BS EN 12077-2:2024

BSI Standards Publication

Cranes safety — Requirements for health and safety

Part 2: Limiting and indicating devices

bsi.

National foreword

This British Standard is the UK implementation of EN 12077-2:2024. It supersedes BS EN 12077-2:1998+A1:2008, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/3/1, Crane design.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Sicherheit von Kranen - Gesundheits- und Sicherheitsanforderungen - Teil 2: Begrenzungs- und Anzeigeeinrichtungen

This European Standard was approved by CEN on 17 June 2024.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

European foreword

This document (EN 12077-2:2024) has been prepared by Technical Committee CEN/TC 147 “Cranes - Safety”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2025 and conflicting national standards shall be withdrawn at the latest by January 2025.

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

This document supersedes EN 12077-2:1998+A1:2008.

In comparison with the previous edition, the following technical modifications have been made:

— updated reference documents and cross-references;

— revised grammar and linguistic consistency;

— revised the list of significant hazards and moved it to Annex A;

— revised Annex ZA and added a Bibliography;

— revised and updated Clause 3;

— revised and updated subclauses 4.2.6, 4.2.7, 4.2.9, 4.3.1, 4.3.2, 4.3.4, 4.3.5, 4.4.1.1, 4.4.1.2, 4.5.1.1, 4.5.1.3, 4.5.1.4, 4.6.1.1, 4.6.1.2, 4.7.2;

— removed subclauses 4.5.3, 4.6.2.3, 4.7.2;

— revised and updated Table 1.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

This document is a harmonized standard to provide one means for limiting and indicating devices for cranes to conform with the essential health and safety requirements of the Machinery Directive as mentioned in Annex ZA.

This document 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);

— service providers, e.g. for maintenance (small, medium and large enterprises).

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 are covered are indicated in the scope of this standard.

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

1 Scope

This document specifies general requirements for limiting and indicating devices used in cranes. These devices restrict operation or provide operational information for the operator or other persons. Specific requirements for particular types of cranes are given in the appropriate European Standard for the particular crane type.

This document does not cover erection, dismantling, or changing the configuration of a crane.

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

This document is not applicable to cranes manufactured before the date of its publication.

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 614-2:2000+A1:2008, *Safety of machinery — Ergonomic design principles — Part 2: Interactions between the design of machinery and work tasks*

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

EN 61310-1:2008, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

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

EN ISO 13849-1:2023, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2023)*

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

3 Terms and definitions

For the purposes of this document the terms and definitions given in EN ISO 12100:2010, ISO 4306-1:2007 and the following apply.

ISO and IEC maintain terminology 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/

3.1
configuration
combination of structural members, counterweights, support or outrigger position, hook block reeving and similar items assembled, positioned and erected according to manufacturers' instructions and ready for operation

3.2
continuous warning
warning that is given visually by either a flashing or uninterrupted light, or acoustic by either a pulsing or uninterrupted sound, and persists throughout the time the condition being indicated exists

3.3
control station position limiter
device to prevent movement of the powered control station beyond specified limits

3.4
derricking limiter
device to prevent the raising or lowering of a boom, jib, fly jib, "A-frame" or mast beyond specified limits

3.5
hoisting limiter
device to prevent either the load lifting attachment from being raised such that it inadvertently strikes the crane structure, or any other specified upper limitation of the load lifting attachment from being exceeded

3.6
indicator
device to provide warnings and/or data to facilitate control of the crane within its design parameters

3.7
motion limiter
device to initiate the stopping of motion or restrict crane movement

Note 1 to entry: See examples in 4.6.1.1.

3.8
overturning moment
mathematical product of the load and horizontal distance between a vertical line through the centre of gravity of a load and the corresponding tipping line

3.9
performance limiter
device to prevent a design performance characteristic from being exceeded

3.10
rated capacity
maximum net load or, for mobile cranes, hoist medium load that the crane is designed to lift for a given crane configuration and load location during operation

3.11
rated capacity indicator
device to indicate that the lifted load exceeds the rated capacity and that, in particular crane types, the lifted load approaches the rated capacity

3.12
rated capacity limiter
device to prevent the crane from handling loads in excess of its rated capacity

Note 1 to entry: Rated capacity limiter is also called a load limiter or lifting force limiter.

3.13
slack rope limiter
device to stop motion(s) in the event of the rope becoming slack

3.14
slewing limiter
device to prevent slewing beyond specified limits

3.15
telescoping limiter
device to prevent the extension or retraction of a part beyond specified limits

3.16
working space limiter
device to prevent any part of the crane from entering a prohibited space

Note 1 to entry: Working space limitation is often achieved by a combination of different limiters.

4 Safety requirements and/or measures

4.1 General

Machinery shall comply with the safety requirements and measures of Clause 4. In addition, the machine 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 standard.

4.2 Limiters and indicators

4.2.1 The crane manufacturer shall select a device compatible with the intended use of the crane, taking the following into account:

a) operating environment, e.g. temperature, relative humidity, condensation, vibration;

b) rated capacity;

c) crane characteristics;

d) electromagnetic compatibility.

4.2.2 The installation of limiters and indicators shall be carried out in a manner that does not reduce the strength of the crane.

4.2.3 The effects (e.g. forces, stopping distances) resulting from the operation of the limiter shall be within the design constraints of the crane.

4.2.4 Systems shall enable periodic functional checks to be carried out to verify that indicators are operating correctly.

4.2.5 If interruption of the power supply occurs, the settings of limiters and indicators shall be retained.

4.2.6 Limiters and indicators shall be capable of withstanding the shock loads and vibrations transmitted to them during operation, erection, dismantling and maintenance of the crane.

4.2.7 Limiters and indicators shall have legible and durable markings on or adjacent to them, preferably with symbols to indicate their function and mode of operation, and all indicators shall be compatible with ergonomic principles in accordance with EN 614-2:2000+A1:2008.

4.2.8 Painting or other corrosion protection shall not affect the functioning of limiters and indicators.

4.2.9 Limiters forming a part of a safety related control system shall be in accordance with EN ISO 13849-1:2023. The performance levels and categories used shall be those specified by the European Standards for particular crane types.

4.3 General requirement for rated capacity limiters and indicators

4.3.1 Rated capacity limiters and indicators shall be provided on all cranes having a rated capacity of 1 000 kg or above, or an overturning moment of 40 000 Nm or above due to the rated capacity (see 3.10).

4.3.2 The rated capacity limiter and indicator shall perform in accordance with this standard for all rated capacities and all the configurations described in the information for use of the crane.

4.3.3 If a crane can be operated with different configurations there shall be an indication of the crane configuration for which the rated capacity limiter and indicator has been set. Where a configuration selecting device is provided, a direct description of the configuration selected shall be provided on the device or a code which can be checked against a separate list of codes/configurations.

4.3.4 The rated capacity limiter and indicator shall be designed to operate for all configurations and positions of the crane.

4.3.5 Features shall be incorporated to minimize the risk of unintentional change of any manual setting device (e.g. by locking, double action).

4.3.6 The number of setting positions of the configuration selection device(s) shall relate to the number of configurations provided for the crane. Positions which are not utilized shall render the crane inoperative or not cause an unsafe crane condition if selected.

4.3.7 The design and installation of rated capacity indicators and rated capacity limiters shall allow for the possibility to test the crane with overloads without dismantling or permanently affecting the performance of the indicator or limiter. Where it is necessary to disconnect parts of the devices during testing, facilities shall be provided to check and/or reset the devices after the test.

4.4 Rated capacity limiters

4.4.1 General

4.4.1.1 The rated capacity limiter shall prevent the crane from operating outside of the designed limits.

4.4.1.2 The rated capacity limiter designed operating force shall be determined taking into account:

a) the static force from the rated capacity;

b) the dynamic part of the force from lifting the rated capacity;

c) the tolerance of the force to operate the rated capacity limiter.

The tolerance for the force to operate the limiter shall be specified in the appropriate European Standard for the particular crane type. The objective shall be to ensure that the rated capacity limiter operates at as close to the rated capacity as is practicable.

4.4.2 Operating requirements

4.4.2.1 When the load on the crane exceeds the rated capacity, the rated capacity limiter shall override the controls of the crane to prevent any condition that increases the overload.

NOTE Reference can be made to European Standards for particular crane types for details of motions that will increase the overload.

4.4.2.2 The rated capacity limiter shall not prevent the crane operator from returning the controls to the neutral position and initiating actions that will move the crane to a reduced loading or unloaded condition.

4.4.2.3 The rated capacity limiter, once triggered, shall continuously override the related controls until the overload has been removed and the relevant control lever has been returned to the neutral position.

4.5 Rated capacity indicators

4.5.1 Operating requirements

4.5.1.1 The rated capacity indicator shall give visual or acoustic warnings or both for all motions of the crane that induce a load in excess of the rated capacity, as shown in the information supplied by the manufacturer for the particular crane.

4.5.1.2 The rated capacity indicator shall:

a) for those cranes where the rated capacity varies according to the position of the load, warn the crane operator when the rated capacity is approached;

b) warn crane operators and persons in the danger zone when the rated capacity limiter is triggered;

c) for those cranes where a limiter override is provided, warn the crane operators and persons in the danger zone whenever the rated capacity limiter has been overridden.

4.5.1.3 When the rated capacity is approached, the rated capacity indicator shall give a preventative warning which gives the crane operator time to react to the warning and prevent the crane from being overloaded.

4.5.1.4 No provision shall be made for the crane operator to switch off a warning from the control station, except when both acoustic and visual warnings are used for the same situation, in which case the acoustic warning may have a manual reset that becomes operable after the warning has been active for 5 s. If such a manual reset is used, the warning shall automatically operate if the crane subsequently returns to a condition requiring an acoustic warning. Provision may be made to switch off the acoustic warning during calibration and testing of the crane.

4.5.2 Form of warning

4.5.2.1 Warnings for both the approach to rated capacity, in cases where it is required, and for rated capacity being exceeded shall be continuous, see 3.2. There shall be a clear difference between the warning for approach and the warning for overload, e.g. a visual warning may be one colour for the approach and another colour for overload.

4.5.2.2 Warnings shall be in accordance with EN 61310-1:2008 and Clause 10 of EN 60204-32:2008.

4.5.2.3 Visual warnings for the crane operator shall be positioned to be in full view from every control station without obscuring the crane operator's view of the load and its immediate surroundings.

4.6 Motion and performance limiters

4.6.1 Motion limiters

4.6.1.1 Any motion which has a designed restriction of movement shall be provided with motion limiters.

NOTE 1 Reference can be made to European Standards for particular crane types for further information.

NOTE 2 Examples are listed as follows: hoisting limiter, lowering limiter, slack rope limiter, slewing limiter, travelling and traversing limiter, derricking limiter, telescoping limiter, control station position limiter, working space limiter, anti-collision device.

4.6.1.2 The effect of one motion upon another shall be taken into account in the design, where that motion can cause another limit to be exceeded.

4.6.1.3 Where a motion is provided with one motion limiter, after the triggering of that motion limiter, movement in the opposite direction of the motion to a safe condition shall be possible without resetting.

NOTE Movement in the same direction is possible without resetting if the triggering condition is removed.

4.6.1.4 Where a second limiter is provided for a motion, failure of the first limiter shall result in an indication of the failure to the crane operator by means as specified in the appropriate European Standard for the particular crane type. To ensure continued safety of the crane, it shall not be possible to operate the limited motion in both directions after the second limiter has been triggered until a reset action has been carried out. This reset action shall not be available to the crane operator at the active control station. The indication and reset action are not required when the second limiter is a fixed stop designed to absorb the energy of the motion.

4.6.1.5 If two or more motions can be carried out simultaneously, the design of the motion limiters shall take into account the effects of the possible combinations.

4.6.2 Performance limiters

4.6.2.1 A motion shall have a performance limiter if:

a) the motion has a designed performance limitation;

b) there is an external force which could cause the performance limitation to be exceeded (e.g. gravity).

NOTE Examples of aspects of crane performance that can be required to be limited are speed, acceleration, deceleration.

4.6.2.2 A performance limiter is not required where the design inherently prevents performance limits from being exceeded.

4.6.2.3 If two or more motions can be carried out simultaneously, the design of the performance limiter shall take into account the effects of these combinations.

4.7 Indicators

4.7.1 Indicators shall be fitted to cranes in accordance with the requirements given in the European Standards for the specific crane types.

4.7.2 Continuous unambiguous visual, acoustic, or tactile indication shall be provided for the crane operator when required.

4.7.3 Indicators shall be in accordance with EN 61310-1:2008 and Clause 10 of EN 60204-32:2008.

4.7.4 The response time of indicators shall be appropriate to the rate of change of the indicated value.

5 Verification of the safety requirements and/or measures

5.1 Verification of limiting and indicating devices shall be generally carried out when installed on a crane. However, when applicable, individual components may be separately verified or tested (e.g. marking). Conformity to safety requirements and/or measures (given in Annex A, Table A.1) shall be verified by the methods detailed in Table 1.

Table 1 — Methods to be used to verify conformity with the safety requirements and/or measured

Clause number	Method of verification
4.2.1	Confirmation that the devices fitted are those specified by the crane manufacturer.
4.2.2	Inspection, to confirm that the device has been installed as specified by the manufacturer.
4.2.3	Test and examination, to confirm that all permitted crane movements do not cause damage to the crane.
4.2.4	Inspection and test, to confirm that the devices facilitate functional checks to be carried out.
4.2.5	Functional check, by comparing the configuration selected before and after interruption of power.
4.2.6	Inspection and examination after a period of intended use.
4.2.7	Visual inspection and functional check that markings or symbols are undamaged and unambiguous.
4.2.8	Visual inspection and functional check.
4.2.9	Visual check that the devices fitted are those specified by the manufacturer.
4.3.1	Inspection, to confirm that devices exist on cranes on or above the ratings quoted in the clause.
4.3.2	Test, to confirm that the devices fitted perform for all configurations and capacities shown in the information supplied by the manufacturer.
4.3.3	Visual check to confirm that each available configuration is indicated, and test to confirm that the details of the configurations selected match the setting of the rated capacity limiter/indicator.

Clause number	Method of verification
4.3.4	Test for operation for all configurations and positions of the crane.
4.3.5	Visual inspection and functional check.
4.3.6	Inspection, to confirm that the number of selections that can be made on the configuration selector compare with the configurations acknowledged by the manufacturer.
4.3.7	Test, to confirm that the devices can withstand the loads that the crane will be subjected to in overload testing. Where it is necessary to disconnect parts of the devices during testing, test to confirm that facilities provided to check and/or reset the devices after the test are operational.
4.4.1.1	Test, to confirm that the crane does not operate outside the limits specified.
4.4.1.2	Test, to confirm that the operating force is within the tolerance specified.
4.4.2.1	Test, by subjecting the crane to an overload condition and checking that the controls have been overridden.
4.4.2.2	Test, by subjecting the crane to an overload condition and checking that controls can be returned to the 'stop' position, and that the load can be brought to a safe position.
4.4.2.3	Test, by subjecting the crane to an overload condition and whilst maintaining this condition, checking that the related controls have been overridden until the overload is removed.
4.5.1.1	Test, by subjecting the crane to all overload conditions and checking that the specified warnings are operable.
4.5.1.2	Test, by subjecting the crane to the specified overload conditions and checking that warnings are perceivable to the operator and to persons in the danger zone.
4.5.1.3	Test, by increasing the load towards the rated capacity condition and checking if the indicator allows sufficient time for the operator to take corrective action.
4.5.1.4	Test, by checking that the warning cancellation facility is operational only under the specified conditions for use.
4.5.2.1	Test, by checking that the specified warning is continuous, and that the approach and overload warnings are perceptively different.
4.5.2.2	Inspection, to ensure that devices are in accordance with EN 61310-1:2008 and Clause 10 of EN 60204-32:2008.
4.5.2.3	Checks, to ensure that all visual warnings are within the crane operator's area of vision when at the control station.
4.6.1.1	Inspection, to check that all such motions have a motion limiter fitted.
4.6.1.2	Test, by subjecting the crane to all possible combined motions to verify that the limiter(s) are not adversely affected.
4.6.1.3	Test, by checking that the specified movement is possible.

Clause number	Method of verification
4.6.1.4	Test, by subjecting the motion to trigger both limiters and checking that the motion is inoperable until a reset action is carried out; also with the crane operator at the control station is not able to reach the reset facility.
4.6.1.5	Check to confirm that two or more motions have been taken into account in the design.
4.6.2.1, 4.6.2.2	Check that the design has justified the use of a performance limiter.
4.6.2.3	Check to confirm that two or more motions have been taken into account in the design.
4.7.1	Inspection to check that all specified devices have been fitted to the crane.
4.7.2	Inspection, by checking that the indication provided is continuous and unambiguous.
4.7.3	Inspection and test, to ensure that the devices conform to the quoted standards.
4.7.4	Test, by subjecting the crane to all relevant motions to check that continuous indicators are not hunting or oscillating, and that the response is appropriate to the rate of change of the parameter indicated.

6 Information for use

6.1 Instructions shall be provided for the protection of limiters and indicators when arc welding is carried out on the crane.

6.2 Instructions shall be provided for the actions to be taken to protect the limiter/indicator when overload testing the crane.

6.3 Warnings shall be provided to prevent excessive paint from being applied to areas impacting to operation of limiters and/or indicators.

6.4 Instructions shall be provided for the setting and the verification of the accurate setting of the limiter and indicator devices.

6.5 The particular operations to be performed with bypassing of one or more limiters shall be identified. Instructions describing the procedures for bypassing the limiters shall be given, including the safety actions to be taken during the particular operations and instructions for resetting of bypassed limiters after the particular operation is completed.

Annex A
(informative)

List of significant hazards

Table A.1 — List of significant hazards

No	Hazard	Relevant clause(s) in this European Standard
1	Mechanical hazards	
1.1	Mechanical strength	4.2.1 b), 4.2.2, 4.2.3, 4.2.6, 4.3.1, 4.3.2, 4.4.1.1, 4.4.1.2, 4.4.2.1, 4.4.2.3, 4.5.2.2, 4.6.1.1, 4.6.1.2, 4.6.1.5, 4.6.2.1, 4.6.2.2, 4.6.2.3, 4.7.4
1.8	Impact hazard	4.5.2.2, 4.6.1.1, 4.6.1.2, 4.6.1.5, 4.6.2.1, 4.6.2.2, 4.6.2.3, 4.7.4
1.13	Lack of stability	4.2.1 b), 4.3.1, 4.3.2, 4.4.1.1, 4.4.1.2, 4.4.2.1, 4.4.2.3, 4.5.2.2, 4.6.1.1, 4.6.1.2, 4.6.1.5, 4.6.2.1, 4.6.2.2, 4.6.2.3, 4.7.4
2	Electrical hazards	4.2.4, 4.2.5
6	Radiation hazards	4.2.1 d)
8	Ergonomic hazards	
8.5	Design or location of indicators and visual displays units	4.2.1 c), 4.2.7, 4.2.9, 4.3.3, 4.4.1.1, 4.4.1.2, 4.4.2.1, 4.4.2.2, 4.4.2.3, 4.5.1.4, 4.6.1.4, 4.7.2, 4.7.3, 4.7.4, 6.1, 6.2, 6.3
8.9	Human error/unauthorized actions	4.2.7, 4.2.8, 4.3.3, 4.3.4, 4.3.5, 4.3.7, 4.4.1.1, 4.4.2.1, 4.4.2.1, 4.4.2.2, 4.4.2.3, 4.5.1.4, 4.6.1.4, 4.7.2, 6.4, 6.5
12	Hazards due to assembly and installation, setting, cleaning, fault-finding, maintenance	
12.1	Maintenance	4.2.1 c), 4.2.9, 4.3.7, 4.4.2.2, 4.4.2.3, 4.5.1.4, 4.6.1.3, 6

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered

This European Standard has been prepared under a Commission's standardization request "M/396 Mandate to CEN and CENELEC for Standardisation in the field of machinery" to provide one voluntary means of conforming to essential requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2006/42/EC

The relevant Essential Requirements of Directive 2006/42/EC	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
1.1.2 (a)	4, 5, 6	
1.1.2 (c)	4, 5, 6	
1.1.2 (d)	4, 5, 6	
1.1.2 (e)	4, 5, 6	
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The relevant Essential Requirements of Directive 2006/42/EC	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
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