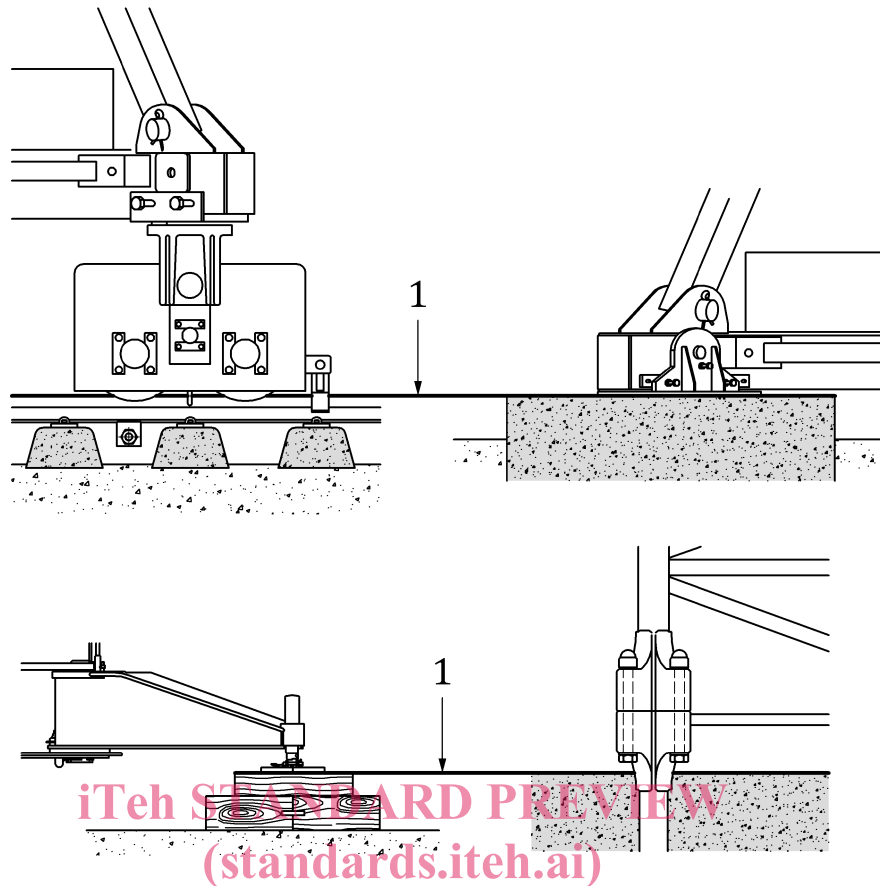
**3.2.3****mobile self-erecting tower crane**

self-erecting tower crane mounted on a self-propelled chassis and designed for a significantly lower load spectrum compared to tower cranes according to 3.2.1 and 3.2.2

**3.3****crane reference bottom level**

interface of an erected tower crane with the supporting structure or rail track (see Figure 1)

Note 1 to entry: The top level of a concrete foundation is considered the crane reference bottom level.

**Key**

- 1 crane reference bottom level

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**Figure 1** Crane reference bottom level

**3.4****working range limiting device**

set of components installed on the same crane whose combined actions enable management of prohibited zones only

[EN 17076:2020, 3.7]

**3.5****anti-collision system**

network of anti-collision devices that enable management of interference zones and/or prohibited zones, in which each anti-collision device is an input device for the other anti-collision devices within this network

[EN 17076:2020, 3.5]

**3.6****climbing system**

specific equipment optionally installed on a tower crane erected from parts to increase or to decrease the height under hook of the crane

**prEN 14439:2021 (E)****3.6.1****external climbing system**

climbing system where the tower of a crane is extended or reduced by the use of a climbing frame jacking system to add or to remove tower sections

**3.6.2****internal climbing system**

climbing system where the height of a tower crane is raised or lowered by the use of a jacking system acting directly onto the structure on which the crane is supported

**3.7****balancing moment**

moment at which the balance of the lifted components of the crane is achieved before start of the climbing operation

**3.8****deviation moment**

amount by which the balancing moment may deviate during a climbing sequence

**4 Safety requirements and/or protective measures****4.1 General**

Tower cranes and climbing systems shall comply with the safety requirements and/or protective measures of this clause. In addition, tower cranes and climbing systems shall be designed according to the principles of EN ISO 12100:2010 for hazards relevant but not significant, which are not dealt with by this document.

The classification as given in ISO 4301-3:2021 shall be used as a minimum design requirement for the proof of fatigue strength of tower cranes, its mechanisms and components.

**4.2 Design requirements on the load bearing structure****4.2.1 General**

The proof calculation (proof of strength and proof of stability) shall be done using the standards EN 13001-1:2015, EN 13001-2:2014 and EN 13001-3-1:2012+A2:2018 with requirements and recommendation of 4.2.1 to 4.2.6 of this document and corresponding to the recognized state of the art in tower crane design.

General principles of calculation shall be done according to EN 13001-1:2015. Calculations shall be based on the assumption of a deformed system in a state of equilibrium (second order theory).

**4.2.2 Crane parts classification**

Structural crane parts classification and the computational proof of fatigue strength shall be done in accordance with EN 13001-1:2015 and EN 13001-3-1:2012+A2:2018. Stress history parameters and consequently the S-classes for different structural details shall be calculated based on the specified U- and Q-classes together with the average displacements of relevant crane movements (trolley travelling, slewing).

For tower cranes, the S-class for structural details shall not be taken lower than those given in ISO 4301-3:2021.

Alternatively, in case of better knowledge of the loading conditions of the design detail under consideration, a specific stress history parameter  $s_m$  may be calculated.

### 4.2.3 Loads

#### 4.2.3.1 General

For each jib length and configuration of the tower crane, a standard load chart is determined by the crane manufacturer. Thereby all loads that are acting during the crane's life shall be considered and shall reflect unfavourable but realistic operating conditions and sequences of actions by the crane driver (see Table 1 and Table 4).

With the use of a programmable logic control, it is possible that for the same jib length and configuration of the tower crane an additional special load chart is provided by the crane manufacturer. Thereby all loads shall be considered as stated above, however it is admissible to disable a crane motion, e.g. crane travelling, which provides a significant load effect, or to modify control parameter of a crane mechanism to reduce inertia loads. Further, at a special load chart it is allowed to reduce the minimum in-service wind level according to the requirements given in Table 1.

All loads shall be defined and classified as regular loads (for load combinations A), occasional loads (for load combinations B) and exceptional loads (for load combinations C) according to EN 13001-2:2014, 4.2.

#### 4.2.3.2 Loads and values for dynamic factors $\phi_i$

Table 1 indicates loads that are generally relevant for tower cranes, and gives guidance on values for appropriate dynamic factors. All dynamic factors  $\phi_i$  shall be considered according to EN 13001-2:2014.

Alternatively other values for dynamic factors may be used when determined by recognized theoretical analysis or a practical test.

In case of a tower crane designed for a special use and/or with dedicated requirements additional loads and relevant values of dynamic factors shall be considered and defined according to EN 13001-2:2014, 4.2 and 4.3

**Table 1 — Loads and guidance on values for dynamic factors  $\phi_i$  for tower cranes**

Line number i	Load	Dyn. factor $\phi_i$	Definitions and guidance on values for dynamic factors $\phi_i$ and load determination
1	Hoisting and gravity effects acting on the mass of the crane	$\phi_1$	The value $\delta$ defined for tower cranes is: $\delta = 0,05$
2	Inertial and gravity effects by hoisting an unrestrained grounded load	$\phi_2$	Hoisting class HC1 is typical for tower cranes and shall be used, except in cases of unusually rigid structure. For load combinations A1 and B1: $\phi_{2,max} = 1,3$ For load combination C1: $\phi_2$ without limitation Due to the nature of tower cranes, only the hoist drive classes HD1 or HD4 shall be used. The classes HD2, HD3 and HD5 are not allowed to be used unless all requirements of EN 13001-2 are met.