BRITISH STANDARD

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474-4:2006
+A2:2012

Earth-moving machinery — Safety —

Part 4: Requirements for backhoe loaders

ICS 53.100

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 474-4:2006+A2:2012. It supersedes BS EN 474-4:2006+A1:2009, which is withdrawn.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⟩.

The UK participation in its preparation was entrusted by Technical Committee B/513, Construction equipment and plant and site safety, to Subcommittee B/513/1, Earth moving machinery (International).

A list of organizations represented on this Subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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Engins de terrassement - Sécurité - Partie 4: Prescriptions applicables aux chargeuses-pelleteuses

Erdbaumaschinen - Sicherheit - Teil 4: Anforderungen für Baggerlader

This European Standard was approved by CEN on 17 April 2006 and includes Amendment 1 approved by CEN on 20 December 2008 and Amendment 2 approved by CEN on 22 November 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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Foreword

This document (EN 474-4:2006+A2:2012) 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of an identical text or by endorsement, at the latest by July 2012, and conflicting national standards shall be withdrawn at the latest by July 2012.

This document includes Amendment 1, approved by CEN on 2008-12-20 and Amendment 2, approved by CEN on 2011-11-22.

This document supersedes [A2] EN 474-4:2006+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 EU Directive.

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

For bibliographic references, see [A1] EN 474-1:2006+A1:2009 [/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 pipelayers
— Part 10: Requirements for trenchers
— Part 11: Requirements for earth and landfill compactors
— Part 12: Requirements for cable excavators

This European Standard is intended for use in combination with Part 1 of the series.

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, Romania, 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 part of EN 474 deals with all significant hazards, hazardous situations and events relevant to wheel and crawler backhoe loaders as defined in EN ISO 6165:2006, when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4).

This part also deals with fork application, object handling application and log handling.

The requirements of this part are complementary to the common requirements formulated in ⟩A1⟨ EN 474-1:2006+A1:2009 ⟩A1⟨.

This does not repeat the requirements from ⟩A1⟨ EN 474-1:2006+A1:2009 ⟩A1⟨, but adds or replaces the requirements for application for backhoe loaders.

This part 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 backhoe loaders.

This European Standard is not applicable to machinery manufactured before the date of publication of this European Standard by CEN.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

⟩A1⟨ EN 474-1:2006+A1:2009 ⟩A1⟨, *Earth-moving machinery — Safety — Part 1: General requirements*

⟩A1⟨ EN ISO 3164:2008 ⟩A1⟨, *Earth-moving machinery — Laboratory evaluations of protective structures — Specifications for deflection-limiting volume (ISO 3164:1995)*

⟩A1⟨ EN ISO 3449:2008, *Earth-moving machinery - Falling-object protective structures - Laboratory tests and performance requirements (ISO 3449:2005)* ⟩A1⟨

⟩A1⟨ EN ISO 6682:2008 ⟩A1⟨, *Earth-moving machinery — Zones of comfort and reach for controls (ISO 6682:1986 including Amendment 1:1989)*

⟩A1⟨ EN ISO 7096:2008 ⟩A1⟨, *Earth-moving machinery — Laboratory evaluation of operator seat vibration (ISO 7096:2000)*

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

ISO 2330:2002, *Fork-lift trucks — Fork arms — Technical characteristics and testing*

⟩A1⟨ ISO 6016:2008 ⟩A1⟨, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

⟩A1⟨ ISO 7451:2007, *Earth-moving machinery — Volumetric ratings for hoe-type and grab-type buckets of hydraulic excavators and backhoe loaders* ⟩A1⟨

⟩A1⟨ ISO 7546:1983 ⟩A1⟨, *Earth-moving machinery — Loader and front loading excavator buckets — Volumetric ratings*

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

ISO 9248:1992, *Earth-moving machinery — Units for dimensions, performance and capacities, and their measurement accuracies*

[A1] ISO 14397-1:2007 [A1], *Earth-moving machinery — Loaders and backhoe loaders — Part 1: Calculation of rated operating capacity and test method for verifying calculated tipping load*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in [A1] EN 474-1:2006+A1:2009 [A1], EN ISO 12100-1:2003 and the following apply.

NOTE 1 Terminology for backhoe loaders is specified in ISO 8812:1999 and most common backhoe loaders are illustrated in Annex C of this European Standard.

NOTE 2 Definitions used in EN and ISO standards referred to in this European Standard are also valid for this document.

3.1
backhoe loader
self-propelled crawler or wheeled machine having a main frame designed to carry both front-mounted equipment and rear-mounted backhoe equipment, normally with stabilisers or outriggers (see EN ISO 6165:2006)

NOTE 1 When used in backhoe mode, the machine is stationary and normally digs below ground level, but when used in loader mode (bucket use), the machine loads through forward motion.

NOTE 2 A backhoe work cycle normally comprises excavating, elevating, swinging and discharging material. A loader work cycle normally comprises filling, elevating, transporting and discharging material.

3.2
compact backhoe loader
backhoe loader with an operating mass (see [A1] ISO 6016:2008 [A1]) of 4 500 kg or less, designed to work in confined spaces with the associated needs for greater manoeuvrability

4 List of additional 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 significant for this type of machinery and which require action to eliminate or reduce the risk.

5 Safety requirements and/or measures

5.1 General

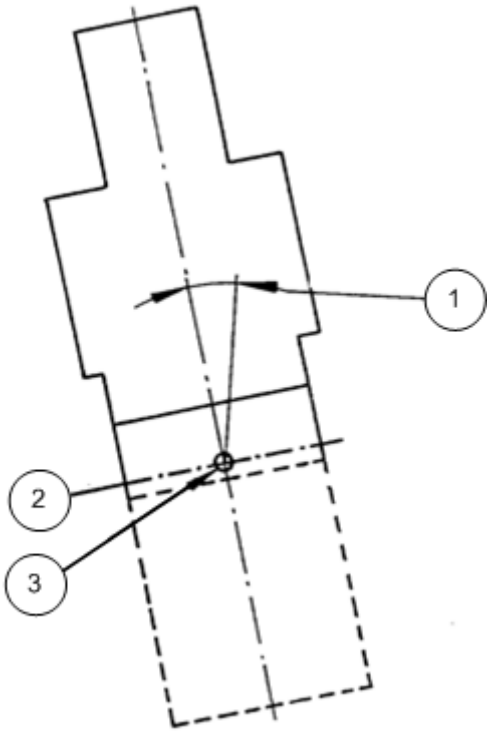
Backhoe loaders shall comply with the requirements of [A1] EN 474-1:2006+A1:2009 [A1], as far as not modified or replaced by the requirements of this part.

5.2 Protection

5.2.1 Roll-over protective structures (ROPS)

[A1] EN 474-1:2006+A1:2009 [A1], 5.3.3 applies with the following addition for compact backhoe loaders:

The portion of deflection-limiting volume (DLV) above the LA (SIP) line according to ⟩A1⟨ EN ISO 3164:2008 ⟩A1⟨ is allowed to deviate (lean) up to 15° laterally as shown in Figure 1, when the minimum energy requirement is met. Portion below the LA (SIP) line of DLV can be disregarded.



Key

1 up to 15°
2 LA
3 Seat index point (SIP)

Figure 1 — Deflection-limiting volume (DLV), front view

5.2.2 Falling object protective structures (FOPS)

⟩A1⟨ EN 474-1:2006+A1:2009, 5.3.4 applies with the following additions for backhoe loaders. Machines with an operating mass less than or equal to 700 kg according to ISO 6016:2008 shall be fitted with a falling-object protective structure (FOPS), when they are intended for applications where there is a risk of falling objects. If FOPS is fitted, it shall meet the performance requirements of EN ISO 3449:2008 Level 1. ⟩A1⟨

5.3 Operator's station

5.3.1 Minimum space envelope

⟩A1⟨ EN 474-1:2006+A1:2009 ⟩A1⟨, 5.3.2.5 applies with the following additions:

On backhoe loaders with retractable rear window, the cab height above SIP shall not be less than 920 mm measured with the window retracted into the cab.

NOTE This requirement is at present under consideration. In the future this exception will disappear.

5.3.2 Operator's controls

⟩A1⟨ EN 474-1:2006+A1:2009 ⟩A1⟨, 5.5 applies with the following additions:

— on backhoe loaders equipped with outriggers, an acoustic and visual warning device shall be installed to warn the operator when the travel motion is engaged with lowered outriggers;

NOTE Preferably an interlocking device should be provided, which makes it impossible to raise the outriggers if the travel motion is engaged.

— if the backhoe loader is provided with an alternative operator position with alternative travel controls, there shall also be control devices for braking and steering at this alternative position, which meet the performance requirements for the primary functions.

5.3.3 Operator's seat

〚A1〛 EN 474-1:2006+A1:2009 〚A1〛, 5.4.1, applies with the addition that the seat shall meet the requirements of the following input spectral class according to 〚A1〛 EN ISO 7096:2008 〚A1〛:

— EM5 for backhoe loaders;

— EM8 for compact backhoe loaders.

5.4 Warning devices

〚A1〛 EN 474-1:2006+A1:2009 〚A1〛, 5.9, first indent, applies with the addition that the sound level shall also be greater than or equal to 93 dB (A) at 7 m distance from backhoe swing centre to the rear. The operator shall be able to activate the warning device also from the backhoe operation position.

5.5 Stability

5.5.1 General

〚A1〛 EN 474-1:2006+A1:2009 〚A1〛, 5.11 applies with the additions given in 5.5.2 to 〚A1〛 5.5.3 〚A1〛 below.

All rated capacities as defined hereafter are based on tests and/or calculations of machines being on level and firm supporting surface.

The mass of the load, its density and the location of its centre of gravity as well as the mass of the attachment and the attachment bracket, if fitted, shall be included in the determination of the rated operating capacity and the size/capacity of the attachment.

Hoses shall withstand four times the operating pressure.

To provide a sufficient stability the rated operating capacity/rated lift capacity in intended operations shall be determined as specified in 〚A1〛 5.5.2 and 5.5.3 〚A1〛.

5.5.2 Loader portion

5.5.2.1 General

The rated capacities of the backhoe loader used in loader application shall be determined as follows with the backhoe in its transport position as specified by the manufacturer.

The loader portion of backhoe loaders do not need lowering control device as defined in ISO 8643:1997

5.5.2.2 Bucket application

The rated operating capacity shall be determined according to 〚A1〛 ISO 14397-1:2007 〚A1〛.

The volumetric rating of bucket shall be determined according to ISO 7546:1983.

NOTE The mass, volumetric rating of bucket and density of the material have to be taken into account when the bucket capacity is selected for a specific application.

5.5.2.3 Fork application

5.5.2.3.1 General

The rated operating capacity is based on the use of forks and shall be determined by the criteria specified in 5.5.2.3.2 to 5.5.2.3.5.

5.5.2.3.2 Rated load

The tipping load shall be determined according to ⟦A1⟩ ISO 14397-1:2007 ⟨A1⟧ (except for stability factor stated in 4.1) and with the fork in a horizontal position. The rated load as a percentage of tipping load shall not exceed the applicable value specified in Table 1.

Table 1 — Stability factors in fork application

Rated load as a percentage of tipping load for loader portion	
Ground condition	**Wheel loader**
Rough terrain	60
Firm and level ground	80

Stability factors to determine rated load of crawler backhoe loader shall not exceed 35 % of the tipping load.

5.5.2.3.3 Hydraulic lift capacity

It shall be possible to control the rated load in all positions foreseen by the manufacturer, considering all relevant hydraulic circuits involved.

NOTE The hydraulic lift capacity is the maximum mass that can be lifted in any arm position with the fork in horizontal position limited by the hydraulic circuit working pressure according to ⟦A1⟩ ISO 14397-2:2007 ⟨A1⟧.

5.5.2.3.4 Rated operating capacity

The rated operating capacity shall be determined either by:

— the rated load specified in 5.5.2.3.2 or

— the hydraulic lift capacity specified in 5.5.2.3.3,

whichever is less.

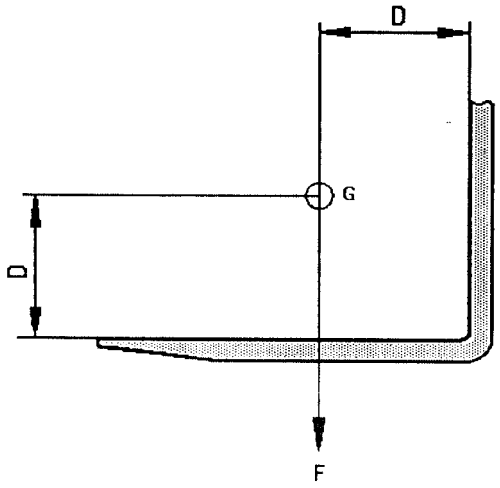
5.5.2.3.5 Fork size

To select the fork arm size and to determine the load centre gravity distance (D) as shown in Figure 2, the specifications in Table 2 shall be followed.

Table 2 — Load centre distance

Load F N			Distance D mm
	$F \leq$	10 000	400
10 000	$< F \leq$	50 000	500
50 000	$< F \leq$	100 000	600

Fork arms shall meet the performance requirements stated in ISO 2330:2002.



Key

D distance in millimetres (see table 2)

F load in Newton

G centre of gravity

Figure 2 — Load centre distance with fork arms

5.5.2.4 Log handling application

5.5.2.4.1 General

The rated operating load of a backhoe loader in log handling application shall be determined by the criteria given in 5.5.2.4.2 and 5.5.2.4.3.

5.5.2.4.2 Rated load

Tipping load shall be determined according to [A1] ISO 14397-1:2007 [A1], (except for the stability factor stated in 4.1) with the log grapple fitted. The rated load as a percentage of tipping load shall not exceed the applicable value specified in Table 3.

Table 3 — Stability factors in log handling

Rated load as percentage of tipping load		
Ground condition	**Wheel backhoe loaders**	**Crawler backhoe loaders**
Rough terrain	75	50
Firm and level ground	85	60

5.5.2.4.3 Hydraulic lift capacity

It shall be possible to control the rated load in all positions foreseen by the manufacturer, considering all relevant hydraulic circuits involved.

NOTE The hydraulic lift capacity is the maximum mass that can be lifted in any arm position with the log grapple fitted limited by the hydraulic circuit working pressure according to [A1] ISO 14397-2:2007 [A1].

5.5.2.4.4 Rated operating capacity

The rated operating capacity shall be determined either by:

— the rated load specified in [A1] 5.5.2.4.2 [A1] or

— the hydraulic lift capacity specified in [A1] 5.5.2.4.3 [A1]

whichever is less.

5.5.2.5 Object handling application

5.5.2.5.1 General

The rated operating capacity of a backhoe loader in object handling is based on use of (a) lifting accessory(ies) and the attachment and shall be determined by the criteria given in [A1] 5.5.2.5.2 to 5.5.2.5.4 [A1].

5.5.2.5.2 Rated load

Tipping load shall be determined according to [A1] ISO 14397-1:2007 [A1] and with the load attached to the actual load hooking points as specified by the manufacturer. The rated load, as a percentage of tipping load, shall be determined according to [A1] ISO 14397-1:2007 [A1], Clause 4.

5.5.2.5.3 Hydraulic lift capacity

It shall be possible to control the rated load in all positions foreseen by the manufacturer, considering all relevant hydraulic circuits involved.

NOTE Hydraulic lift capacity is the maximum mass that can be lifted in any arm position with the hooking point(s) fitted, limited by the hydraulic circuit working pressure according to [A1] ISO 14397-2:2007 [A1].

5.5.2.5.4 Rated operating capacity

The rated operating capacity shall be determined either by:

— the rated load specified in 5.5.2.5.2 or

— the hydraulic lift capacity specified in 5.5.2.5.3,

whichever is less.

5.5.2.6 Other applications

The rated operating capacity of derivated machinery shall be determined by the manufacturer according to the load specification given in 5.5.2.2 to 5.5.2.5, whereby the comparable hazard has to be considered for the special application.

5.5.3 Backhoe portion

5.5.3.1 General

[A1] EN 474-1:2006+A1:2009 [A1], 5.11 applies with the following exceptions:

— if the loader bucket is intended to increase the stability of the machine, the hydraulic circuits of the loader portion do not require locking devices;

— the rated capacities of a backhoe loader used in backhoe application shall be determined with the loader bucket and the outriggers placed on the ground (see B.4.2 d)). The hydraulic circuits of the loader portion do not require locking devices.

5.5.3.2 Bucket and shovel application

The rated lift capacity for a backhoe loader used in backhoe application with a bucket or shovel shall be determined in accordance with Annex B as the value according to B.6.

The volumetric rating of the bucket shall be determined according to [A1] ISO 7451:2007 [A1] or ISO 7546:1983.

NOTE The mass, the volumetric rating of the bucket and the density of the material have to be taken into account when a bucket is selected for a specific application.

5.5.3.3 Object handling application

5.5.3.3.1 General

The rated lift capacity of a backhoe portion used for object handling application shall be determined according to 5.5.3.3.2 to 5.5.3.3.4.

5.5.3.3.2 Rated lift capacity in object handling

The rated lift capacity in object handling of the backhoe portion is defined in B.7.

5.5.3.3.3 Rated lift capacity table in object handling

A table of the rated lift capacity in object handling, established by the manufacturer, shall be provided.

The rated lift capacity table in object handling shall be generated with the rated lift capacity in object handling on different lift point radii, minus the mass of the attachment if necessary (see B.8). There shall be at least five different lift point radii. Minimum and maximum lift point radius shall always be included.

The table(s) shall be available at the operator's station for each object-handling configuration specified in the operation manual.

5.5.3.3.4 Load safety devices

The backhoe portion used in object handling operations, with a maximum rated lift capacity, (see 3.5 of [A1] EN 474-1:2006+A1:2009 [A1]) of equal or greater than 1 000 kg, measured according to Annex B, or an overturning moment equal or greater than 40 000 Nm shall be equipped with:

a) an acoustic or visual warning device which indicates to the operator when the rated lift capacity/ corresponding load moment is reached and continues as long as the lift capacity or load moment is exceeded. The rated lift capacity is defined in 5.5.3.3.2.

   This device may be deactivated while the backhoe equipment is performing operations other than object handling. The activation shall be clearly indicated. The control device(s) for activation/deactivation shall be within the operator's zone of comfort according to [A1] EN ISO 6682:2008 [A1]. A warning sign shall be placed close to the control device indicating the need for activation during object handling.

[A2]

b) a lowering control device on each raising boom and arm cylinder. For arm cylinders the device(s) shall be installed at the end which is pressurised to raise the arm away from the base machine. Lowering control devices for boom and arm cylinder(s) shall be tested in accordance with ISO 8643:1997.

NOTE The scope of ISO 8643:1997 (currently under revision) does not cover the testing of arm cylinder devices. However, arm cylinder devices should be tested by the same procedure as those described for boom lowering control devices. [A2]

5.5.3.4 Other applications

The rated lift capacity of derivated machinery shall be determined by the manufacturer according to the load specification given in 5.5.3.2 and 5.5.3.3.3, whereby the comparable hazard has to be considered for the special application.

5.6 Travelling and transportation

The backhoe portion shall be equipped with a device which securely locks the back-hoe in transport position.

6 Information for use

[A1] EN 474-1:2006+A1:2009 [A1], 7.2 applies with the following addition:

The manufacturer shall provide information of the rated operating load or bucket volume whenever applicable on:

— bucket application according to 5.5.2.2 for loader application;

— fork handling in accordance with 5.5.2.3 for loader application;

— [A1] log handling application in accordance with 5.5.2.4 for loader application;

— object handling application in accordance with 5.5.2.5 for loader application; [A1]

— other handling application in accordance with 5.5.2.6 for loader application;

— backhoe bucket application according to 5.5.3.2;

— backhoe object handling application according to 5.5.3.3;

— backhoe other application according to 5.5.3.4;

— instruction how to securely lock the backhoe in transport position;

— [A1] backhoe rated object handling capacity table e.g. in accordance with 5.5.3.3.3. [A1]

Annex A
(normative)

List of additional significant hazards – Backhoe loaders

The list of hazards in [A1] EN 474-1:2006+A1:2009 [A1], Annex A, applies with the following additions:

Table A.1 — List of additional significant hazards

No.[1)]	Hazard	Relevant clauses of this European Standard
	Hazards, hazardous situations and hazardous events	
1	**Mechanical hazards** due to: machine parts or working tools, e. g. — attachment, attachment brackets and/or equipment; — object handling;	 5.5.2, 5.5.3 5.5.2.5
	— log handling	[A1] 5.5.2.4 [A1]
1.1	Crushing hazard	5.2.1, 5.2.2, [A1] *deleted text* [A1], 5.5.2, 5.5.3, 5.6
1.4	Drawing-in or trapping hazard	5.2.1, 5.2.2
16	**Loss of stability/overturning of machinery**	5.2.1, 5.5, 5.5.2, 5.5.3, [A1] *deleted text* [A1]
16.1	Loader portion: Rated operating load with bucket, fork, object handling and log handling applications	5.5.2
16.2	Backhoe portion: Rated capacity with bucket, object handling and other applications	5.5.3, Annex B
	Additional hazards, hazardous situations and hazardous events due to mobility	
18	**Relating to travelling function**	
18.3	Movement without all parts in a safe position	5.6
19	**Linked to the operator's station** on the machine	
19.4	Mechanical hazards at the operator's station: a) rollover; b) fall of objects, penetration by objects	 5.2.1 5.2.2
19.5	Insufficient visibility from the operator's station(s)	5.3.2
19.7	Inadequate seating	[A1] 5.3.3 [A1]
20	**Due to control system**	
20.3	Inadequate design of manual controls and their mode of operation	[A1] 5.3.2 [A1]
23	**From/to third persons**	
23.3	Lack or inadequacy of visual or acoustic warning means	5.4
24	**Insufficient instructions for the operator** (operation manual, signs, warnings, and markings)	6

1) Number refers to Annex A of [A1] EN 474-1:2006+A1:2009 [A1].

Table A.1 *(continued)*

No.[2)]	Hazard	Relevant clauses of this European Standard
25	**Mechanical hazards and hazardous events:**	
25.1	From load falls, collision, machine tipping caused by:	
25.1.1	Lack of stability	⟦A1⟩ *deleted text* ⟨A1⟧
25.1.3	Inadequate holding devices/accessories	⟦A1⟩ *deleted text* ⟨A1⟧ ⟦A1⟩ EN 474-1:2006+A1:2009 ⟨A1⟧, Annex E

2) Number refers to Annex A of ⟦A1⟩ EN 474-1:2006+A1:2009 ⟨A1⟧.

Annex B
(normative)

Test method for backhoe loader lift capacity at the backhoe portion

NOTE This annex specifies a test method for determining the backhoe loader capacity when used in backhoe applications.

B.1 Terms and definitions

B.1.1
anchorage point
vertical point below the lifting device where the load force is applied or transposed

B.1.2
hydraulic holding circuit pressure
maximum static pressure in a specific circuit, limited by a relief valve at a flow no greater than 10 % of rated circuit flow

B.1.3
tipping load
static load at the balance point

B.1.4
hydraulic lift capacity
maximum load that can be lifted at the bucket hinge pin with any hydraulic circuit activated, limited by the working circuit hydraulic pressure

B.1.5
lift point radius
horizontal distance between the bucket hinge pin and the swing pivot centre

B.1.6
balance point
point at which the moment acting to overturn the machine with a specific load and lift point radius is equal to the moment of the machine available to resist overturning

B.1.7
overturning moment
moment when the balance point is reached

B.1.8
test force
force applied to the load cell either by test weight or by applying hydraulic means

B.2 Apparatus

The apparatus shall comprise the following and with tolerances as specified in ISO 9248:1992:

— load cell or force transducer appropriate to the magnitude of the load to be measured;

— wire ropes and shackles, pulley, safety chains and adjustable anchor point (e. g. slide rail);

— pressure gauge;

— means for measuring linear dimensions.

B.3 Test site

The test site shall consist of a substantially level (± 2 % inclination), hard surface, preferably concrete, with anchor point and sufficient space for the load cell.

B.4 Preparation for test

B.4.1 General

The machine shall be clean and equipped according to the manufacturer's specifications.

The machine shall be equipped with an attachment bracket if applicable (but no attachment). The machine shall have the tyre inflation and tyre ballast as specified by the manufacturer. The fuel tank shall be filled to 50 % capacity.

Prior to testing, the engine and hydraulic system shall be at the normal working temperature, and the hydraulic system pressure(s) shall then be checked for compliance with the manufacturer's recommended hydraulic pressure setting(s).

B.4.2 Position

The machine shall be positioned on the test site as follows:

a) in the least stable position (e. g. fully side-shifted and/or fully articulated);

b) the oscillation of the articulated steering joint (if any) shall be locked;

c) if the arm can be articulated horizontally, it shall be in the straight position;

d) stabilisation devices shall be engaged according to the manufacturer's specifications.

Outriggers and loader bucket shall be in a position so that the wheels just clear off ground.

B.5 Capacity test

B.5.1 Load cell

A load cell shall be installed between the excavator bucket hinge pin and anchorage points, vertically below the hinge pin.

B.5.2 Position of boom/arm

The boom/arm shall be so positioned that the line between boom hinge pin and bucket hinge pin is horizontal when the force is applied.

B.5.3 Test procedure

B.5.3.1 Step one

The test force shall be progressively applied until either:

a) the tipping load is reached or

b) the hydraulic holding circuit pressure is reached.

B.5.3.2 Step two

After completion of step one, the hydraulic lift capacity (as defined in B.1.4) shall be measured.

B.5.4 Verification

The following shall be measured and recorded:

a) the lift point radius;

b) the tipping load;

c) the hydraulic holding circuit pressure;

d) the hydraulic lift capacity.

B.6 Rated lift capacity in bucket or shovel application

The rated lift capacity for a backhoe loader used in bucket or shovel application shall be determined either by:

— 75 % of maximum load according to B.5.3.1 a) or

— hydraulic lift capacity according to B.5.3.2

whichever is less.

B.7 Rated lift capacity in object handling

Rated lift capacity in object handling shall be determined either by:

— 75 % of maximum tipping load according to B.5.3.1 a) or

— 87 % of hydraulic lift capacity according to B.5.3.2

whichever is less.

B.8 Rated lift capacity with attachment

The rated lift capacity shall be determined with the backhoe in the centre position at maximum lift point radius, minus the mass of the attachment. Backhoe loaders with side shift shall be measured both with the backhoe in the centre position and fully side shifted.

Annex C
(informative)

Illustrations

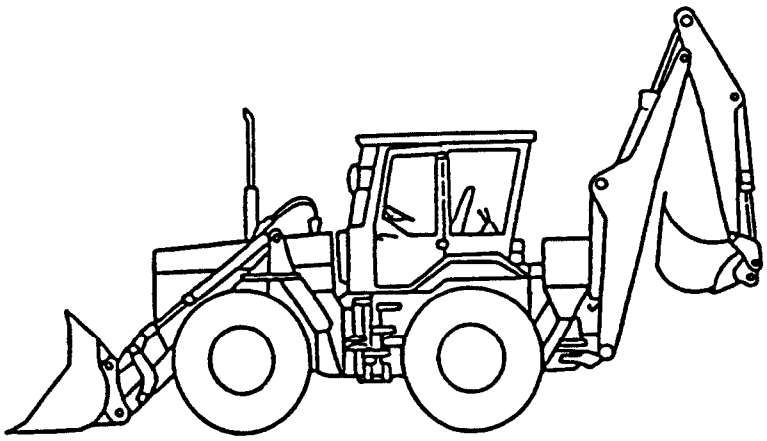


Figure C.1 — Wheel backhoe loader

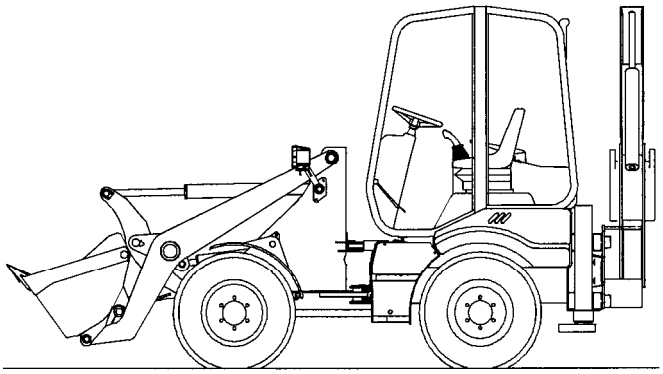


Figure C.2 — Compact wheel backhoe loader

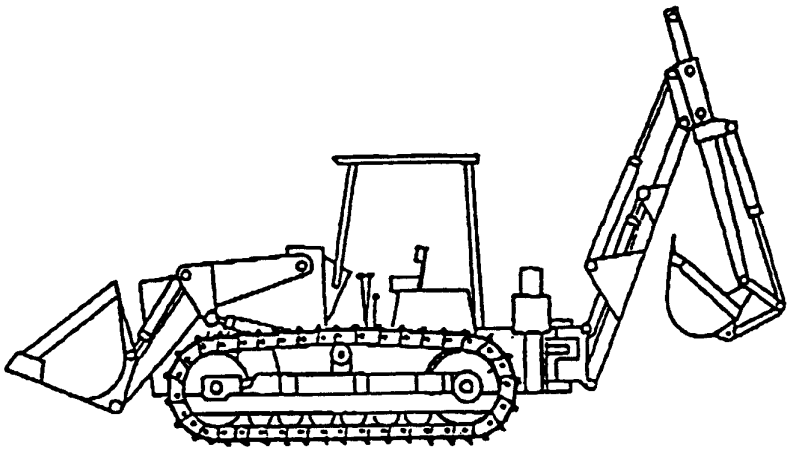


Figure C.3 — Crawler backhoe loader

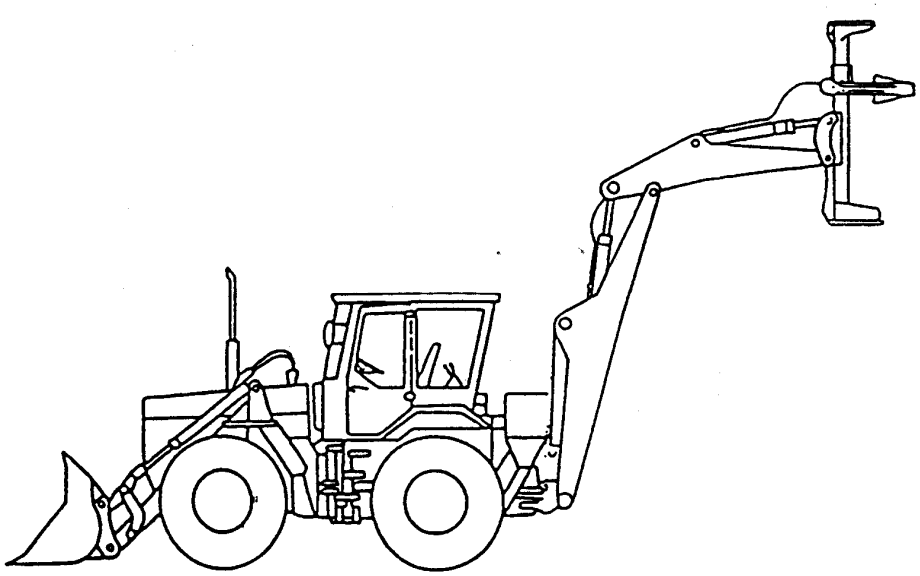


Figure C.4 — Backhoe loader with pole erecting attachment

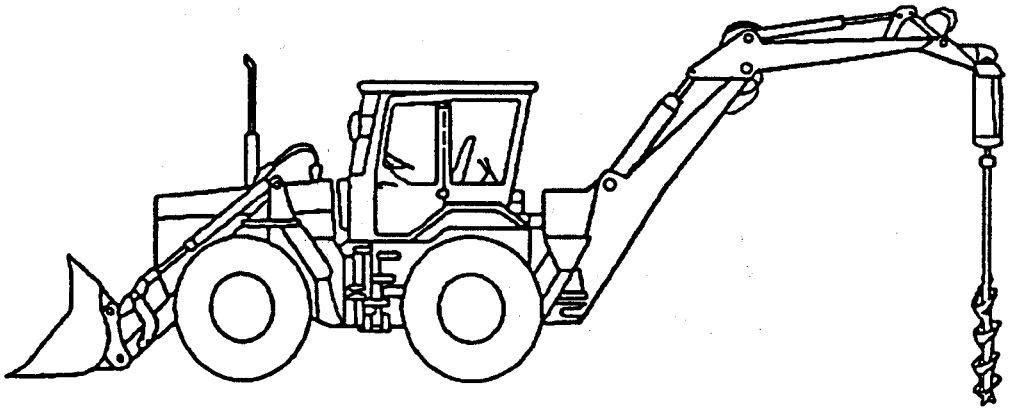


Figure C.5 — Backhoe loader with earth drill

[A2⟩ *deleted text* ⟨A2]

Annex ZA
(informative)

[A1] Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the [A2] European Union [A2] under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. [A1]

Bibliography

[1] EN ISO 6165:2006, *Earth-moving machinery — Basic types — Identification and terms and definitions (ISO 6165:2006)*

[2] ISO 8812:1999, *Earth-moving machinery — Backhoe loaders — Definitions and commercial specifications*

[3] ▌A1⟩ ISO 14397-2:2007 ⟨A1▌, *Earth-moving machinery — Loaders and backhoe loaders — Part 2: Test method for measuring breakout forces and lift capacity to maximum lift height*

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