SLOVENSKI STANDARD
SIST EN 13524:2004+A2:2014

01-april-2014

Nadomešča:
SIST EN 13524:2004+A1:2009

Stroji za vzdrževanje avtocest - Varnostne zahteve

Highway maintenance machines - Safety requirements

Maschinen für den Straßenbetriebsdienst - Sicherheitsanforderungen

Machines de maintenance des routes - Exigences de sécurité

Ta slovenski standard je istoveten z: EN 13524:2003+A2:2014

ICS:

43.160	Vozila za posebne namene	Special purpose vehicles
93.080.99	Drugi standardi v zvezi s cestnim inženiringom	Other standards related to road engineering

SIST EN 13524:2004+A2:2014 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13524:2003+A2

February 2014

ICS 43.160; 93.080.99

Supersedes EN 13524:2003+A1:2009

English Version

Highway maintenance machines - Safety requirements

Machines de maintenance des routes - Exigences de sécurité

Maschinen für den Straßenbetriebsdienst - Sicherheitsanforderungen

This European Standard was approved by CEN on 6 December 2002 and includes Amendment 1 approved by CEN on 24 November 2008 and Amendment 2 approved by CEN on 24 November 2013.

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (EN 13524:2003+A2:2014) 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of an identical text or by endorsement, at the latest by August 2014, and conflicting national standards shall be withdrawn at the latest by August 2014.

This document includes Amendment 1, approved by CEN on 2008-11-24 and Amendment 2, approved by CEN on 2013-11-24.

This document supersedes [A2] EN 13524:2003+A1:2009 [/A2].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [/A1] and [A2] [/A2].

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 EC Directive(s).

[A1] For relationship with EU Directive(s), see informative [A2] Annex ZA, which is an integral part [/A2] of this document. [/A1]

The Annex A is informative and contains „Attachment plate of truck“. The Annex B is normative and contains “Stipulations on the design and testing of mowing and mulching machines”.

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.

0 Introduction

This European Standard is a Type C-standard as stated in [A1⟩ EN ISO 12100 ⟨A1].

[A1⟩ 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 machines that have been designed and built according to the provisions of this type C standard.

The machinery concerned and the extent to which hazards, hazardous situations and events are indicated in the scope of this European Standard. ⟨A1]

1 Scope

This European Standard applies to machines used for highway maintenance which are attached to or mounted on carrier vehicles and which are defined in clause 3. Directives and standards for the vehicular truck chassis aspect, termed 'carrier vehicle' in this standard, would be those relevant to that equipment, even where specific modifications have been made to adapt the machines for highway maintenance application. The use in public road traffic is governed by the national regulations.

This European Standard deals with all significant hazards identified through a risk assessment pertinent to highway maintenance machines, when they are used as intended and under the conditions foreseen by the manufacturer (see clause 4). This European Standard does not deal with significant hazards associated with [A1⟩ *deleted text* ⟨A1] EMC. This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards associated with machine operation, setting and adjustments, load discharge and routine maintenance.

This European Standard does not include requirements for the carrier vehicles (e.g. trucks, tractors, construction machines, industrial trucks) as well as their demountable bodywork. These are covered in directives related to the construction of vehicles. Demountable bodywork systems are specified in other standards.

This European Standard does not deal with:

— walker-operated an hand-held machines;

— machines for the maintenance of sports grounds;

— machines for agriculture, horticulture and forestry;

— winter-service machines;

— street-cleansing machines, except sweepers [A2⟩ *deleted text* ⟨A2];

— earth-moving machinery;

— pit and sewer cleaning vehicles/-machines;

— lifting platforms;

— refuse-collecting vehicles;

— bridge-inspection equipment;

— loading cranes;

— wood-choppers (bush wood choppers).

A machine which is a combination of several parts with different uses should conform to all the standards referring to the corresponding parts of the machine.

This European Standard does not deal with the risks associated with the operation of machines in potentially explosive atmospheres.

This standard applies to machines manufactured after the date of approval of this standard through CEN.

2 Normative references

[A1] The following referenced documents are indispensable for the application 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. [A1]

[A1] *deleted text* [A1]

[A2] EN 953:1997+A1:2009 [A2], *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

[A2] *deleted text* [A2]

[A1] *deleted text* [A1]

[A2] EN ISO 2867:2011, *Earth-moving machinery — Access systems (ISO 2867:2011)* [A2]

[A2] EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)* [A2]

[A2] EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)* [A2]

[A1] [A2] EN ISO 13732-1:2008 [A2], *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)* [A1]

[A2] ISO 536:2012, *Paper and board — Determination of grammage* [A2]

[A2] ISO 730:2009, *Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2N, 2, 3N, 3, 4N and 4* [A2]

[A2] ISO 789-1:1990, *Agricultural tractors — Test procedures — Part 1: Power tests for power take-off*

ISO 1974:2012, *Paper — Determination of tearing resistance — Elmendorf method* [A2]

ISO 2758:2001, *Paper — Determination of bursting strength*

[A2] *deleted text* [A2]

[A2] ISO 6405-1:2004, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols* [A2]

[A1] ISO 6750:2005 [A1], [A2] *Earth-moving machinery — Operator's manual — Content and format* [A2]

[A1] *deleted text* [A1]

[A1] ISO 11001-1:1993, *Agricultural wheeled tractors and implements — Three-point hitch couplers — Part 1: U-frame coupler*

ISO 11001-2:1993, *Agricultural wheeled tractors and implements — Three-point hitch couplers — Part 2: A-frame coupler*

ISO 11001-3:1993, *Agricultural wheeled tractors and implements — Three-point hitch couplers — Part 3: Link coupler*

ISO 11001-4:1994, *Agricultural wheeled tractors and implements — Three-point hitch couplers — Part 4: Bar coupler* [A1]

3 Terms and definitions

[A1] For the purposes of this document, the terms and definitions given in [A2] EN ISO 12100:2010 [A2] and the following apply. [A1]

3.1
machine for highway maintenance
machine situated at the traffic surface which, from this position, prepares the traffic surface and its neighbouring areas

3.2
traffic surface
paved area where there is vehicular and/or pedestrian traffic. Not included are rail tracks which are solely for rail-mounted traffic, and traffic areas inside buildings and in underground mines

3.3
mulching machine
machine for reducing and/or shredding vegetation, working in a direction of motion substantially parallel and close to the ground

3.4
mowing machine
machine for cutting vegetation, working in a direction of motion substantially parallel and close to the ground

3.5
hedge-cutting machine
machine for cutting vegetation that operates not only close to the ground but can be used also, for example, for cutting hedges

3.6
verge mower
machine for removing growth on verges

[A2] *deleted text* [A2]

[A2] **3.7** [A2]
cleansing machine
machine for cleaning highway equipment such as delineators, traffic signs, tunnel walls

[A2] *deleted text* [A2]

[A2] **3.8** [A2]
boom
equipment that is located between the carrier vehicle and a machine listed under [A2] 3.3 to 3.7 [A2], serving as positioning devices

3.9
operating area
operating area is that area in or immediately around the machine within which the work procedures are carried out (e.g. mowing of vegetation)

4 List of significant hazards

This clause contains all hazards and hazardous situations as far as they are dealt with in this European Standard, identified by risk assessments significant to this type of machinery that require action to eliminate or reduce risk.

Table 1 — List of significant hazards

	Hazards	Location of hazard	relevant for machine	Dealt with in clause
1.1	Crushing hazard	Persons in danger zone Coupling area of machines	all all	5.5 5.16 5.7
1.2	Shearing hazard	Operating area of rotating/oscillating tools; Moving elements; Slewing area of machines and machine parts	all	5.16
1.3	Cutting or severing hazard	Operating area of cutting machinery	3.4 3.5	5.16
1.4	Entanglement hazard	Operating area of rotating machinery; Rotating or oscillating machine parts	all	5.16
1.5	Drawing-in or trapping hazard	Operating area of rotating machinery; Rotary or oscillating machine parts	all	5.16
1.6	High pressure fluid ejection or ejection hazard	Power transmission lines	all	5.13.1 5.13.2
2	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	Engine cooling systems; Exhaust system	all	5.6
3	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	Workplace	3.3 3.4 3.6 3.7 *deleted text*	6
4	Human error, human behaviour	Operating area of the machines	all	6
5	Inadequate design, location or identification of manual controls	Operating area of the machines	all	5.3 5.15

6.1	Failure/disorder of the control system	Operating area of the machines	all	5.9 5.12
6.2	Restoration of energy supply after an interruption	Operating area of the machines	all	5.15 6
7	Falling or ejected objects or fluids	Operating area of rotating machinery	3.3 3.4 3.6 *deleted text*	5.14 5.16
8	Hazards generated by noise, resulting in:		all	
8.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)		all	5.18
8.2	Interference with speech communication, acoustic signals etc.		all	5.18
9	Hazards generated by vibration		all	
9.1	Whole body vibration, particularly when combined with poor postures		all	5.19
10	Loss of stability/overturning of machinery	Impermissible combinations; Supporting equipment	all all	5.2 5.11
11	Slip, trip and fall of persons (related to machinery)	Access steps	3.8	5.4
12	Movement without all parts in a safe position	Movable machine parts	all	5.10 5.11

5 Safety requirements and/or measures

5.1 General

The machines shall comply with the safety requirements and/or measures of this clause. In addition the machines shall be designed to comply with the requirements of EN ISO 12100 for hazards that are relevant but not significant and therefore are not dealt with in this standard.

For the application of the reference standards *deleted text* EN 953, EN ISO 4413, EN ISO 4414 and EN ISO 13732-1 which are used in this standard, the manufacturer shall carry out an adequate risk assessment relating to those requirements for which a special safety measure or category is necessary.

NOTE This specific risk assessment should be part of the general risk assessment relating to the hazards not covered by this standard.

Where the means of reducing the risk is by a safe system of working the machinery, the manufacturer shall include in the Information for use details of the system and of the elements of training required by the operating personnel.

5.2 Combination of carrier vehicle and machine for highway maintenance

The design of the highway maintenance machines shall conform to the requirements of the carrier vehicle defined by its manufacturer.

[A1] The assembled machine (carrier vehicle and the attached machine(s)) shall not cause any deterioration in safety provisions such as braking, operator's view, stability during transportation, assembly, use, dismantling and any other action. [A1]

5.3 Controls

a) Controls of command devices which require a float setting or pressure setting.

   Controls for elevating and slewing devices shall be designed so that they automatically return to zero position when released. This does not apply to elevating devices that necessitate a float or pressure position or a proportional control according to their function and also does not apply to continuously operating mechanisms such as hydraulic motors.

b) Protection against actuation of controls by unauthorized person.

   Controls shall be lockable by the operator when leaving the workplace by the use of:

   — guards, or,

   — mechanical locking means, or,

   — locking through key-operated switches.

c) Controls shall be positioned outside of the hazard zone. Hazardous conditions that are not protected shall be observable by the operator during the operation of the controls.

5.4 Access and walkways

Where equipment requiring regular access and walking on is inaccessible from the ground level, access ladders, walkways and standing areas complying with EN ISO 2867 shall be provided.

The bottom step or rung of a ladder shall not be more than 650 mm away from the ground level.

5.5 Precautions against hazards caused by moving parts

Hazards from moving parts shall be avoided by construction. Access to moving parts shall be prevented by the use of covers conforming to EN 953.

If there is a possibility of danger occurring as a result of the operation of the machine or machine components in normal use, no persons shall remain within the danger zone. The manufacturer shall fit warning notices that are easily visible from outside the danger zone, and shall make specific reference to the hazard in the information for use.

The danger zone shall be visible to the operator, either directly or by the provision of suitable measures, and information shall be provided in the Information for use.

5.6 Hot surfaces

Temperatures of surfaces of machinery with which the operator may come into contact shall conform to [A1] EN ISO 13732-1 [A1]. This shall be achieved by the use of guards (e.g. perforated plates placed in front of or around the hot surfaces) or be positioned to avoid unintended risk of contact. Where guarding is impractical, e.g. engine radiator caps, adequate warning signs shall be employed advising on the nature of the risk and avoidance measures shall be described in information for use.

5.7 Attachment fittings

Attachment fittings on highway maintenance machines shall be designed so that during the actual coupling and de-coupling action nobody is required to be in the hazard zone between the components concerned.

This requirement is satisfied by attachment fittings designed in conformity with Annex B (for front fittings by adapter plates), or with [A2] ISO 730 [A2] in conjunction with ISO 11001 (for front and rear attachments respectively using three-point linkage).

5.8 Safety mechanisms for changing machines

Safety mechanisms shall be designed to be positively locking and shall be permanently fixed to the machine.

5.9 Lifting devices

a) Lifting devices when used as intended shall prevent any unintended lowering of the load[1)].

This requirement shall be achieved by the provision of:

— non-return valves or a corresponding function in the control valves of hydraulic or pneumatic lifting devices, or;

— self-locking driving gear or an automatic drop-latch arrangement with a ratchet wheel for mechanical winches, or;

— a control valve as a back-run safety mechanism.

b) Where persons have to stand under raised or tilted machines or components thereof as part of the working procedure[2)] unintended lowering shall be prevented. This can be achieved, for example, by:

— automatically engaging mechanical locks, or;

— externally unlocking non-return valves mounted directly on the lifting cylinder, or;

— mechanical safety mechanisms which are operated from outside of the danger zone.

c) Power-driven lifting devices shall not permit equipment to fall freely in an uncontrolled manner.

In hydraulic or pneumatic systems, this requirement is satisfied when the reverse flow is restricted e.g. by a non-return valve or an appropriately sized orifice.

d) Back-run safety mechanisms and devices to protect lifting mechanisms against free-fall shall be so designed to ensure that any interference is possible only with the aid of tools.

e) Demounting devices for demountable bodywork and components shall be designed and constructed to safely support the equipment during the mounting or demounting process.

Power-driven devices shall have a suitable form of synchronisation for the individual lifting elements of supporting equipment. Where these lifting elements are controlled independently of each other, there shall be a locking means for each lifting element (e.g. shut-off valve on the hydraulic cylinder). Where manual jacking systems are used, such as screw jacks, helix angles shall be such that friction locking occurs in any position of the handwheel.

[A2]

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1) Unintended lowering is when a load runs back or descends because of an interruption or an irregularity in the energy supply.

2) The term “as part of working procedure” does not cover repair work.

5.10 Transportation

5.10.1 General ⟨A2

Machines and movable components shall be provided with means to prevent unintended movements during transportation. The manufacturer shall include details of these means in the Information for use.

A2⟩

5.10.2 General requirements

Parts of the machinery which have to be folded or moved for transportation purpose (e.g. articulated hydraulic arm) shall be designed in such a way that they can be immobilised in order to avoid unexpected movement during transportation.

In order to facilitate the removal and installation, the machine shall have appropriate devices for lifting and/or handling (e.g. lifting anchorage point(s), fork-lift device).

NOTE The attachment point can be a hole or an eye.

5.10.3 Location of attachment point(s)

The lifting attachment point(s) shall be so located in such a way that damage of the lifting accessories due to sharp edges, etc. is avoided when the machine is lifted according to the manufacturer's instructions.

If it is not possible, a specific procedure for lifting shall be described in the operator's manual (e.g. appropriate edges protectors).

The lifting attachment points shall be designed in such a way that they will prevent any unintended movement of the lifted part of the machine, taking into account the position of the centre of gravity and the lifting procedure.

5.10.4 Identification of lifting attachment points

Lifting attachment points shall be identified adjacent to the points using ISO 6405-1:2004, symbol 7.23, preferably with contrasting colour.

Lifting attachment points can also be painted in colour contrasting with the rest of the machinery unit. ⟨A2

5.11 Support equipment for machines and components

Means of support shall be designed and positioned or be able to be positioned so that the machine can be safety supported on level, stable ground.

Means of support shall be connected to the machine by means of positive engagement.

The distance between the support legs shall be dimensioned to permit safe movements of the carrier vehicle during the mounting and demounting process.

Where the means of support cannot carry the gross overall weight of the demounted machine (structural weight plus effective load) it shall be clearly marked with the maximum load which can be supported.

Warning signs that draw attention to the need to check that the load to be supported does not exceed the maximum load that can be supported shall be fixed visible to the operator.

Means of support employed for moving the machinery when demounted shall be fitted with equipment that prevents any unintentional rolling away when unattended.

The manufacturer shall provide advice on safe working practices for the use of the means of support in the information for use.

5.12 Disconnectable power and signal-transmitting systems

Disconnectable power and signal-transmitting systems shall be provided with connecting elements fit for their operating environment. Disconnectable hydraulic fluid power systems shall be provided with suitable, self-sealing coupling elements. If several coupling elements are closely grouped in a location, it shall be ensured that incorrect connections do not give rise to a hazardous situation. This can be achieved, for example, by providing non interchangeable connections or by using unambiguous, permanent markings.

5.13 Requirements for fluid power systems

5.13.1 Hydraulic systems

Hydraulic systems shall be designed and components selected in conformance with [A2⟩ EN ISO 4413 ⟨A2].

5.13.2 Pneumatic systems

Pneumatic systems shall be designed and components selected in conformance with [A2⟩ EN ISO 4414 ⟨A2].

5.14 Special protection against parts being ejected

Machines shall be provided with protective methods to prevent parts being ejected uncontrollably by rotating tools [A2⟩ towards the operator and ⟨A2] into traffic areas where there is [A1⟩ vehicular and/or pedestrian ⟨A1] traffic.

For mowing and mulching machines, the testing method and verification means given in annex B shall be used.

5.15 Controls for machines using revolving/oscillating tools

It shall be possible to stop revolving or oscillating tools whilst the power source remains running and to prevent the tools from being accidentally re-started. As appropriate to their operational possibilities, controls for switching machines on and off and for controlling such machines shall be arranged in such a way that they are easily and safely accessible from the machine operator's position.

5.16 Protective covering of moving parts

Rotating or oscillating machine parts (e.g. tools) on highway maintenance machines shall be protected against unintentional contact by means of guards which conform to EN 953.

Wherever it is impracticable to cover moving parts, e.g. in the case of revolving brushes, tools, rod assemblies etc., appropriate warning signs shall be provided indicating the type of danger and the measures to be taken to avoid it.

The operating area of blade arms shall be covered in the transport position.

5.17 Special protection measures to prevent unintentional contact with revolving tools in the operating area of mowing and mulching machines

Taking into account the necessity to be able to carry out mowing and mulching operations in the direct vicinity of fixed obstacles (e.g. delineators, traffic signs), the protective equipment shall be designed as follows.

a) Guard on mowing and mulching machines in the direction of feeding and ejecting

Guards in the direction of feeding and ejecting, e.g. deflector bar, shall be arranged as shown in Figure 1. The spacing shall be measured from the path of rotation of the tools, where the mulching or mowing machine is in the operating position.