



BSI Standards Publication

Earth-moving machinery — Safety

Part 1: General requirements

National foreword

This British Standard is the UK implementation of EN 474-1:2006+A6:2019, incorporating corrigendum March 2014. It supersedes BS EN 474-1:2006+A5:2018, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

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The UK participation in its preparation was entrusted to Technical Committee B/513/1, Earth moving machinery (International).

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English Version

Earth-moving machinery - Safety - Part 1: General requirements

Engins de terrassement - Sécurité - Partie 1:
Prescriptions générales

Erdbaumaschinen - Sicherheit - Teil 1: Allgemeine
Anforderungen

This European Standard was approved by CEN on 1 October 2017 and includes Amendment 6 approved by CEN on 9 August 2019.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (EN 474-1:2006+A6:2019) 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of an identical text or by endorsement, at the latest by April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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 includes Corrigendum 1 issued by CEN on 2014-03-05, Amendment 1, approved by CEN on 2009-01-04, Amendment 3, approved by CEN on 2013-01-06, Amendment 4, approved by CEN on 2013-08-10, Amendment 5, approved by CEN on 2017-10-01 and Amendment 6, approved by CEN on 2019-08-09.

This document supersedes A6 EN 474-1:2006+A5:2018 A6.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1 and A3 A3 and A4 A4 and A5 A5 and A6 A6.

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags AC AC.

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.

A1 For relationship with EU Directive(s), see A3 informative Annex ZA A3, which is an integral part of this document. A1

EN 474 “Earth-moving machinery — Safety” comprises the following parts:

- *Part 1: General requirements*
- *Part 2: Requirements for tractor-dozers*
- *Part 3: Requirements for loaders*
- *Part 4: Requirements for backhoe-loaders*
- *Part 5: Requirements for hydraulic excavators*
- *Part 6: Requirements for dumpers*
- *Part 7: Requirements for scrapers*
- *Part 8: Requirements for graders*
- *Part 9: Requirements for pipe-layers*
- *Part 10: Requirements for trenchers*

- *Part 11: Requirements for earth and landfill compactors*
- *Part 12: Requirements for cable excavators*

For specific machines covered by other parts of the standard, this European Standard is intended for use in combination with relevant other parts of the series.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Turkey and the United Kingdom.

Introduction

This part of EN 474 is a type C standard as stated in EN ISO 12100-1:2003.

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

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.

1 Scope

This **A3** European Standard **A3** specifies the general safety requirements for earth-moving machinery¹⁾ described in EN ISO 6165:2006, except rollers and horizontal directional drill.

NOTE 1 Rollers are covered by EN 500.

NOTE 2 Horizontal directional drills are covered by EN 791.

This **A3** European Standard **A3** also applies to derivative machinery (see 3.1.2) designed primarily for use with equipment to loosen, pick-up, move, transport, distribute and grade earth and rock.

This **A3** European Standard **A3** gives the common safety requirements for earth-moving machinery families and is intended to be used in conjunction with one of the EN 474 parts 2 to 12. These machine specific parts (EN 474-2 to -12) do not repeat the requirements from **A1** EN 474-1:2006+A1:2009 **A1**, but add or replace the requirements for the family in question.

NOTE 3 The requirements specified in this part of the standard are common to two or more families of earth-moving machinery.

A4 This part gives specific requirements for demolition machinery. **A4**

Specific requirements in EN 474 parts 2 to 12 take precedence over the respective requirements of **A1** EN 474-1:2006+A1:2009 **A1**.

For multipurpose machinery the parts of the standard that cover the specific functions and applications have to be used e.g. a compact loader also used as a trencher shall use the relevant requirements of EN 474 parts 1, 3 and 10.

The standard also covers general requirements for attachments intended to be used with earth moving machine families covered in the scope.

A1 Except for part 12 this European Standard does not deal **A1** with the electrical hazards related to the main circuits and drives of machinery when the principal source of energy is electrical.

A1 This European Standard does not deal with towing of trailers. **A1**

This European Standard deals with all significant hazards, hazardous situations and events relevant to earth-moving machinery, when used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4). This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards, hazardous situations and events during commissioning, operation and maintenance of earth-moving machinery.

This European Standard is not applicable to earth moving machines, which are manufactured before the date of publication of this European Standard by CEN.

¹⁾ For travelling on public roads the national traffic regulations apply until harmonised requirements are available. (A CEN-standard is under preparation.)

2 Normative references

Ⓐ₃ 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. Ⓐ₃

EN 286-2:1992, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 2: Pressure vessels for air braking and auxiliary systems for motor vehicles and their trailers*

EN 287-1:2004, *Qualification test of welders — Fusion welding — Part 1: Steels*

Ⓐ₄ EN 356:1999, *Glass in building — Security glazing — Testing and classification of resistance against manual attack*

EN 474-5:2006+A3:2013, *Earth-moving machinery — Safety — Part 5: Requirements for hydraulic excavators*

EN 474-12:2006+A1:2008, *Earth-moving machinery — Safety — Part 12: Requirements for cable excavators* Ⓐ₄

Ⓐ₁ *deleted text* Ⓐ₁

EN 982:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 1677-2:2000, *Components for slings — Safety — Part 2: Forged steel lifting hooks with latch, Grade 8*

Ⓐ₁ EN 12643:1997+A1:2008 Ⓐ₁, *Earth-moving machinery — Rubber-tyred machines — Steering requirements (ISO 5010:1992, modified)*

EN 13309:2000, *Construction machinery — Electromagnetic compatibility of machines with internal electrical power supply*

Ⓐ₁ *deleted text* Ⓐ₁

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 61310-1:1995, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)*

EN ISO 2860:1999, *Earth-moving machinery — Minimum access dimensions (ISO 2860:1992)*

Ⓐ₅ EN ISO 2867:2011, *Earth-moving machinery — Access systems (ISO 2867:2011)* Ⓐ₅

Ⓐ₁ EN ISO 3411:2007, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope (ISO 3411:2007)* Ⓐ₁

Ⓐ₁ EN ISO 3449:2008, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements (ISO 3449:2005)* Ⓐ₁

EN ISO 3450:1996, *Earth-moving machinery — Braking systems of rubber-tyred machines — System and performance requirements and test procedures (ISO 3450:1996)*

EN ISO 3457:2003, *Earth-moving machinery — Guards — Definitions and requirements (ISO 3457:2003)*

Ⓐ₁ EN ISO 3471:2008, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements (ISO 3471:2008)* Ⓐ₁

EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)* ^{A4}

EN ISO 4871:2009 ^{A4}, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 5353:1998, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point (ISO 5353:1995)*

EN ISO 6165:2006, *Earth-moving machinery — Basic types — ^{A1} deleted text ^{A1} Identification and terms and definitions (ISO 6165:2006)*

EN ISO 6682:1995, *Earth-moving machinery — Zones of comfort and reach for controls (ISO 6682:1986 including Amendment 1:1989)*

EN ISO 6683:2005, *Earth-moving machinery — Seat belts and seat belt anchorages — Performance requirements and tests (ISO 6683:2005)*

EN ISO 7096:2000, *Earth-moving machinery — Laboratory evaluation of operator seat vibration (ISO 7096:2000)*

EN ISO 11688-1:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)* ^{A1}

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

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

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)* ^{A1}

ISO 3795:1989, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in work places and public areas*

ISO 3864-2:2004, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

ISO 4250-3:2006 ^{A1}, *Earth-mover tyres and rims — Part 3: Rims*

ISO 5006:2017, *Earth-moving machinery — Operator's field of view — Test method and performance criteria* ^{A5}

ISO 6011:2003, *Earth-moving machinery — Visual display of machine operation*

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

ISO 6016:1998, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

ISO 6395:2008, *Earth-moving machinery — Determination of sound power level — Dynamic test conditions* ^{A1}

ISO 6396:2008 ^{A1}, *Earth-moving machinery — Determination of emission sound pressure level at operator's position — Dynamic test conditions*

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

ISO 6405-2:1993, *Earth-moving machinery — Symbols for operator controls and other displays — Part 2: Specific symbols for machines, equipment and accessories*

ISO 6749:1984, *Earth-moving machinery — Preservation and storage*

ISO 8643:1997, *Earth-moving machinery — Hydraulic excavator and backhoe loader boom-lowering control device — Requirements and tests*

ISO 9533:1989, *Earth-moving machinery — Machine mounted forward and reverse audible warning alarm — Sound test method*

ISO 10262:1998, *Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards* ^{A4}

ISO/DIS 10263-2:2007, *Earth-moving machinery — Operator enclosure environment — Part 2: Air filter element test method* ^{A1}

ISO/DIS 10263-3:2007, *Earth-moving machinery — Operator enclosure environment — Part 3: Pressurization test method* ^{A1}

ISO/DIS 10263-4:2007, *Earth-moving machinery — Operator enclosure environment — Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance* ^{A1}

ISO 10264:1990, *Earth-moving machinery — Key-locked starting systems*

ISO 10265:2008 ^{A1}, *Earth-moving machinery — Crawler machines — Performance requirements and test procedures for braking systems*

ISO 10532:1995, *Earth-moving machinery — Machine-mounted retrieval device — Performance requirements*

ISO 10533:1993, *Earth-moving machinery — Lift-arm support devices*

ISO 10570:2004, *Earth-moving machinery — Articulated frame lock — Performance requirements*

ISO 10968:2004, *Earth-moving machinery — Operator's controls*

ISO 11112:1995, *Earth-moving machinery — Operator's seat — Dimensions and requirements*

ISO 11862:1993, *Earth-moving machinery — Auxiliary starting aid electrical connector*

ISO 12508:1994, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

ISO 12509:2004, *Earth-moving machinery — Lighting, signalling and marking lights, and reflex-reflector devices*

ISO 13031:2016, *Earth-moving machinery — Quick couplers — Safety* ^{A6}

ISO 13333:1994, *Earth-moving machinery — Dumper body support and operator's cab tilt support devices*

ISO 14396:2002, *Reciprocating internal combustion engines — Determination and method for the measurement of engine power — Additional requirements for exhaust emission tests in accordance with ISO 8178*

ISO 14401-1:2004, *Earth-moving machinery — Field of vision of surveillance and rear-view mirrors — Part 1: Test methods*

ISO 14401-2:2004, *Earth-moving machinery — Field of vision of surveillance and rear-view mirrors — Part 2: Performance criteria*

ISO 15817:2005, *Earth-moving machinery — Safety requirements for remote operator control*

ISO 15998:2008 ^{A1}, *Earth-moving machinery — Machine-control systems (MCS) using electronic components — Performance criteria and tests for functional safety*

3 Terms and definitions

For the purposes of this ^{A3} document ^{A3}, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

Earth-moving machinery and their families are defined in EN ISO 6165:2006.

NOTE Definitions used in EN and ISO standards referred to in this European Standard are also valid for this document.

3.1 earth-moving machinery

self-propelled or towed machine on wheels, crawler or legs, having equipment and/or attachment (working tool), primarily designed to perform excavating, loading, transporting, spreading, compacting or trenching of earth, rock or similar materials

NOTE An earth-moving machine is normally operated by a ride-on operator but can also be remote – or pedestrian –controlled.

3.1.1 compact machine

earth-moving machinery having an operating mass (see ISO 6016:1998) of 4 500 kg or less, or compact excavators having an operating mass (see ISO 6016:1998) of 6 000 kg or less

3.1.2 derivative machinery

earth-moving machinery fitted with equipment and/or attachment which modifies its function

NOTE For the European Economic Area (EEA) the equipment or attachment or a piece of equipment as defined in ISO 6016:1998 which modifies the function of the machine and is intended to be assembled by the operator can be "interchangeable equipment" in the sense of the Machinery Directive.

3.2 attachment (working tool)

component or assembly of components, which can be mounted onto the base machine or equipment (see ISO 6746-1:2003, ISO 6746-2:2003 and ISO 6016:1998) for a specific use

A6 Note 1 to entry: Attachments might be, in the meaning of the Machinery Directive 2006/42/EC, either interchangeable equipment or tools. The term 'attachments' is used in this standard to cover both. **A6**

A6 3.3

quick coupler

device mounted on an earth-moving machine to allow the quick interchange of attachments

Note 1 to entry: Quick couplers are also commonly referred to under many different names, including "quick hitch" and "attachment bracket". For the purposes of this International Standard, only the term "quick coupler" is used."

[SOURCE: ISO 13031:2016, 3.1]

Note 2 to entry: Quick couplers are generally considered to be interchangeable equipment when placed on the market separately, whether or not installed on the machine before first use, and when it is reasonably foreseeable that they might be installed or removed by the operator (e.g. for installation on another machine). **A6**

3.4

object handling

application of earth-moving machinery comprising lifting, lowering and transporting of a load by use of lifting accessories, whereby the assistance of a person or the operator of the machine is required for hooking, unhooking or stabilising (whilst transporting) the load

NOTE 1 If the load is picked-up by a self-acting device and no assistance of a person is required for hooking, unhooking and stabilising the load, this work is considered as usual earth-moving application.

NOTE 2 Lifting accessories are, e.g., wire ropes, chains or textile straps; loads in object handling application are, e.g., pipes, vessels; self-acting devices are, e.g., grabs, clamshell buckets, log clamps, vacuum lifting device, magnetic plate and fork.

3.5

maximum rated operating/lift capacity in object handling

maximum capacity which can be lifted at least in one position of the working range as specified by the manufacturer (e.g. on the rated object handling capacity table) in the most stable configuration (e.g. outriggers down)

NOTE The term "rated operating capacity" is defined in ISO 14397-1:2002 and used in **A1** EN 474-3:2006+A1:2009 **A1** and **A1** EN 474-4:2006+A1:2009 **A1**. The term "rated lift capacity" is defined in ISO 10567:1992 and used in **A1** EN 474-5:2006+A3:2013 **A1**. Both terms are equivalent.

A4 3.6

demolition machine

machine based on earth moving machinery (see EN ISO 6165) and including equipment and attachment (working tool – e.g. processor or breaker) specifically designed to demolish, cut, loosen, separate, pick up, transport and distribute component parts of buildings, civil engineering structures

3.7

processor

attachment with tooth, teeth and/or cutting edges, used for demolition or deconstruction

3.8

hydraulic hammer or breaker

equipment which uses the hydraulic power source of the carrier machine to accelerate a piston (sometimes gas-assisted), which then hits a tool

Note 1 to entry: The stress wave generated by kinetic action flows through the tool into the material, which causes the material to break. Hydraulic hammers need a supply of pressurised oil to function. The complete carrier/hammer unit is controlled by an operator, usually seated in the cabin of the carrier.

3.9
high reach equipment
multi piece rigid or telescopic equipment with the primary function of operating specialised attachments for the demolition of structures at heights that cannot be reached by standard backhoe equipment

3.10
base machine
machine with a cab or canopy and operator protective structures if required, without equipment or attachments but possessing the necessary mountings for such equipment and attachments

[SOURCE: ISO 6016:2008, 3.1.1] A4

4 List of significant hazards

See Annex A.

NOTE Annex A (normative) contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this European Standard, identified by risk assessment as common to two or more machinery families and which require action to eliminate or reduce the risk.

5 Safety requirements and/or measures

5.1 General

Earth-moving machinery shall comply with the safety requirements and/or protective measures of this European Standard, as far as not modified by requirements of the relevant specific part of the standard series. In addition, the machine shall be designed according to the principles of EN ISO 12100-1:2003 and EN ISO 12100-2:2003 for hazards relevant but not significant which are not dealt with by this European Standard.

5.2 Access

5.2.1 General requirements

Adequate access systems shall be provided to the operator's station and areas where routine maintenance has to be performed by the operator as described in the operator's manual. Access A5 systems A5 shall comply with A5 EN ISO 2867:2011 A5.

Effect of mud on the means of access shall be minimised by adequate design.

5.2.2 Access to articulated machines

On machines with articulated frames and in the fully articulated steering position, a minimum clearance of 150 mm for the lower limbs shall be provided A1 between firm structures and components with A1 relative movement in the path of the access systems to the operator's station, as illustrated in Figure 1.

Dimensions in millimetres

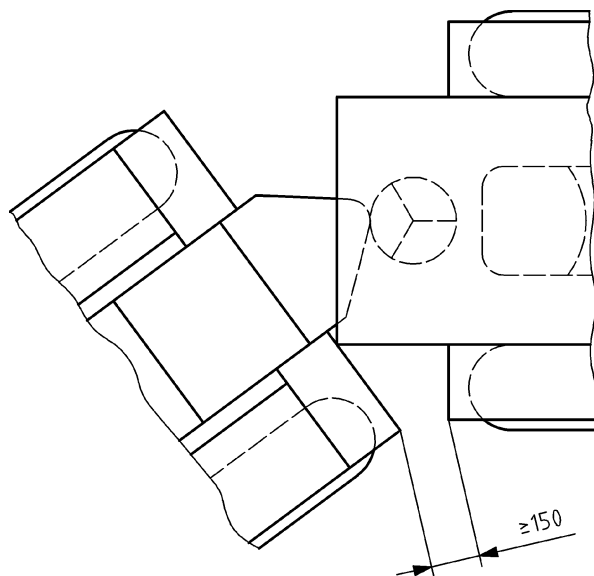


Figure 1 — Minimum clearance of lower limbs at access to the operator's station on machines with articulated steering

A5 deleted text **A5**

5.3 Operator's station

5.3.1 General requirements

5.3.1.1 Machinery equipment

A1 The driving position of ride-on drivers shall be designed and constructed in such a way that a driver's cab may be fitted, provided this does not increase the risk and there is room for it. **A1**

Machines with an operating mass less than 1 500 kg are not required to have a cab.

Machines with an operating mass greater than or equal to 1 500 kg shall be equipped with a cab, unless the foreseeable adverse weather conditions allow all-year operation without a cab (negotiated between manufacturer and user).

Machines shall be equipped with a cab and a contamination protective system if the machine is intended for use in unhealthy environments, e.g. contaminated areas (negotiated between manufacturer and user). See 5.14.1.

If a hazard due to projection of splinters exists, e.g. operation with a hydraulic- or demolition-hammer, an adequate protection such as bullet proof glass, mesh guard or an equivalent protection is required.

5.3.1.2 Minimum space

The minimum space available to the operator shall be as defined in **A1** EN ISO 3411:2007 **A1** (except as amended in 5.3.2.5).

For compact machines the minimum space envelope width (dimension 920 mm in **A1** EN ISO 3411:2007, Figure 4 **A1**) may be reduced to 650 mm.

The minimum space and location of the controls at the operator's station shall meet the requirements specified in EN ISO 6682:1995.

5.3.1.3 Moving parts

Measures shall be taken to avoid accidental contact from the operating position with moving parts, e.g. the wheels, or tracks or working equipment and/or attachment in accordance with relevant subclauses of 5.14.

5.3.1.4 Engine exhaust

The engine exhaust system shall release the exhaust gas away from the operator and the air inlet of the cab.

5.3.1.5 Instruction storage

A space intended for the safekeeping of the operator's manual and other instructions shall be provided near the operator's station. The space shall be lockable, unless the operator's station can be locked.

5.3.1.6 Sharp edges

The operator's space within the operator's station, e.g. ceiling, inner walls, instrument panels and access to the operator's station shall not present any sharp edges or acute angles/corners. Radius of corners and bluntness of edges shall comply with ISO 12508:1994 to avoid sharp edges (see also 5.14.6).

5.3.2 Operator's station equipped with a cab

5.3.2.1 Climatic conditions

The cab shall protect the operator against foreseeable adverse climatic conditions. Provisions shall be made to install a ventilation system, an adjustable heating system and a system for defrosting windows. For details see 5.3.2.6 to 5.3.2.8.

5.3.2.2 Pipes and hoses

Pipes and hoses located inside the cab which contain fluids that are dangerous, for example because of their pressure (greater than 5 MPa), temperature (greater than 50°C) shall be guarded, see EN ISO 3457:2003, Clause 9.

NOTE As far as possible pipes and hoses should be placed outside the cab.

Parts or components placed between pipes or hoses and the operator, which divert e.g. a hazardous spray of fluid, can be considered as a sufficient protection device.

5.3.2.3 Primary access opening

A primary access opening shall be provided. The dimensions shall comply with  EN ISO 2867:2011, Table 1 .

5.3.2.4 Alternative opening (emergency exit)

An alternative opening shall be provided on a side other than that of the primary opening. The dimensions shall comply with  EN ISO 2867:2011, Clause 5 . A window panel or another door is acceptable if they are easy to open or remove without the use of keys or tools. Latches may be used if they can be opened from the inside without the use of keys or tools. The break of a suitable size of glass pane is considered equivalent to an alternative opening. In such a case the necessary pane hammer, immediately accessible to the operator, shall be provided and stored in the cab.

When the window panel is used as an emergency exit it shall bear an appropriate marking according to Figure 8 of EN 61310-1:1995.

5.3.2.5 Space envelope height

The minimum space envelope height R_1 as defined in  Figure 4 of EN ISO 3411:2007  and measured from the seat index point (SIP), as defined in EN ISO 5353:1998, shall meet the values given in Table 1.

Table 1 — Space envelope height related to machine classification

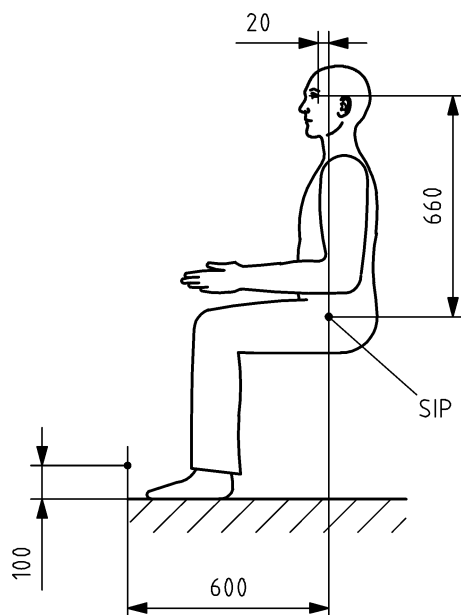
Machine classification	Minimum space envelope height mm from the SIP
Compact machines	920
All other machines	1 000

The minimum dimensions given in Table 1 are also required for machines having a front or rear window which are located (in an opened position) above the operator's seat.

5.3.2.6 Heating and ventilation system

If a heating system is fitted it shall either:

- a) comply with  ISO/DIS 10263-4:2007 , or
- b) have the capability of increasing the temperature of the air inside the cab and maintain a temperature of + 18°C at expected ambient temperature the machine is intended for. The minimum capacity of the heating system shall have a ΔT of 25°C (ΔT of 25 K) within 30 min. The test shall run starting with the engine at working temperature as specified by the manufacturer. Measurement of the system capacity shall be made at three points. The three points shall be located in a vertical plane through the SIP and parallel to the longitudinal axis of the machine as follows (see  Figure 2 ):
 - 1) at filament position centre-point as defined in  ISO 5006:2017 ;
 - 2) at the SIP as defined in EN ISO 5353:1998;
 - 3) 100 mm above floor plate and 600 mm in front of SIP.



A5

Figure 2 — Location of measuring points

A5

c) Alternatively, the heating capacity can be determined by calculation.

The ventilation system shall be capable of providing the cab with filtered fresh air at the minimum of 43 m³/h. The filter shall be tested according to A1 ISO/DIS 10263-2:2007 A1.

NOTE The filter element selection depends on the intended operating environment conditions.

5.3.2.7 Defrosting system

Machine with a cab shall provide facilities to defrost the front and rear window(s), for example by means of a heating system or a particular defrosting device.

NOTE A testing method of windscreen defrosting system is described in A1 ISO/DIS 10263-5:2007 A1.

5.3.2.8 Pressurisation system

Where a cab is provided with a pressurisation system, it shall be tested according to A1 ISO/DIS 10263-3:2007 A1 and shall provide an interior relative pressure of at least 50 Pa.

5.3.2.9 Doors and windows

Doors, windows and flaps shall be securely held in their functional positions; measures shall be taken for preventing inadvertent opening. Doors shall be retained at their intended operating position(s) by a positive engagement device. A primary opening designed to be held securely open as an intended operating position, shall be releasable from the operator's station.

Windows shall be made of safety glass or other material which provides similar safety performance (see e.g. ECE R43).

Roof windows do not need additional mechanical safeguarding.

The front and rear window(s) shall be fitted with motorised windscreen wiper(s) and washer(s). The tank of the window washer(s) shall be easily accessible.

5.3.2.10 Inner lighting

The cab shall be fitted with a fixed inner lighting system and be able to function with the engine at a stop, to make it possible to illuminate the operator's station and to read the operation manual in darkness.

5.3.3 Roll-over protective structures (ROPS)

5.3.3.1 General

Earth-moving machinery shall be equipped with a roll-over protective structure (ROPS). The ROPS shall comply with **A1** EN ISO 3471:2008 **A1**.

A1 *deleted text* **A1**

5.3.3.2 ROPS for derivative machinery

For derivative machinery, the ROPS shall be designed taking into account the operating mass (see ISO 6016:1998) of the derivative machinery in the heaviest configuration as specified by the manufacturer.

5.3.4 Falling-object protective structures (FOPS)

A1 Earth-moving machinery above 15 kW shall be fitted with a falling-object protective structure (FOPS), when they are intended for applications where there is a risk of falling objects.

NOTE 1 The following machines are normally not used for applications with a risk of falling objects: scrapers, pipe-layers, trenchers and landfill compactors.

If FOPS is fitted it shall comply with EN ISO 3449:2008. For machines not covered by EN ISO 3449:2008 the corresponding protection shall be provided when they are intended for applications where there is a risk of falling objects.

NOTE 2 For excavators, see **A4** EN 474-5:2006+A3:2013 **A4** and EN 474-12:2006+A1:2008. **A1**

5.3.5 Elevating operator's station

See Annex D.

5.3.6 Replacement of operator protective structure

In case any part of the protective structure (e.g. ROPS, TOPS, FOPS) is affected by a plastic deformation and/or rupture (e.g. by roll-over, tip-over or object impact), the protective structure has to be replaced according to manufacturer's specifications. See also 7.2.

5.4 Seats

5.4.1 Operator's seat

5.4.1.1 General requirement

Machinery with provision for a seated operator shall be fitted with an adjustable seat that supports the operator in a position, which allows the operator to control the machine under intended operating conditions.

5.4.1.2 Dimensions

The seat dimensions shall comply with ISO 11112:1995.

5.4.1.3 Adjustment

[A1] All adjustments to accommodate the operator's size shall comply with ISO 11112:1995, Table 1, except vertical adjustment (ISO 11112:1995, Table 1, h_1) where a minimum value of 60 mm shall be used. The adjustment shall be possible without the use of any tool. **[A1]**

For compact machines (see 3.1.1) the following seat adjustments apply:

- either the fore and aft adjustment (see ISO 11112:1995, Table 1, l_2) shall be at least ± 35 mm or the corresponding adjustment of frequently used operator's controls shall be provided;
- vertical adjustment (ISO 11112:1995, Table 1, h_1) is not required.

5.4.1.4 Vibration

The operator's seat shall meet the requirements of EN ISO 7096:2000 with regard to its ability to reduce the vibration transmitted to the operator.

[A1] NOTE Comparative data for vibration can be found in e.g. ISO/TR 25398. **[A1]**

5.4.1.5 Restraint system

Machines fitted with ROPS or TOPS (tip over protective structure) shall have an operator restraint system that meets the requirements specified in EN ISO 6683:2005.

5.4.2 Additional seat

5.4.2.1 Instructor's seat

If an additional seat for an instructor is installed in the operator's station, it shall be padded and provide adequate space for the instructor. The instructor shall also have available a conveniently placed handhold.

[A1] The instructor's seat shall fulfil the requirements of the safety structures as specified in 5.3.3 (ROPS) and 5.3.4 (FOPS). **[A1]**

5.4.2.2 Second operator's seat

If a second operator's seat is required for a specific machine, which can be frequently or alternatively used by the operator to perform the application of the machine, this seat shall fulfil the requirements for seats as specified in 5.4 and the safety structures as specified in 5.3.3 (ROPS) and 5.3.4 (FOPS).

5.5 Operator's controls and indicators

5.5.1 General

The controls (hand levers, pedals, switches etc.) and indicators of the machine, equipment, attachment, shall be chosen, designed, constructed and arranged according to ISO 10968:2004, so that:

- a) they are of easy access, in accordance with EN ISO 6682:1995 and ISO 10968:2004;
- b) neutral positions of controls shall be in accordance with 5.3 of ISO 10968:2004;

- c) they are clearly identified (see ISO 6405-1:2004 and ISO 6405-2:1993) in the operator's station and explained in the operation manual (see 7.2);
- d) the movement of the controls to activate the functions and indicators shall correspond to the intended effect or common practice whenever possible;
- e) the normal engine stop device shall be within the zone of reach (see EN ISO 6682:1995);
- f) when a control is designed and constructed to carry out several functions of the machine, e.g. keyboard, joystick control, the activated function shall be clearly identified;
- g) for requirements on joy-sticks, see also ISO 10968:2004;
- h) for safety related functions of control system(s) having no electronic components, the principles outlined in **A1** EN ISO 13849-1:2008 **A1** shall be used or methods giving similar protection;
- i) **A1** where there is more than one control position the control system shall be designed in such a way that the use of one of them precludes the use of the other(s) (except for stop controls and emergency stops). **A1**

A4 In the case of hydraulically assisted variable gauge undercarriage, the controls shall be located in the operator's station. **A4**

5.5.2 **A1** Starting/stopping system **A1**

A1 The starting/stopping system of earth-moving machinery shall be provided with a starting/stopping device (e.g. key) and shall comply with ISO 10264:1990 or have a similar protection against unauthorized use.

Earth-moving machines shall be so designed that hazardous movement of the machine or its working equipment and/or attachment shall not be possible without action on the controls whilst starting/stopping the engine.

If the visibility from the operator's station to the rear by direct or indirect view cannot be achieved in accordance with 5.8.1, the machine shall be equipped with an acoustic and/or visual warning signal activated automatically when the reversing command is given, combined with a delay in starting the reverse movement, leaving sufficient time for an exposed person to leave the danger zone.

NOTE When drafting this text it was not possible to define clear criteria for the necessary delay time as it depends on different parameters. In the idea of the drafters a delay of 3 s (that may be achieved completely or in part in the reaction time of the machine) will in general be appropriate. **A1**

5.5.3 Inadvertent activation

A1 Controls, which can cause a hazard due to inadvertent activation, shall be so arranged or deactivated or guarded as to minimise the risk, when the operator gets into or out of the operator's station. **A1** The deactivation device shall either be self-acting or acting by compulsory actuation of the relevant device.

5.5.4 Pedals

Pedals shall have an appropriate size, shape and be adequately spaced. The pedals shall have a slip-resistant surface and be easy to clean.

If the pedals of an earth-moving machine have the same function (clutch, brake, and accelerator) as on a motor vehicle, they shall be arranged in the same manner to avoid the risk of confusion.