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Agricultural machinery — Backhoes — Safety

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National foreword

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A list of organizations represented on this committee 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.

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Foreword

This document (EN 16246:2012) has been prepared by Technical Committee CEN/TC 144 “Tractors and machinery for agriculture and forestry”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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.

Introduction

This document is a type-C standard as specified in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document. These hazards are specific to hydraulic backhoes.

Hazards that are common to all agricultural machines (self-propelled, mounted, semi-mounted and trailed) are dealt with in EN ISO 4254-1.

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 European Standard, when used together with EN ISO 4254-1 and EN 15811, specifies the safety requirements and their verification for the design and construction of hydraulic backhoes mounted to the three point linkage of a tractor. It describes methods for the elimination or reduction of hazards arising from the intended use of these machines by one person (the operator) in the course of normal operation and service. In addition, it specifies the type of information on safe working practices (including residual risks) to be provided by the manufacturer.

When requirements of this document are different from those which are stated in EN ISO 4254-1, the requirements of this document take precedence over the requirements of EN ISO 4254-1 for machines that have been designed and built according to the provisions of this document.

This European Standard, taken together with EN ISO 4254-1, deals with all the significant hazards, hazardous situations and events (as listed in Table 1) relevant to hydraulic backhoes mounted to the three point linkage of a tractor, when they are used as intended and under the conditions of misuse foreseeable by the manufacturer.

This European Standard is not applicable to lifting operations for the movement of unit loads with hooks or other similar devices. Materials connected with excavation activities are not intended as unit loads and their movement is covered by this standard.

This European Standard does not give requirements for quick hitch devices.

NOTE 1 An amendment of EN 474-1 is under preparation to deal with this issue. It will be evaluated for inclusion in this European Standard.

NOTE 2 Specific requirements related to road traffic regulations are not taken into account in this European Standard.

This European Standard is not applicable to hydraulic backhoes which are manufactured before the date of its publication as EN.

2 Normative references

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

EN ISO 4254-1:2009, *Agricultural machinery — Safety — Part 1: General requirements (ISO 4254-1:2008)*

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

ISO 3600, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and presentation*

ISO 3767-2, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 2: Symbols for agricultural tractors and machinery*

ISO 3776-1, *Tractors and machinery for agriculture — Seat belts — Part 1: Anchorage location requirements*

ISO 3776-2, *Tractors and machinery for agriculture — Seat belts — Part 2: Anchorage strength requirements*

ISO 11684, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN ISO 4254-1:2009 and the following apply.

NOTE An example of the machine types covered by this standard is illustrated in Annex A.

3.1
rear-mounted hydraulic backhoe
machine with hydraulically powered arms mounted to the rear three point linkage of the tractor, used with an attachment for various operations, such as excavating, elevating, swinging, discharging

3.2
primary loading arm
loading arm located between the frame of the machine and the secondary arm

3.3
secondary loading arm
loading arm located between the primary loading arm and the attachment

3.4
telescopic arm
arm capable of being extended in a longitudinal direction

3.5
swing pivot
device which pivotally connects the frame with the primary loading arm, in order to let it swing about a vertical axis

3.6
outriggers
device to keep the machine stable on the ground when the backhoe is in use

3.7
side shifting
device to allow horizontal movement within limits of the backhoe swing pivot

3.8
attachment
tool or interchangeable equipment that can be attached to the secondary loading arm, such as a bucket or an inverted bucket, as indicated by the manufacturer

3.9
inverted bucket
rearward facing bucket for the excavating, elevating, swinging and discharging of the material

4 List of significant hazards

Table 1 gives the significant hazard(s), the significant hazardous situation(s) and hazardous event(s) covered by this standard that have been identified by risk assessment as being significant for this type of machine, and which require specific action by the designer or manufacturer to eliminate or to reduce the risk.

Attention is drawn to the necessity to identify any additional significant hazards associated with a specific machine and to provide suitable safety measures. Such additional safety measures are not dealt with by this standard.

Table 1 — List of significant hazards associated with hydraulic backhoes

No. [a]	Hazard	Hazardous situation and event	Clauses/subclauses of EN ISO 4254-1:2009	Clause/subclause of this standard
A.1	**Mechanical hazard**			
A.1.1	Crushing hazard	— Controls — Boarding means — Platforms — Working tools — Service/maintenance — Shearing/pinching points — Moving the machine — Stability — Mounting of machines	4.4.3; 5.1.3.2; 5.1.8; 6.1 4.5.1.1.2; 4.5.1.2.5; 4.5.2; 4.6 6.4 4.7 4.14.6 5.1.2.3 5.1.4 5.2 6.2 6.2.2; 6.2.3; 6.3	5.3.1 5.1, 5.5 5.1, 5.4 5.7.1 6 5.1 5.2 5.2 5.2
A.1.2	Shearing hazard	— Controls — Boarding means — Platforms — Working tools — Service/maintenance — Shearing/pinching points — Moving the machine — Stability — Mounting of machines	4.4.3; 5.1.3.2; 5.1.8; 6.1 4.5.1.1.2; 4.5.1.2.5; 4.5.2; 4.6 6.4 4.7 4.14.6 5.1.2.3 5.1.4 5.2 6.2 6.2.2; 6.2.3; 6.3	5.3.1 5.1, 5.5 5.1, 5.4 5.7.1 6 5.1 5.2 5.2 5.2
A.1.6	Impact hazard	— Boarding means	4.5.1.2.5	5.1, 5.4, 5.5
A.1.8	Friction or abrasion hazard	— Controls — Electrical equipment — Boarding means	4.4.3; 5.1.3.2 4.9.1 4.5.1.1.2	5.3.1 5.6 5.4, 5.5
A.1.9	High-pressure fluid injection or ejection hazard	— Hydraulic components	4.10; 6.5	5.7
A.2	**Electrical hazards**			
A.2.1	Contact of persons with live parts (direct contact)	— Electrical equipment	4.9; 5.3; 6.5	5.6
A.2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	— Electrical equipment	4.9.1	-

No. [a]	Hazard	Hazardous situation and event	Clauses/subclauses of EN ISO 4254-1:2009	Clause/subclause of this standard
A.2.3	Approach to live parts under high voltage	— Overhead power lines	8.1.3	8.1
A.2.4	Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc.	— Electrical equipment	4.9.2; 5.3.1	5.6
A.3	**Thermal hazards**			
	Burns, scalds and other injuries by 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	— Operating fluids — Cab material — Hot surfaces	4.12 5.1.6 5.5	5.7
A.4	**Hazards generated by noise**			
	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness) Accidents due to interference with speech communication and accoustic warning signals	— Noise	4.2	5.1
A.5	**Hazards generated by materials and substances**			
A.5.1	Hazards from contact with, or inhalation, of harmful fluids, gases, mists, fumes and dusts	— Operating fluids	4.10; 5.4	5.7
A.6	**Hazards generated by neglecting ergonomic principles in machinery design**			
A.6.1	Unhealthy	— Controls	4.4	5.3

No. [a]	Hazard	Hazardous situation and event	Clauses/subclauses of EN ISO 4254-1:2009	Clause/subclause of this standard
	postures or excessive effort	— Boarding means — Service and maintenance — Operator station	4.5; 4.6 4.14.2; 4.14.4 5.1.1; 5.1.3; 5.1.5.2	5.4, 5.5 6 5.4
A.6.2	Inadequate consideration of hand-arm or foot-leg anatomy	— Controls — Boarding means — Operator station	4.4 4.5; 4.6 5.1	5.3 5.4, 5.5 5.4
A.6.3	Neglected use of personal protective equipment	— Operator's manual	8.1.3	8.1
A.6.5	Mental overload and under load, stress	— Controls	4.4	5.3
A.6.6	Human error, human behaviour	— Controls — Operator's manual — Signs	4.4 8.1 8.2	5.3 8.1 8.2
A.6.7	Inadequate design, location or identification manual controls	— Controls	4.4; 5.1.3; 6.1	5.3
A.7	**Combination of hazards**	— Individual assemblies — Operator's manual	4.13 8.1	- 8.1
A.8	**Unexpected start-up, unexpected overrun/overspeed**			
A.8.1	Failure/disorder of the control system	— Service and maintenance — Electrical equipment — Connections	4.8 4.9 6.5	5.7 5.6 5.6
A.8.3	External influences on electrical equipment	— Cables	4.9.1	5.6
A.8.4	Other external influences (gravity, wind, etc.)	— Stability	6.2.1.1; 6.2.1.2	5.3, 5.6
A.8.5	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities	— Controls — Boarding means — Operator station — Moving the machine — Mounting of machines	4.4; 6.1.2 4.5; 4.6 5.1 5.2 6.2; 6.3 4.14 8.1.3	5.3 5.4, 5.5 5.4 5.8 5.2 6 8.1

No. [a]	Hazard	Hazardous situation and event	Clauses/subclauses of EN ISO 4254-1:2009	Clause/subclause of this standard
		— Service and maintenance — Operator's manual		
A.9	**Impossibility of stopping the machine in the best possible conditions**	— Controls	4.4; 6.1	-
A.11	**Failure of power supply**	— Supports — Electrical equipment — Connections	4.8 4.9 6.5	5.7 5.6
A.13	**Errors of fitting**	— Mounting of machines — Operator's manual	6.2; 6.3 8.1.3	5.2 8.1
A.14	**Break-up during operation**	— Hydraulic components	4.10	5.7
A.15	**Falling or ejected objects or fluids**	— Hydraulic components	4.10	5.7
A.16	**Loss of stability/overturning of machinery**	— Stability — Roll-over	6.2 5.1.2.3	5.2, 5.8 -
A.17	**Slip, trap and fall of persons (related to machinery)**	— Boarding means	4.5; 4.6	5.2, 5.4, 5.5
Additional hazards, hazardous situations and hazardous events due to mobility				
A.19	**Link to the work position**			
A.19.1	Fall of persons during access to (or at/from) the work position	— Boarding means	4.5; 4.6	5.4, 5.5
A.19.4	Mechanical hazards at the working position: a) contact with	— Shearing/pinching points	4.4.3; 4.5.1.2.5; 5.1.4	-

No. [a]	Hazard	Hazardous situation and event	Clauses/subclauses of EN ISO 4254-1:2009	Clause/subclause of this standard
	wheels; b) rollover; c) fall of objects, penetration by objects;			
A.19.7	Inadequate seating	— Operator's seat	5.1.2	5.4
A.19.8	Noise at work position	— Operator's work station	4.2	5.1
A.20	**Due to the control system**			
A.20.1	Inadequate location of manual controls	— Controls	4.4; 4.8.1.2; 5.1.2.1; 6.1.1; 6.1.2	5.3
A.20.2	Inadequate design of manual controls and their mode of operation	— Controls	4.4; 5.1.3; 5.1.8	5.3
A.21	**From handling the machine (lack of stability)**	— Stability — Roll-over	6.2 5.1.2.3	5.7.7
A.22	**Due to the power source and to the transmission of power**			
A.22.2	Hazards from transmission power between machines	— Power transmission	6.4; 6.5	5.7
A.22.3	Hazards from coupling and towing	— Mounting of machines	6.2.2; 6.2.3; 6.3	5.2
A.23	**From/to third persons**			
A.24	**Insufficient instructions for the driver/operator**	— Operator's manual	8.1	8.1

[a] With reference to EN ISO 4254-1:2009, Table A.1.

5 Safety requirements and/or measures

5.1 General

The backhoe shall be in accordance with the safety requirements and/or protective measures of this clause. In addition, the backhoe shall be designed according to the principles of EN ISO 12100, for hazards relevant, but not significant, which are not dealt with by this document.

Unless otherwise specified in this European Standard, the machine shall comply with the requirements EN ISO 4254-1.

5.2 Attachment to tractor – prevention of uncontrolled movement

The backhoe shall be mountable on a tractor in a way that prevents relative movement between the backhoe and the tractor. In particular, unintentional rising of the tractor link arms during operation shall be prevented. This can be achieved by means of a sub-frame or other device that creates a solid mechanical lock. Chains alone are not considered to fulfil this requirement.

The device shall:

a) be necessary for the fitting of the backhoe to the tractor, i.e. it shall not be possible to mount the backhoe on the tractor without the device;

b) be integrated into the machine so that it is not easily removed;

c) be easily adjustable to allow correct coupling of tractor and backhoe; it shall be possible to adjust it without removing or deactivating it;

d) be removable only with specific tools.

An example of such a device is given in Figure A.3.

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

5.3 Controls

5.3.1 Clearance

See 4.4 of EN ISO 4254-1:2009.

5.3.2 Configuration, functions and marking of the controls

Controls shall be designed and arranged in order to be:

a) easily accessible and identifiable;

b) corresponding to functions as shown in Figures 3 and 4;

c) permanently and visibly marked as shown in Figures 1 and 2.

Symbols shall be in accordance with ISO 3767-2.

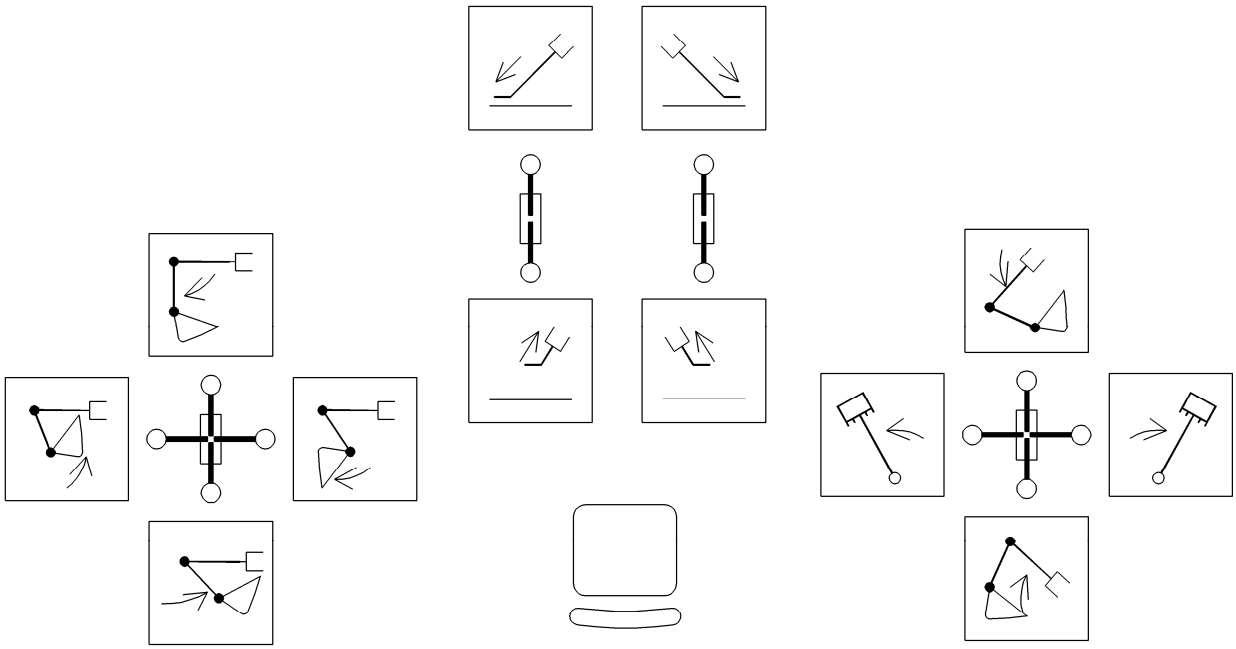


Figure 1 — Configuration, functions and marking of a four-levers control

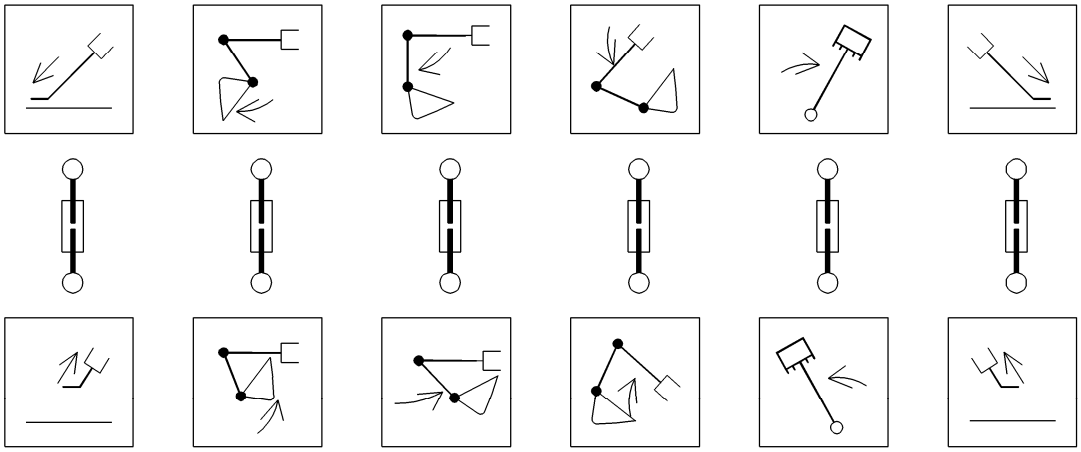


Figure 2 — Configuration, functions and marking of a six-levers control

In Figures 1 and 2, one of the controls is allocated to the opening and closing of the bucket. If this control is used to activate other types of attachments, it has to be marked so as to clearly identify its function.

Controls shall automatically return to a neutral position when released. If the use of attachments that require a continuous oil flow are foreseen, a specific hydraulic line shall be provided and the instructions for correct use shall be provided by the manufacturer.

Control levers shall be designed and protected in order to avoid inadvertent operation; a guard may be used to meet this objective provided that it does not interfere with the normal operation of controls.

5.4 Operator's work station

The controls shall be located in the hand and foot reach, for machines without cab, as defined in 3.5 of EN ISO 4254-1:2009.

The operator's work station shall:

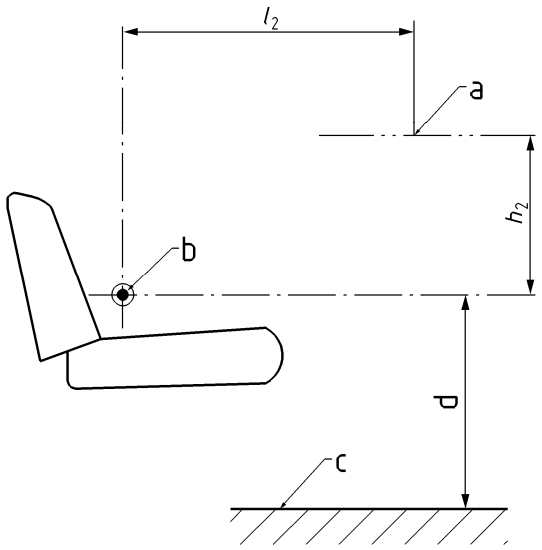
a) be easily accessible; accessibility shall not be restricted by the backhoe controls or other parts of the backhoe or tractor in the reach zone;

b) be resistant to the stresses imposed; the seat supporting device, in particular, shall resist without permanent deformation a vertical force of 2 000 N applied vertically down to the cushion of the seat on a surface of 0,04 m^2;

c) be provided with a platform for the feet of the operator. The platform shall be at least 160 mm wide and 200 mm long, for each foot. The platform shall have a lateral stop at each end and be so designed (e.g. mudguards, perforated steps) that an accumulation of mud and/or snow is minimised under normal work conditions;

d) be comfortable for the operator. Controls or other parts of the machine or of the tractor in the reach zone shall not force the operator into an unsuitable ergonomic posture;

e) be designed such that it will not cause shearing, cutting or impact hazards. In particular, the exposed ends of the controls shall be located in the area specified in Figures 3 and 4 and, centred in respect of the operator's seat (front view).

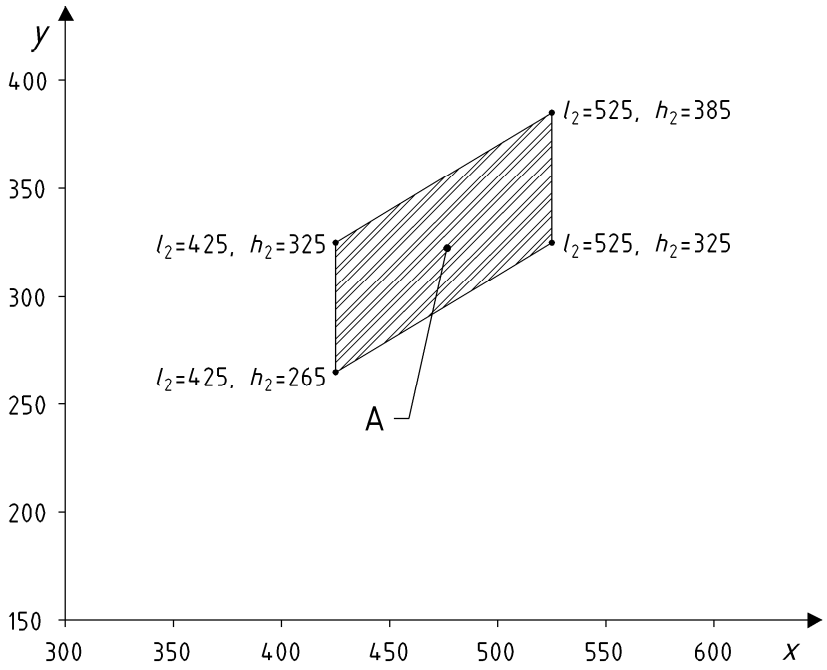


Key

a protruding end of control actuator
b SIP
c platform for operator's feet
d 450 mm to 520 mm

Figure 3 — Position of the end of protruding controls

Dimensions in millimetres



Key

A specified area

x distance l_2 forward of SIP

y distance h_2 above SIP

Figure 4 — Position of the end of protruding controls: values for h_2, l_2

Operator's seat shall be provided with seat-belts in accordance to ISO 3776-1 and ISO 3776-2.

5.5 Access to the operator's work station

Handles, handrails and steps shall together provide the operator with three continuous points of contact during machine access and egress.

Access to the seat shall be possible with the alternate use of the feet and suitable hand holds. Steps for the feet shall be at least 160 mm wide and 100 mm deep. The vertical distance between two successive steps shall not exceed 400 mm and the horizontal distance between two successive steps shall not exceed 400 mm. Steps shall resist, without permanent deformation, at every 100 mm across their width, a downward vertical force of at least 1 500 N when applied on their surface.

The lowest step shall not be higher than 550 mm from the ground when the machine is in the highest working position i.e. stabilisers fully extended and resting on level ground.

If ladders are used, they shall meet the requirements of EN ISO 4254-1.

Handles or handrails shall be provided on both sides of the access and:

a) the minimum length for a handle shall be 150 mm;

b) at every 100 mm along their length handles and handrails shall resist, without permanent deformation, a force of 300 N.

Controls, except presence sensors, shall not be located in the access zone, as defined by the manufacturer.

The operator's manual shall specify the safe means of access and egress.

5.6 Electrical equipment

Electrical connections shall be suitably protected against unintentional contact and short circuit from ingress of moisture and debris.

Solutions shall be adopted in order to avoid wrong connections between electrical power sources.

5.7 Hydraulics

5.7.1 General

Components, hoses and other devices containing hydraulic fluid shall be designed or protected to avoid fluid projection towards the operator's work station in case of rupture (e.g. shield or double hoses).

Components and lines shall be dimensioned in a way that when the hydraulic circuit is activated at the maximum working pressure, failure and excessive temperatures are avoided.

The hydraulic system shall be designed to ensure compatibility between the components and with the fluid specified by the manufacturer for the intended operating and environmental conditions. It shall also be provided with filters to avoid contamination of the hydraulic fluid and of a pressure-control device.

Where a hydraulic failure results in a hazardous situation e.g. failure of an outrigger leading to instability, the hydraulic circuit shall be fitted with automatic locking devices in accordance with 4.8.3 of EN ISO 4254-1:2009.

5.7.2 Pump

The pump shall guarantee the flow rate and the pressure specified by the manufacturer when activated at the specified speed.

Pumps shall be dimensioned and its speed shall be set in order to ensure safe connections with the different types of tractors, i.e. excessive mechanical stresses and excessive flow-rates of the pump shall be avoided.

5.7.3 Fluid reservoir

Hydraulic tanks shall have an adequate capacity in order to let the pump work correctly even when all cylinders are completely extended, and to contain the fluid when all cylinders are retracted.

Devices shall be installed to indicate the level in the hydraulic tank.

The tank shall have an opening to fill it; the height of the opening shall not exceed 1 500 mm from the ground or from a working platform.

A means of emptying the reservoir shall be provided.

5.7.4 Pressure limit valves

Every part of the hydraulic circuit shall be equipped with a pressure limiting valve or another device in order to limit the pressure to 125 % of the maximum foreseen working pressure.

Valves shall be set to avoid uncontrolled movements of parts of the machine.

5.7.5 Hoses and fittings

The bursting pressure of hoses shall be at least four times the maximum working pressure.

Hoses and fittings shall be designed or protected in a way that they are not damaged by contact with parts of the machine.

5.7.6 Dimensioning of hydraulic cylinders

Hydraulic cylinders shall be dimensioned for dynamic working pressure with a safety factor of at least 1,5.

5.7.7 Control of movements

The movement speeds of the loading arms (including telescopic extension, if present) and swing pivot should not give rise to unacceptable inertial forces. If necessary, devices to limit the speed of movement shall be provided.

5.8 Stability of the tractor backhoe combination

5.8.1 General

The stability of the combined tractor/backhoe loader is dependent on the range and capacity of the attachment, the arrangement of the backhoe loader on the tractor together with the type of tractor. Improvements in stability can be achieved by fitting a counterweight or ballasting the front wheels and observing limits to operating conditions. Further guidance for particular operating conditions are given in Annex B.

Each permitted combination tractor and backhoe shall have a suitable margin against overturning. Permitted combinations and instructions for fitting shall be included in the information for use.

5.8.2 Outriggers

5.8.2.1 Bearing surface

At least two outriggers shall be provided with the backhoe unit.

The bearing surfaces of the outriggers shall be adjustable or freely moveable to maintain adequate ground contact in uneven conditions and allow for a lateral slope of 10° in either direction.

The bearing surface of the outrigger shall be designed to limit ground pressure to 400 kPa when the maximum force is applied to the outrigger.

5.8.2.2 Extension of the outriggers

Extendable outriggers, if present, shall have signs to indicate their correct positioning.

Manually activated extensions shall have:

a) handles;

b) devices to lock the extending sections in working and transport positions.

Hydraulically activated extensions shall have devices to lock the extending sections in the transport position. Devices to lock the outriggers in the working position shall be provided only if cylinders do not guarantee adequate resistance to the forces transmitted during normal operations.

The operator shall be able to clearly see whether locking device for work and transport are in position, both for manually and hydraulically activated extensions.

6 Maintenance and repair

For maintenance and repair, see EN ISO 4254-1.

7 Verification of the safety requirements or protective measures

See Table 2.

Table 2 — List of safety requirements and/or protective measurements and their verification

Subclause	Verification			Requirement
	Inspection[a]	Measurement[b]	Test	
5.2	X	X	—	Shall be verified by inspection and kinematic analysis.
5.3	X	X	X	Shall be verified by measuring the position and dimensions of the controls and testing their operability and function.
5.4	—	X	X	Shall be verified by measuring the specified dimension and testing with appropriate instruments the strength as specified.
5.5	X	X	X	Shall be verified by inspection, measuring the specified dimensions and by functional test.
5.6	X	—	—	Shall be verified by inspection.
5.7	X	X	X	Shall be verified by inspection, measurement of the specified dimensions and functional test.
5.8	X	X	X	Shall be verified by inspection, measurement of the specified values and functional test

[a] Inspection: visual check of the machine to see that everything is in place.

[b] Measurement: determination of a value by using an appropriate device or instrument.

8 Information for use

8.1 Operator’s manual

Content and presentation shall be in accordance with ISO 3600.

Comprehensive instructions and information on all aspects of the safe use of the machine, including suitable clothing and personal protective equipment requirements and the need for training, if necessary, shall be provided by the manufacturer in the operator’s manual. The operator’s manual shall contain as a minimum the following generally applicable information:

a) information relating to transport, handling and storage of the machine;

b) information relating to installation and commissioning of the machine;

c) information relating to the machine itself;

d) information relating to the use of the machine;

e) information for maintenance;

f) information relating to de-commissioning, dismantling and disposal;

g) information for emergency situations;

h) maintenance instructions provided for skilled persons and those provided for unskilled persons, which should be kept clearly separated from each other.

In particular the following aspects shall be clarified:

i) necessity to keep people away from the working area;

j) foreseen uses of the machine;

k) correct procedure to fit the machine on the tractor including consideration of any other attachment to be fitted to the tractor (e.g. front loader);

l) correct access to the operator's work station;

m) necessity to stop the power sources (engine of the tractor…) and to lower the arms of the backhoe to the ground before any work is carried out on the backhoe or tractor;

n) necessity to verify the good conditions of the PTO drive shaft and guards;

o) procedure to install mechanical locking devices for maintenance operations with the backhoe arms raised;

p) correct installation of the pump on the tractor's PTO;

q) procedure for correct use of the outriggers;

r) procedure to use stability device when the machine is unmounted;

s) information about stability limitations of the tractor backhoe combination when working;

t) description of the information and data related to the backhoe and tractor, that is required needed to assess the stability of the combination of tractor and backhoe during work;

u) risks about contact with overhead power lines or other overhead obstacles;

v) necessity for the operator to make sure that the backhoe seat is not used when the tractor is travelling;

w) procedure to lock the backhoe in its transport position;

x) procedures related to the means for accessing the operating position;

y) explanation of the meaning of the symbols used;

z) use of adequate personal protection equipment (PPE).

8.2 Marking

All machines shall be marked legibly and indelibly with at least the following minimum information:

a) name and address of the manufacturer;

b) designation of the machinery;

c) designation of series or type;

d) serial number, if any;

e) year of construction, that is the year in which the manufacturing process is completed;

f) mass of the backhoe unit.

Safety signs shall conform to the requirements of ISO 11684 and shall be appropriately affixed to the machine as necessary to alert the operator and others of the potential hazard(s) that can cause personal injury during normal operations and servicing.

In particular, the following risks shall be highlighted:

g) risks caused by the movement of the swing pivot;

h) nominal rotational frequency and direction of rotation of the inlet shaft;

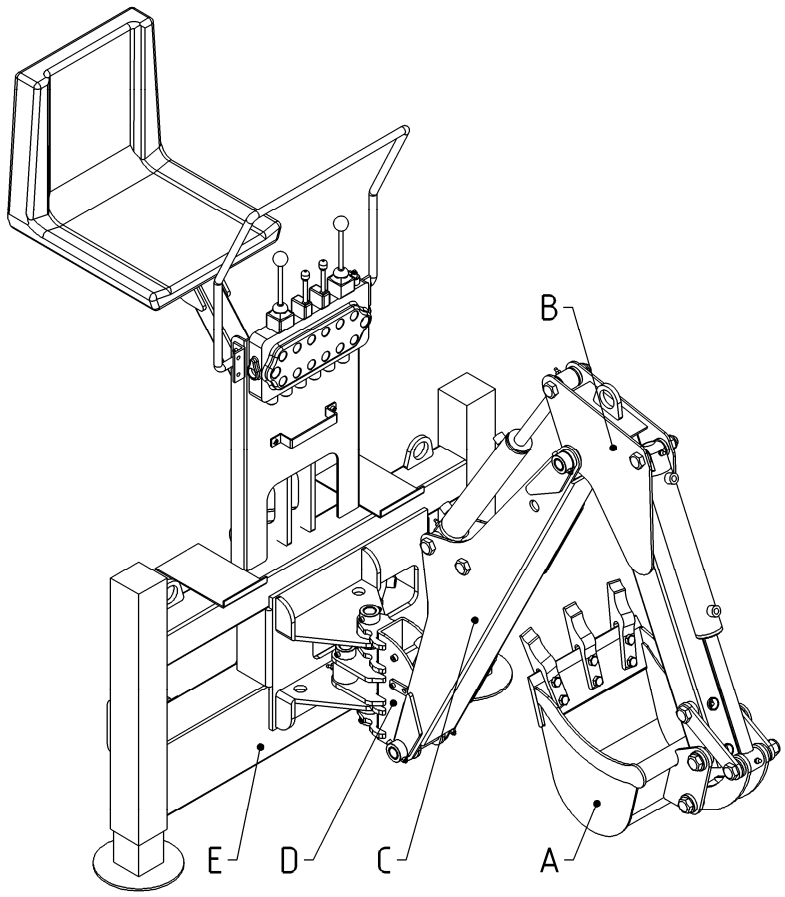
i) risks arising from falling of material from the attachment;

j) risks extending the outriggers;

k) lifting of people and animals prohibited.

Annex A
(informative)

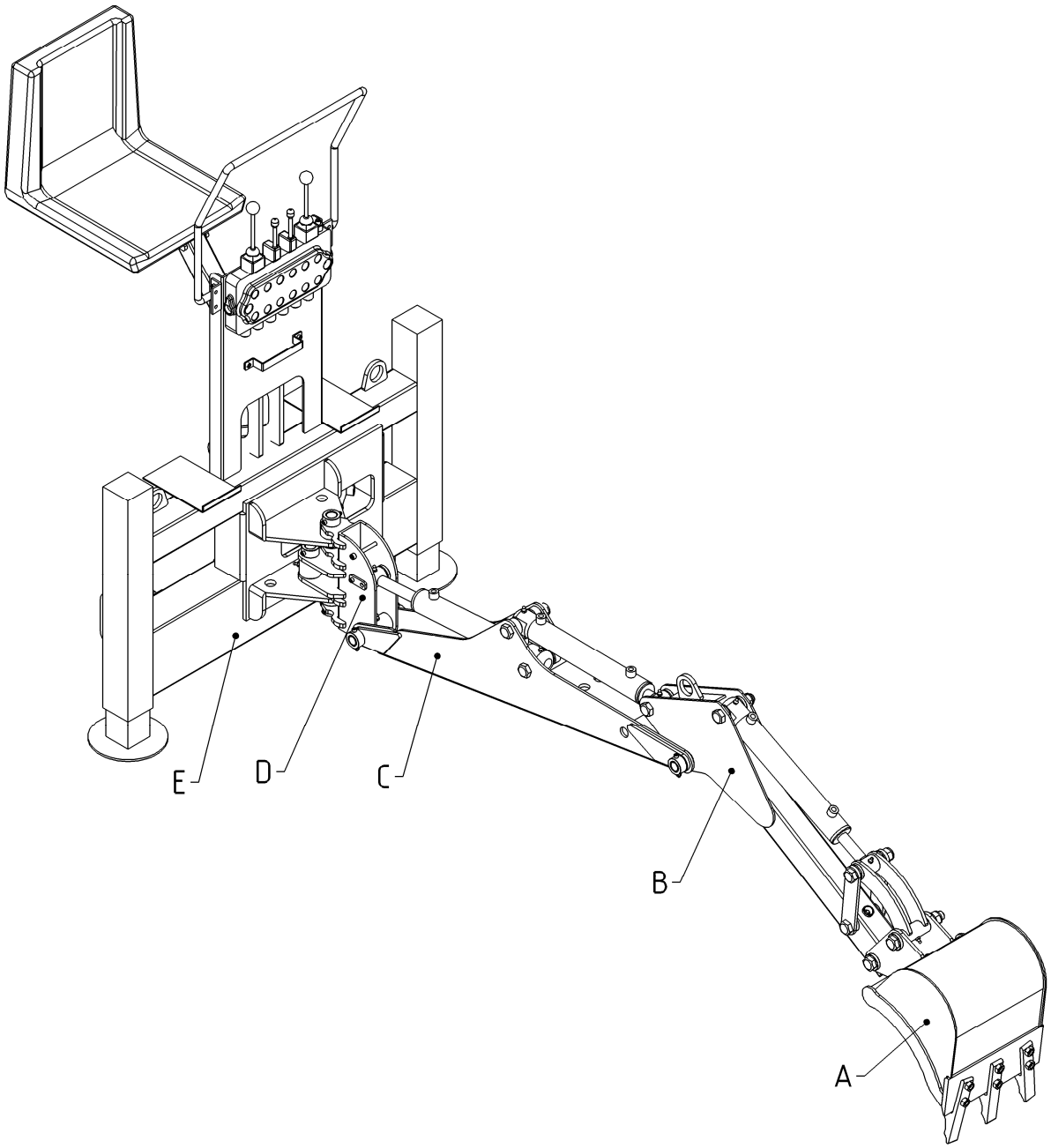
Examples of a backhoe attachment and safety locking device



Key

A attachment
B secondary loading arm
C primary loading arm
D swing pivot
E side shifting

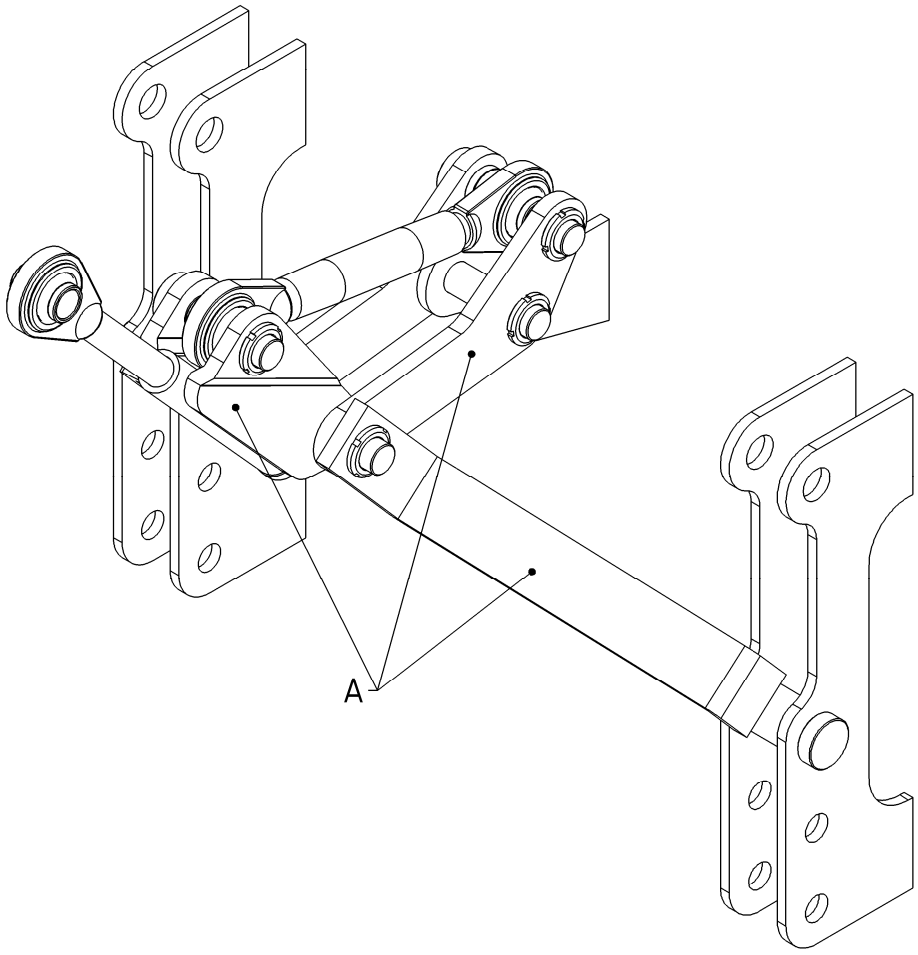
Figure A.1 — Rear-mounted hydraulic backhoe, folded loading arms



Key

A attachment
B secondary loading arm
C primary loading arm
D swing pivot
E side shifting

Figure A.2 — Rear-mounted hydraulic backhoe, extended loading arms



Key

A parts of the locking device

Figure A.3 — Example of safety locking device for the fitting of the machine on the tractor

Annex B
(informative)

Stability of the tractor/backhoe loader combination

B.1 Effects on the stability

The stability is affected by:

a) the centre of gravity of the loaded tractor/backhoe loader combination;

b) the geometric conditions, e.g. position of loader and counterweight;

c) the weight and position of the attachment and the load in the attachment;

d) the weight of the tractor;

e) the track width and the wheelbase of the tractor;

f) the ground conditions, e.g. slope, grip, load capability of the soil.

B.2 Stability calculations

B.2.1 Transverse stability

This calculation method aims to determine the minimum mass (Mt) of the tractor to which the backhoe could be mounted in order to ensure transverse stability, when the backhoe is in its central position (lateral shifting, see Figure B.1). Operating at more unfavourable positions (e.g. with the swing pivot displaced from the central position to the maximum lateral external position) is not covered by this calculation. Operation at these more unfavourable conditions requires further assessment.

When necessary, further assessment should be carried out by the manufacturer.

The input data are:

a) mass of the backhoe, m, expressed in kilograms (kg);

b) track width of the tractor, c, expressed in metres (m);

c) length of the arms (i.e. maximum extension of both arms of the backhoe), b, expressed in metres (m);

d) maximum vertical force that the bucket (or other attachment) can apply on the ground, both upwards directed (lifting force) and downwards directed, F, expressed in Newton (N).

Normally, the most unfavourable condition is reached when the vertical force is directed downwards. However, the calculation should be carried out for both directions.

NOTE The effect of outrigger extension has not been taken into account (it has been assumed that the distance between outriggers is identical to the track width).

– **Vertical force directed upwards**:

$$Q > \frac{F \times \left(b - \frac{c}{2} \right)}{\frac{c}{2}}$$

Where Q is the weight [N] of the combination tractor and machine; then the minimum mass [kg] of the tractor will be:

$$M_t = \frac{Q - m \times g}{g}$$

Where g is the value of the acceleration due to gravity.

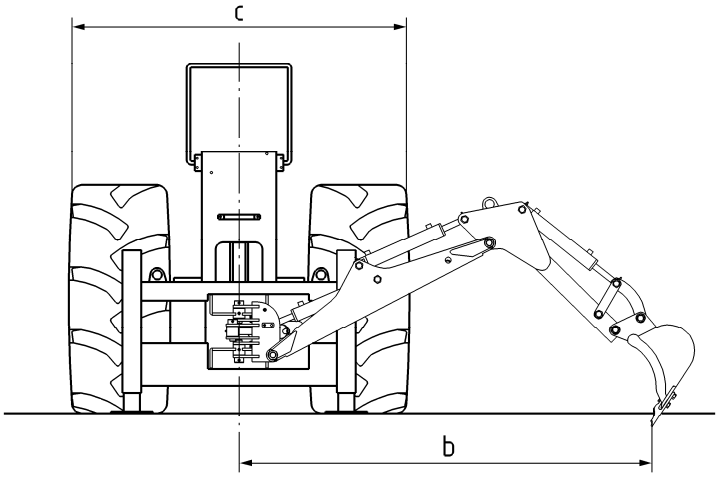
– **Vertical force directed downwards:**

$$Q > \frac{F \times \left(b + \frac{c}{2} \right)}{\frac{c}{2}}$$

Q is the vertical force [N] arising from tractor and machine mass; then the minimum mass [kg] of the tractor will be:

$$M_t = \frac{Q - m \times g}{g}$$

Where g is the value of the acceleration due to gravity.



Key

b arms' length (i.e. maximum extension of both arms of the backhoe)

c track width of the tractor

Figure B.1 — Calculation of transverse stability

B.2.2 Longitudinal stability

This calculation method aims to verify that the mass of the tractor intended to be coupled with the backhoe is adequate to ensure longitudinal stability (see Figure B.2). The input data are:

a) mass of the backhoe, m, expressed in kilograms (kg);

b) mass acting on the front axle of the tractor, M_f, expressed in kilograms (kg);

c) mass acting on the rear axle of the tractor M_r, expressed in kilograms (kg);

d) distance between the centre of the front wheels and outriggers of the backhoe, d, expressed in metres (m);

e) distance between the centre of the rear wheels and outriggers of the backhoe, e, expressed in metres (m);

f) wheelbase of the tractor, w, expressed in metres (m);

g) length of the arms (i.e. maximum extension of both arms of the backhoe), b, expressed in metres (m);

h) maximum vertical force that the bucket (or other attachment) can apply on the ground, upwards directed (lifting force) and downwards directed, F, expressed in Newton (N).

NOTE Normally, the highest value for the vertical force is reached when directed downwards; anyway, it is advisable to do the calculation for both directions.

– **Vertical force directed upwards:**

$$\left[\left(M_f \times g \times d\right) + \left(M_r + m\right) \times g \times e\right] > F \times b$$

Where

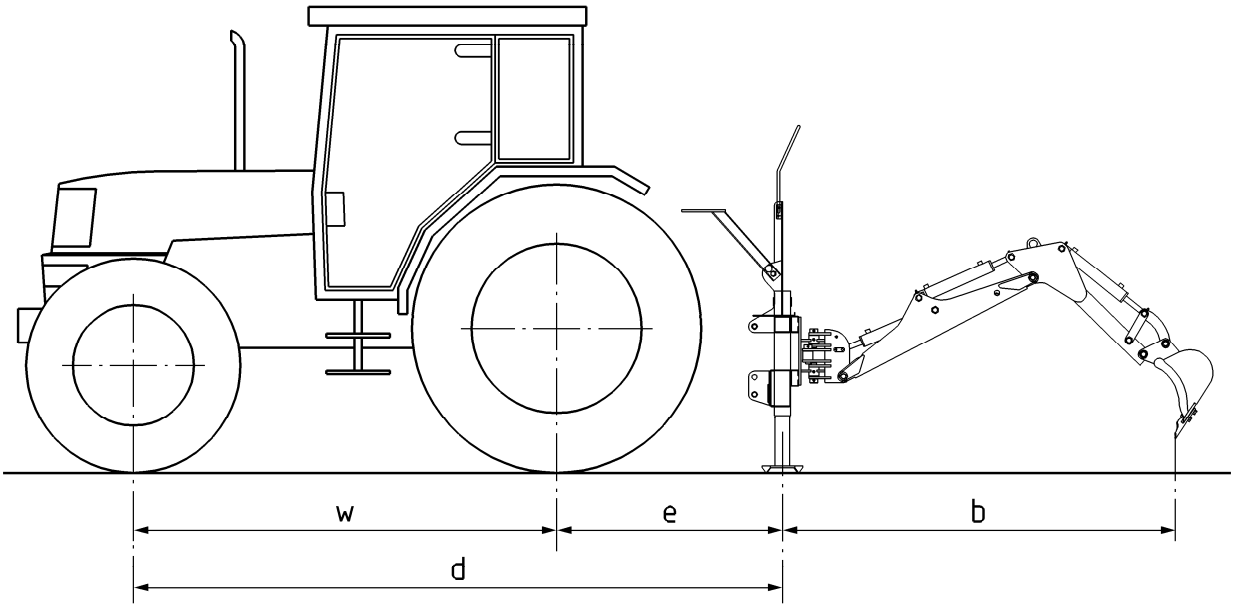
g is the value of the acceleration due to gravity.

– **Vertical force directed downwards:**

$$\left[\left(M_r + m\right) \times g \times w\right] > F \times \left(b + d\right)$$

Where

g is the value of the acceleration due to gravity.



Key

e distance between the centre of the rear wheels and outriggers of the backhoe

b length of the arms (i.e. maximum extension of both arms of the backhoe)

d distance between the centre of the front wheels and outriggers of the backhoe

w wheelbase of the tractor

Figure B.2 — Calculation of longitudinal stability

Annex ZA
(informative)

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 European Union 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, *except Essential Requirement(s): 1.1.8 3rd paragraph, 1.3.4, 1.5.9, 1.7.1.2, 1.7.2, 1.7.4.3* 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.

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