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Agricultural machinery — Safety —

Part 5: Power-driven soil-working machines

Matériel agricole — Sécurité —

Partie 5: Machines de travail du sol à outils animés

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 3, *Safety and comfort*.

This third edition cancels and replaces the second edition (ISO 4254-5:2008), which has been technically revised and includes the following changes:

— alignment with ISO 4254-1:2013 (whole document);

— addition of noise reduction requirements (4.2);

— editorial improvements concerning the protection of working tools (4.3);

— alignment of the list of significant hazards (Annex A).

A list of all the parts in the ISO 4254 series can be found on the ISO website.

Introduction

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e. g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

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

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The structure of safety standards in the field of machinery is as follows.

— Type-A standards (basis standards) give basic concepts, principles for design, and general aspects that can be applied to machinery.

— Type-B standards (generic safety standards) deal with one or more safety aspects or one or more types of safeguards that can be used across a wide range of machinery:

  — Type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

  — Type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards).

— Type-C standards (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

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

Agricultural machinery — Safety —

Part 5: Power-driven soil-working machines

1 Scope

This document, intended to be used together with ISO 4254-1, specifies the safety requirements and their verification for the design and construction of mounted, semi-mounted and trailed power-driven soil-working machines used in agriculture. In addition, it specifies the type of information on safe working practices (including residual risks) to be provided by the manufacturer.

This document deals with significant hazards (as listed in Annex A), hazardous situations and events relevant to power-driven soil-working machines used as intended and under the conditions foreseeable by the manufacturer (see Clause 4).

This document is not applicable to

— spading machines, and

— machines fitted with a retractable device making them capable of working between two successive plants in the same row.

This document is not applicable to environmental hazards. It is not applicable to hazards related to moving parts for power transmission (except for strength requirements for guards and barriers) or to maintenance or repairs carried out by professional service personnel.

NOTE 1 Specific requirements related to road traffic regulations are not taken into account in this document.

NOTE 2 Vibrations are not regarded as a significant hazard in the case of mounted, semi-mounted or trailed machines.

This document is not applicable to power-driven soil-working machines which are manufactured before the date of its publication.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4254-1:2013, *Agricultural machinery — Safety — Part 1: General requirements*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
power-driven soil-working machine
machine with power-driven cutting, chopping, or stirring components which rotate or oscillate designed for modifying soil structure or profile, for incorporating plant and crop residues or animal manure during tillage, or for both functions

Note 1 to entry: See Annex B for examples of such machines.

3.2
attachment preventing access
equipment which can be fitted to a *power-driven soil-working machine* (3.1) which restricts access onto the top of the power-driven soil-working machine and its driven tools at the rear

EXAMPLE Seed drills.

3.3
attachment not preventing access
equipment which can be fitted to a *power-driven soil-working machine* (3.1) and which allows access onto the top of the power-driven soil-working machine

EXAMPLE Frames, rollers or harrows.

4 Safety requirements, risk reduction, and protective measures

4.1 General

Machinery shall comply with the safety requirements, risk reduction and protective measures of this clause.

In addition, the machine shall be designed according to the principles of ISO 12100 for relevant but not significant hazards which are not dealt with by this document.

Except as otherwise specified in this document, the machine shall comply with the requirements of ISO 4254-1.

4.2 Noise reduction as safety requirement

The machine shall comply with ISO 4254-1:2013, 4.3.

The main source causing noise is the gearbox.

NOTE Noise caused by the tractor or the engagement of tools with the soil is not under the control of the machine manufacturer.

4.3 Protection against inadvertent contact with power-driven tools and against thrown objects

NOTE Positioning of guarding required by Clause 4 is related to the outer path of the tool(s) and the dimensions given relate both to tools rotating about a vertical axis and those rotating about a horizontal axis, even when related figures show only one example.

4.3.1 Machines shall be designed or guarded in accordance with 4.3.1.1 to 4.3.1.5 in order to avoid inadvertent contact with powered tools at the front, rear, sides and top of the machine during normal operation and service.

4.3.1.1 At the front, sides and rear of the accessible zone shown in Figure 1, a continuous barrier shall extend from the outermost path of the tools to a minimum distance, *a*, beyond the path of the tools as shown in Figure 2. The dimensions "a" and "b", for openings in the barrier, shall be in accordance with Figure 2.

4.3.1.2 On the top of the machine, access to the tools shall be prevented and thrown objects contained by the following:

a) an imperforate top guard, as a minimum covering the tools up to the outermost points of their path shall be provided.

b) the area between the barriers required by 4.3.1.1 and the edge of the top guard shall be covered in such a way that it is not possible to gain access to the tools. This guarding may be achieved by a guard, any suitable part of the machine or a combination of both.

4.3.1.3 On the sides and rear of the machine, when in the working position, an imperforate guard covering the whole of the tool path above ground level is provided, distance *a* may be reduced to less than 200 mm (see Figure 3).

4.3.1.4 At the rear of the machine when the guard is hinged to allow adjustment to compensate for variable operating conditions (e.g. ground condition), its lower edge shall in any position be, in accordance with Figure 4:

a) up to a maximum height "e", a minimum distance "a" from the power driven tools;

b) up to a maximum height "i", a minimum distance "d" from the power driven tools.

See also 6.1 a).

4.3.1.5 The top guard, barriers and those parts of the machine ensuring the guarding shall be able to withstand a vertical downward load of 1 200 N. In addition, the barriers shall be capable of withstanding the following horizontal loads:

a) 600 N for machines whose soil working tools rotate about a horizontal axis and which are intended to be used with a tractor where the maximum power is equal to or less than 37 kW according to 6.1 b);

b) 1 000 N for all other machines.

This shall be verified by measurement in accordance with ISO 4254-1:2013, Annex C.

4.3.2 The guard at the rear may be moveable or removable in order to permit the fitting of attachments [see 6.1 c)]. Attachments that afford equivalent protection to that provided by the rear guard may be used in place of the guard, provided that the following provisions are met.

a) Such parts or such attachments shall not be power-driven.

b) Access to the driven tools shall be prevented either

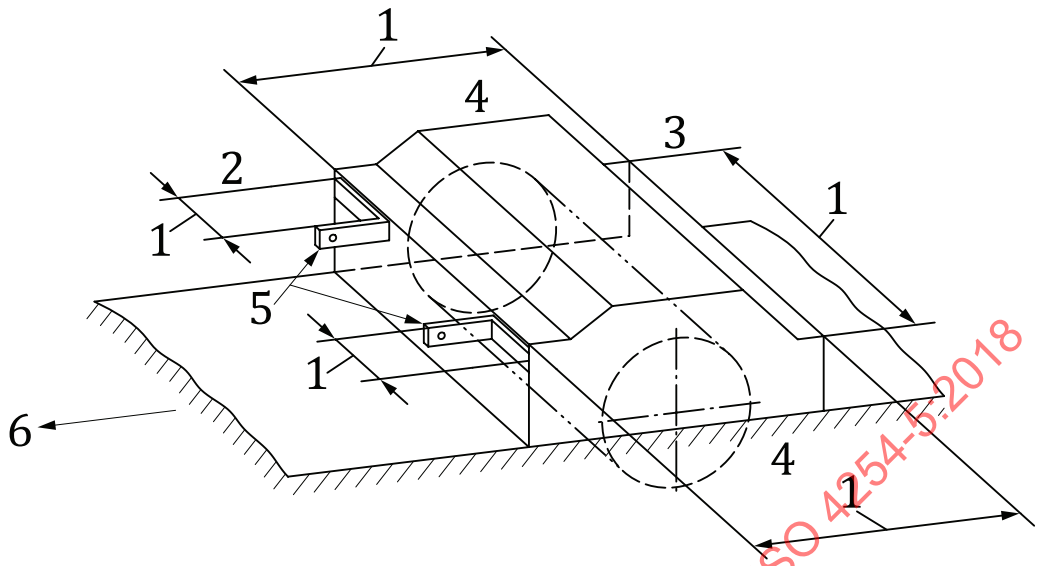
— by a barrier at the height, *g*, ensuring the distance, *a*: the area between this barrier and the edge of the top guard shall be covered in accordance with 4.3.1.2 b) [e.g. by an additional (two) barriers as shown in Figure 2 c)], or

— by a barrier at any point on line ZY: the area between this barrier and the edge of the top guard shall be covered in accordance with 4.3.1.2 b) [e.g. by an additional (four) barriers as shown in the Figure 2 d)].

c) When attachments preventing access (see 3.2) are fitted, it shall not be possible to gain access to the power-driven tools of the soil-working machine through the shaded area shown in Figure 5. This means that for attachments preventing access, the guarding at the rear according to 4.3.1.1 and 4.3.1.2 b) shall extend a minimum 550 mm from both sides of the machine.

4.3.3 When a soil-working machine with powered tools relative to the application can be used without machine components or tools normally serving as a guard according to 6.1 c) and d), the machine shall allow for fitting of an alternative guard in accordance with the requirements given in 4.3.1 and 4.3.2. This alternative guard shall be made available by the manufacturer. Appropriate information on fitting the guard shall be given in the operator's manual.

4.3.4 If there is a hazard of thrown objects to the rear, additional protective measures shall be taken, e.g. by additional tools, not a perforated guard. This alternative guard shall be supplied by the manufacturer. Appropriate information on fitting the guard shall be given in the operator's manual.

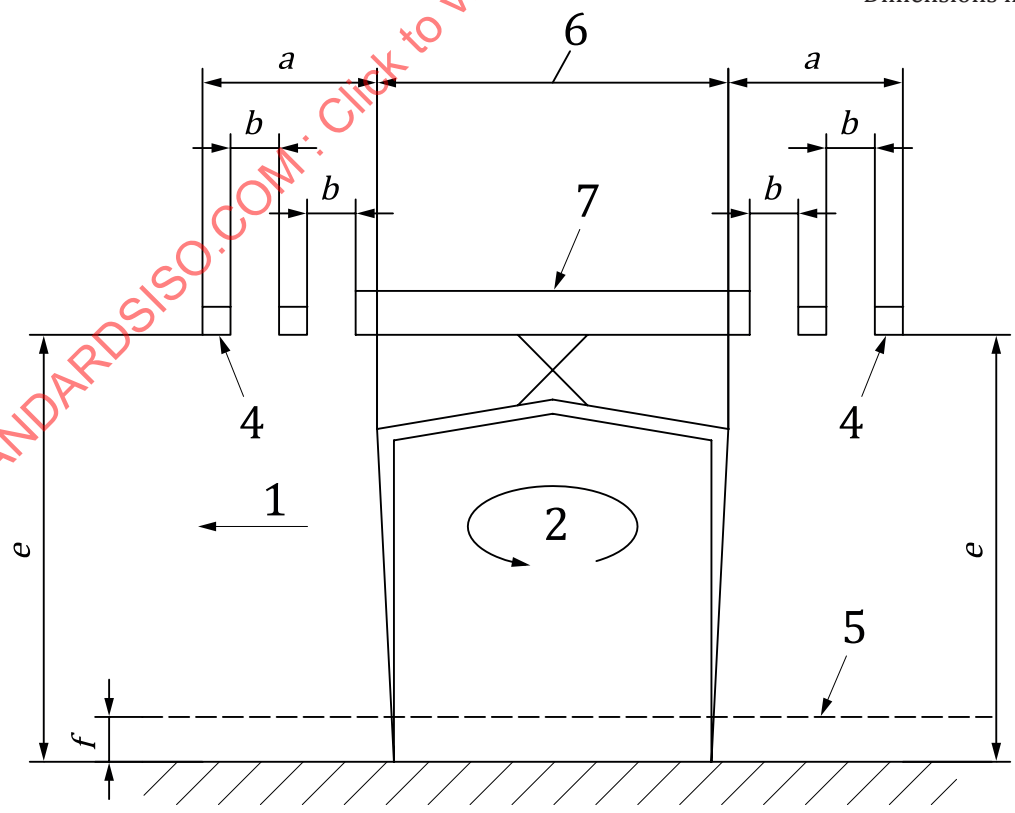


Key

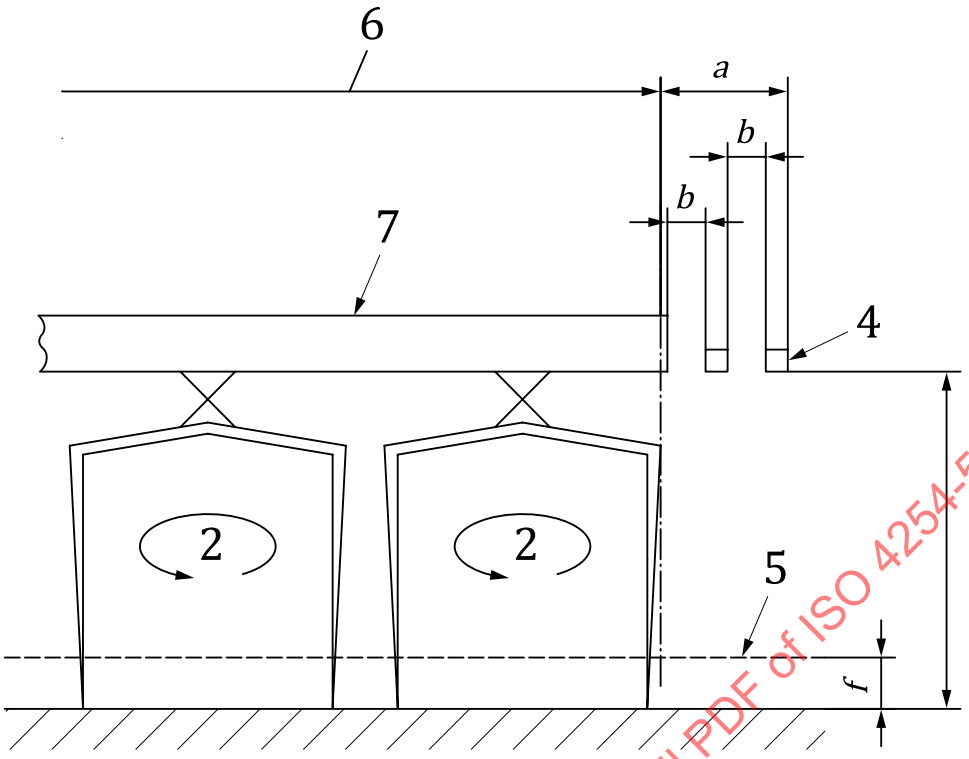
1	accessible zone	4	sides
2	front	5	lower hitch points
3	rear	6	forward direction (rear-mounted machine)

Figure 1 — Accessible zones (see 4.3.1)

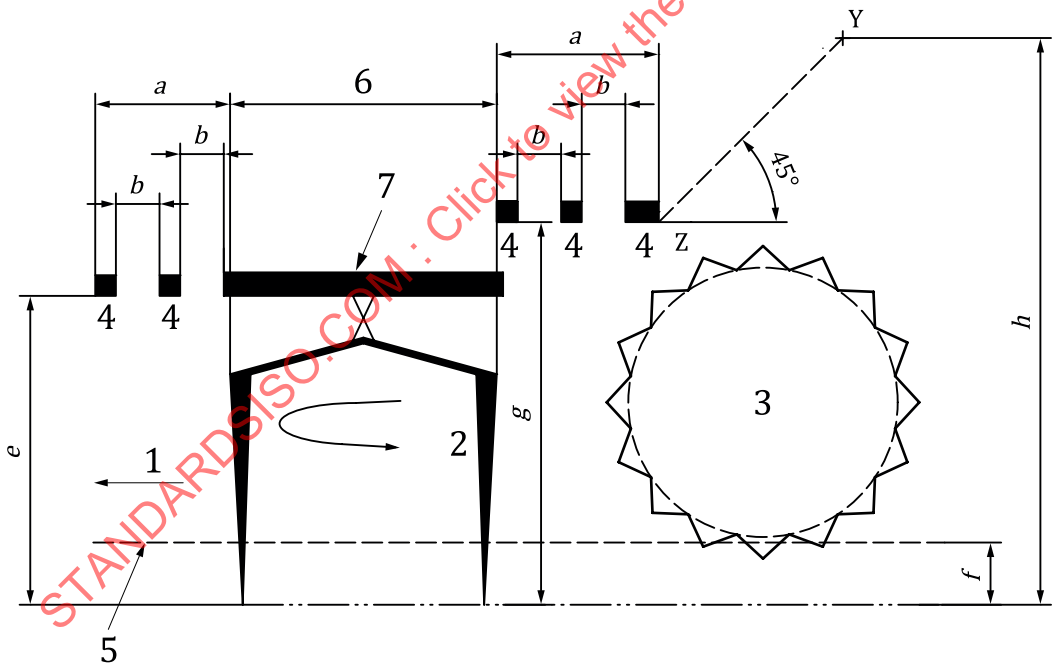
Dimensions in millimetres



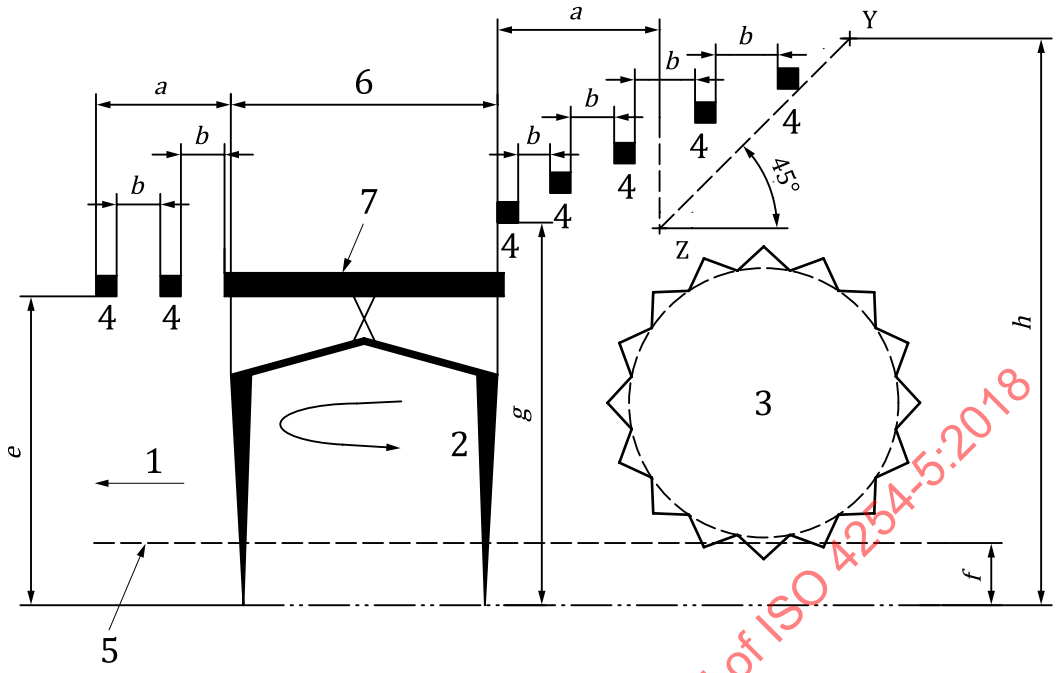
a) Front and rear barriers (see 4.3.1)



b) Side barriers (see 4.3.1)



c) Rear protection [see 4.3.2 b), first indent]



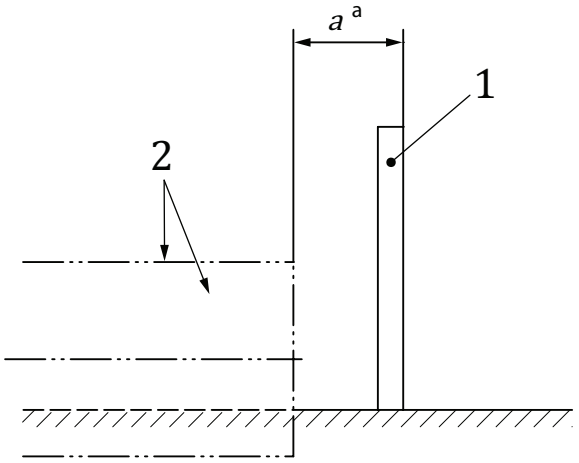
d) Rear protection [see 4.3.2 b), second indent]

a	*b*	*e–f*	*g–f*	*h–f*
≥200	≤60 at front ≤80 at rear and sides	≤400	≤500	≤700
f	Working depth according to information given by manufacturer in operator's manual [see 6.1 e)].			

Key

1 direction of travel
2 power-driven tool
3 depth control roller
4 barrier
5 ground surface
6 tool path
7 top guard
Y virtual point specified by the height, *h*, and the 45° line passing through Z
Z virtual point specified by the height, *g*, and the distance, *a*

Figure 2 — Guarding and barriers — Dimensions



Key

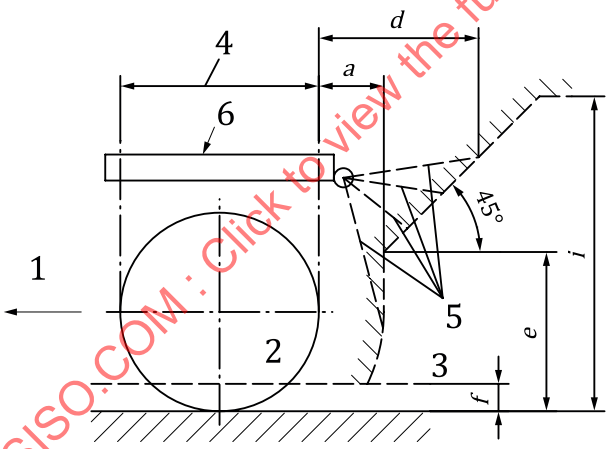
1 guard

2 path of power-driven tool

a Extent of barrier in accordance with 4.3.1.3.

Figure 3 — Lateral guard (see 4.3.1.3)

Dimensions in millimetres



a	*e–f*	*i–f*
≥200	≤400	≤800
d Minimum distance according to 4.3.1.4.		
f Working depth according to information given by manufacturer in operator's manual [see 6.1 e)].		

Key

1 direction of travel

2 power-driven tools

3 ground surface

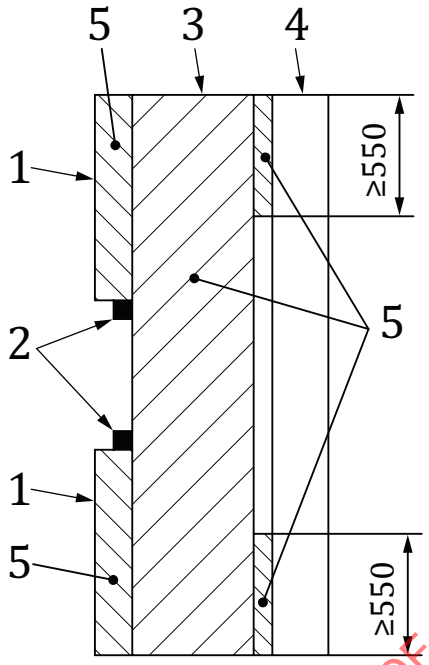
4 tool path

5 examples of positions of the rear hinged guard

6 top guard

Figure 4 — Rear protection — Hinged guard dimensions (see 4.3.1.4)

Dimensions in millimetres



Key

1 front barrier
2 lower hitch points
3 power-driven machine (tool path)
4 attachment preventing access
5 area to be verified in accordance with Clause 5

Figure 5 — Rear protection by attachments in lieu of guard (see 4.3.2)

4.4 Adjustment of working depth

4.4.1 General

These requirements apply to hand-operated controls which need to be actuated when modifying the working depth according to 6.1 f).

4.4.2 Location of controls

Manual controls shall be fitted to adjust the working depth and shall be located

a) on the tractor and accessible only from the driving position, or

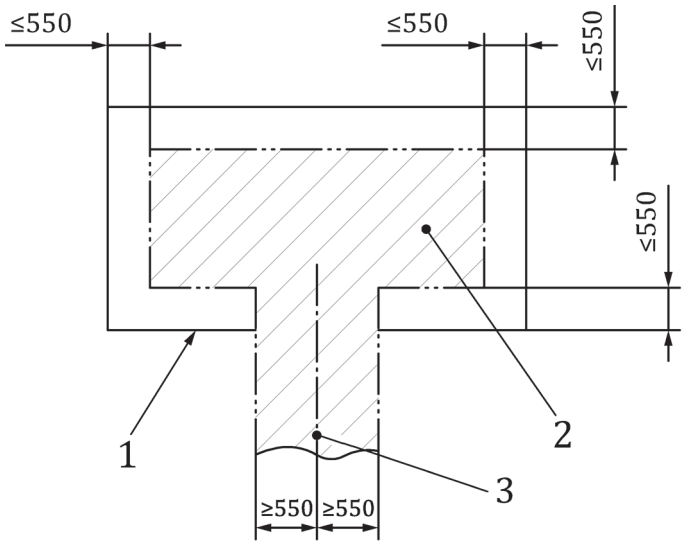
b) on the machine and accessible by the operator standing on the ground, and

c) outside the shaded area as shown in Figure 6, and

d) on the top, sides, front or rear of the machine, at a maximum distance of 550 mm from its outermost extremity, with this distance being measured at right angles from the accessible zone (see Figure 1) parallel to the forward direction for hand-operated controls accessible from the front or rear of the machine, and at right angles to the forward direction for those controls accessible from the sides.

The 550 mm distance specified in 4.4.2 d) above shall apply if the machine is designed so that rollers or similar equipment can be used as an integral part of the machine during cultivation.

Dimensions in millimetres



Key

1 outer limits of machine
2 hand-operated control exclusion area
3 centreline

Figure 6 — Exclusion area for hand-operated controls for adjusting working depth (top view)

4.4.3 Operation of controls

The adjustment of hand-operated controls shall be possible with the working tools at rest.

5 Verification of safety requirements, risk reduction, and protective measures

See Table 1.

Table 1 — List of safety requirements and protective measures and their verification

Clause/subclause	Verification		
	Inspection	Measurement	Procedure/reference
4.1	X	X	Shall be verified in accordance with ISO 4254-1.
4.3	X	X	Passing through the area between the barriers, machine components and the edge of the top guard shall be verified using a 61 mm ± 1 mm and 81 mm ± 1 mm diameter spherical test gauge, respectively. This test gauge shall be of mild steel and shall be applied by hand. The machine and its guards shall be set in any of the guard's or machine's positions. The strength of the guards and barriers shall be tested in accordance with ISO 4254-1:2013, Annex C.
4.4	X	X	Shall be verified in accordance with 6.1 f).

6 Information for use

6.1 Operator's manual

In addition to ISO 4254-1, the following information shall be included in the operator's manual, as applicable:

a) instructions for the adjustment of rear-hinged protective devices (see 4.3.1.4);

b) the maximum power of the tractor (see 4.3.1.5);

c) hazards resulting from the fitting of attachments (see 4.3.2 and 4.3.3);

d) the need to mount the alternative guard supplied with the machine (if applicable, see 4.3.3);

e) information on the minimum working depth;

f) instructions on adjusting the controls needed to modify the working depth (see 4.4);

g) hazards caused by power-driven tools (see 6.2);

h) the prohibition to climb onto the machine when it is in operation (see 6.2);

i) the fact that the stability and steering of the tractor can be affected by mounted machines when they are raised for transport;

j) procedure on how to remove blockages;

k) hazards caused by the ejection of materials.

6.2 Safety and instructional signs

The following warnings shall be provided on the machine in all appropriate places drawing the attention to

a) hazards caused by moving parts (e.g. soil-engaging tools) (see 6.1 g), and

b) the hazard of climbing onto the machine when it is in operation (see 6.1 h).

Annex A
(informative)

List of significant hazards

Table A.1 lists the hazards, hazardous situations, and events, as far as they are dealt with in this document, identified by risk assessment as significant for this type of machinery, which require action to eliminate or reduce the risk.

Table A.1 — List of significant hazards

No.[a]	Hazard	Hazardous situation and event	Clause/subclause of ISO 4254-1:2013	Clause/sub-clause of this document
A.1	**Mechanical hazards**			
A.1.1	Crushing	— Controls	4.5, 6.1	4.4
		— Boarding means	4.8	—
		— Platforms	4.8	—
		— Working tools	4.2	4.3, 4.4
		— Service, maintenance, handling	4.11, 4.17	—
		— Stability	6.2	—
		— Mounting of machines	6.2	—
		— Folding elements	4.9	4.3.2
				—
A.1.2	Shearing	— Controls	4.5, 6.1	4.4
		— Boarding means	4.8	—
		— Platforms	4.8	—
		— Working tools	4.2	4.3, 4.4
		— Service, maintenance, handling	4.11, 4.17	—
		— Stability	6.2	—
		— Mounting of machines	6.2	4.3.2
		— Folding elements	4.9	—
A.1.3	Cutting or severing	— Working tools	4.2	4.3, 4.4, Clause 6
A.1.4	Entanglement	— Working tools	4.2	4.3, 4.4, Clause 6
A.1.5	Drawing-in or trapping	— Working tools	4.2	4.3, 4.4, Clause 6
A.1.6	Impact	— Boarding means	4.8	—
		— Folding elements	4.9	—
A.1.7	Stabbing or puncture	— Working tools	4.2	4.3, 4.4, Clause 6
A.1.8	Friction or abrasion	— Controls	4.4.3	4.3, 4.4, Clause 6
		— Electrical equipment	4.9.1	—
		— Boarding means	4.5, 4.6	—

[a] With reference to ISO 4254-1:2013, Table A.1.

Table A.1 *(continued)*

No.[a]	Hazard	Hazardous situation and event	Clause/subclause of ISO 4254-1:2013	Clause/sub-clause of this document
A.1.9	High pressure fluid injection or ejection	— Hydraulic components	4.13, 6.5	—
A.2	**Electrical hazards**			
A.2.1	Contact of persons with live parts (direct contact)	— Electrical equipment	4.12, 6.5	—
A.2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	— Electrical equipment	4.12	—
A.2.3	Approach to live parts under high voltage	— Overhead power lines	8.2.3	—
A.2.5	Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc.	— Electrical equipment	4.12	—
A.3	**Thermal hazards**			
	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	— Operating fluids — Hot surfaces	4.15 5.5	— —
A.4	**Hazards generated by noise**			
	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	— Noise	4.3; 8.2	—
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	4.15	—
A.6	**Hazards generated by neglecting ergonomic principles in machinery design**			
A.6.1	Unhealthy postures or excessive effort	— Controls — Boarding means — Service, maintenance, handling	4.5, 6.1 4.8 4.11, 4.17	4.4 — —
A.6.2	Missing consideration of hand-arm or foot-leg anatomy	— Controls — Boarding means	4.5, 6.1 4.8	4.4 —

[a] With reference to ISO 4254-1:2013, Table A.1.