



SLOVENSKI STANDARD

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Nadomešča:

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Stroji za zemeljska dela - Stroji s pnevmatikami - Zahteve za krmiljenje (ISO 5010:1992, spremenjen)

Earth-moving machinery - Rubber-tyred machines - Steering requirements (ISO 5010:1992 modified)

Erdbaumaschinen - Räderfahrzeuge - Lenkvermögen (ISO 5010:1992 modifiziert)

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Engins de terrassement - Engins équipés de pneumatiques - Systèmes de direction (ISO 5010:1992 modifié)

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53.100

Stroji za zemeljska dela

Earth-moving machinery

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EUROPEAN STANDARD

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English Version

Earth-moving machinery - Rubber-tyred machines - Steering requirements (ISO 5010:1992 modified)

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This European Standard was approved by CEN on 30 November 2013.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 12643:2014) has been prepared by Technical Committee CEN/TC 151 "Construction equipment and building material machines - 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of an identical text or by endorsement, at the latest by August 2014, and conflicting national standards shall be withdrawn at the latest by August 2014.

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

Modifications to the ISO 5010:1992 text are indicated by a vertical line in the left margin of the text.

This document supersedes EN 12643:1997+A1:2008.

The main changes with respect to the previous edition are listed below:

- update of normative references;
- content list added;
- error correction in 10.3.4;
- update of Annex ZA.

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.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

EN 12643:2014 (E)**1 Scope**

This European Standard specifies steering system tests and performance criteria for evaluating the steering capability of rubber-tyred self-propelled earth-moving machines having a machine speed, determined in accordance with ISO 6014:1986, greater than 20 km/h.

It applies to tractors, loaders, backhoe loaders, excavators, dumpers, tractor-scrappers and graders equipped with either manual (unassisted) steering, power-assisted steering or fully powered steering as defined in ISO 6165:2006.

This European Standard excludes rollers, compactors and pipelayers.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 3450:2011, *Earth-moving machinery – Wheeled or high-speed rubber-tracked machines – Performance requirements and test procedures for brake systems (ISO 3450:2011)*

ISO 6014:1986, *Earth-moving machinery – Determination of ground speed*

EN ISO 6165:2006, *Earth-moving machinery – Basic types – Identification and terms and definitions (ISO 6165:2006)*

ISO 7457:1997, *Earth-moving machinery – Determination of turning dimensions of wheeled machines*

3 Terms and definitions

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For the purposes of this document, the following terms and definitions apply.

3.1**steering system**

system including all machine elements between the operator and the ground-contacting wheels participating in steering the machine

3.1.1**manual steering system**

system depending exclusively on the muscular power of the operator to effect normal steering of the machine

3.1.2**power-assisted steering system**

system employing auxiliary power source(s) to supplement the muscular power of the operator to effect steering of the machine. Without steering auxiliary power source(s), the machine can be steered with muscle power only (see 6.2.1)

3.1.3**fully powered steering system**

system in which steering is provided by steering power source(s). Without the power source(s), the machine cannot reasonably be steered with muscle power only (see 6.2.1)

3.1.4**emergency steering system**

system used to steer the machine in the event of a failure of the normal steering power source(s) or engine stoppage

3.2 steering power source

3.2.1

normal steering power source

means for providing power to effect steering in either power-assisted or fully powered steering systems, for example, hydraulic pump, air compressor, electric generator

3.2.2

emergency steering power source

means for providing power to the emergency steering system, for example, hydraulic pump, air compressor, accumulator, battery

3.2.3

failure of normal steering power source

complete and instantaneous loss of a normal steering power source output. It is assumed that not more than one failure will occur at the same time

3.3

steering control element

manual control means by which the operator provides muscular power inputs to the steering systems to effect the desired steering of the machine, including the typical steering-wheel or any equivalent manual control means

3.4

steering effort

necessary force exerted by the operator on the steering control element in order to steer the machine

3.5

steering angle

total displacement angle between the front wheels and the rear wheels as they move about one or more vertical steering axes from their normal straight-ahead condition to a turned condition

Note 1 to entry: The steering angle for multiple axle machines is determined between the wheels at the farthest forward and the farthest rearward axle.

Note 2 to entry: Ackermann steering inherently has a greater steering angle on the side of the machine towards the inside of the turn as compared to the wheels on the outside of the turn. Therefore, where Ackermann steering is involved, the location of the steering angle measurement also needs to be specified.

A steering angle accomplished by a combination of geometries incorporating Ackermann steering is included, and also requires the location of steering angle measurement to be specified.

3.6

tyre circle

outer tyre clearance diameter determined in accordance with Clause 9

3.7

working circuit pressure

that nominal pressure applied to the specific circuit by the pump(s)

4 General requirements

The following requirements apply to all steering systems within the scope of this European Standard.

4.1 The normal steering control element provided for the operator shall continue in all circumstances to be the steering control means of the operator.

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4.2 All steering systems shall be designed and installed on the machine to withstand, without functional damage, anticipated force inputs from the operator under panic conditions (see 10.1.1).

4.3 The normal steering system sensitivity, modulation and response shall be adequate to allow the skilled operator to maintain the machine consistently within the intended operating path of each operation for which the machine was designed. This shall be verified by meeting the requirements of 10.2.

4.3.1 Machines with rear axle steering shall also meet the steering stability requirements of 10.2.2.

4.3.2 Machines that have speeds in excess of 20 km/h in reverse shall have similar steering system forces, rates and duration capability in both forward and reverse. This shall be verified by system schematics or calculations. A test in reverse is not required.

4.4 Steering hydraulic circuits shall incorporate the following features:

- a) Pressure control devices as required to avoid excessive pressures in the hydraulic circuit;
- b) Hydraulic hoses, fittings and tubing with test burst pressures at least four times the working circuit pressure control device(s) for normal and emergency steering systems;
- c) Plumbing arrangement which avoids excessively tight hose bends, torsion in the installed hoses, or scrubbing and chafing of hoses.

4.5 Steering system reliability shall be enhanced by the selection and design of components arranged so that inspection and maintenance can be readily performed.

4.6 Steering system disturbances shall meet the conditions in 4.6.1 and 4.6.2.

4.6.1 Steering system disturbances due to other machine functions shall be minimised by appropriate arrangement and geometry. Flexure or travel of suspension elements, machine side inclinations or axle oscillations and steering variations due to driving and braking torques at the wheels are amongst the influences which shall be minimised by suitable system arrangement and geometry.

4.6.2 Steering system disturbances due to the influences of external forces on the machine within the applications for which the machine is designed shall not significantly affect steering control.

4.7 Power-assisted and fully powered steering systems shall meet the conditions in 4.7.1 and 4.7.3.

4.7.1 These systems should preferably be separate from other power systems and circuits. Where this is not the case, the power-assisted and fully powered steering systems shall have priority over other systems or circuits except an emergency steering system and emergency stopping system which shall be maintained at the level of performance specified in EN ISO 3450:2011.

4.7.2 If other systems (consumers) are provided with power from the normal steering power source, any failure in these systems (consumers) shall be considered the same as a failure in the normal steering power source.

4.7.3 A change in ratio between the steering control element and steered wheels is permissible after failure of the normal steering power source, provided the requirements of 10.3 are met.

4.8 For machines equipped with an emergency steering system, the system should preferably be separate from other power systems and circuits. Where this is not the case, the emergency steering devices and circuits shall have priority over all other systems or circuits except the emergency stopping system, which shall be maintained at the level of performance specified in EN ISO 3450:2011.

4.9 The operator's manual for machines equipped with an emergency steering system shall include the following information:

- a) An indication that the machine is equipped with an emergency steering system;
- b) The emergency steering capability limitations;
- c) The field test procedure for verifying that the emergency steering system is functional.

5 Ergonomic requirements

The following requirements apply to all steering systems within the scope of this European Standard.

5.1 The machine shall steer in the direction that corresponds to the direction of movement of the steering control element; i.e. steering-wheel rotation shall be such that clockwise rotation will turn the machine to the right; counterclockwise rotation will turn the machine to the left.

5.2 Steering effort as defined in 3.4 shall be as low as practicable and shall not exceed the values in 5.2.1 and 5.2.2.

5.2.1 Steering effort for normal steering systems shall not exceed 115 N when specified for the steering tests described in Clause 10.

5.2.2 Steering effort for emergency steering systems shall not exceed 350 N for the steering tests described in Clause 10.

5.3 Steering control element movement to produce a given result shall not vary more than 25 % between right and left turns up to a 30° steering angle. This may be shown by calculations. For Ackermann steering, this angle applies to the wheels towards the inside of the turn.

5.4 When continued moving of the steering control element is required to continue changing the steering angle, it is desirable to make steering control movement for a given steering angle change greater in the vicinity of the straight-ahead position, such as is commonly achieved with variable rate worm steering gears.

6 Performance requirements

6.1 Normal steering

Steering effort (see 3.4) for normally operating systems, whether manual, power-assisted, or fully powered, shall not exceed 115 N when negotiating the test course described in 10.2.3 and 10.4.2.

6.2 Emergency steering: power-assisted steering

6.2.1 Steering effort (see 3.4) shall not exceed 350 N during the emergency steering tests in 10.3.5, 10.3.6 and 10.4.5. If this requirement is not met, the steering system shall be classified and tested as a fully powered steering system.

6.2.2 A warning device indicating a normal steering power source failure is required. This warning device shall be audible or visual, and shall be activated by failure of the normal steering power source. However, no emergency steering power source or warning device is required provided that the emergency steering capability remains within the limits of 6.2.1, regardless of time or number of steering applications, and that either a significant increase in steering effort or a significant increase in steering wheel movement for a given amount of steering gives a definite indication to the operator of normal steering power source failure.

6.2.3 This emergency steering system shall also function with reverse machine movement if the maximum rated speed in reverse exceeds 20 km/h.