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Agricultural machinery — Safety —

Part 17: Root crop harvesters

Matériel agricole — Sécurité —

Partie 17: Matériel de récolte de racines et tubercules

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 of the voluntary nature of standards, 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 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 7, *Equipment for harvesting and conservation*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 144, *Tractors and machinery for agriculture and forestry*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a type-C standard as stated in ISO 12100:2010.

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.

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.

NOTE Examples of machine and components, illustrating the terms and definitions in Clause 3, are given in Annex B.

Agricultural machinery — Safety —

Part 17: Root crop harvesters

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 the following types of root crop harvesting machines trailed, mounted or self-propelled:

— sieving harvesters,

— root lifting harvesters,

— top lifting harvesters,

which carry out more than one of the following operations: haulm/leaf topping, digging/taking-in/lifting, cleaning, conveying and unloading of root crops.

This document is also applicable for haulm/leaf toppers used individually.

This document is not applicable to cleaner-loaders which operate from a heap of beet. For these type of machines, additional hazards are, at present, not dealt with in this document.

In addition, it specifies the type of information on safe working practices to be provided by the manufacturer.

The list of significant hazards covered in this document is given in Annex A. It also indicates the hazards which have not been dealt with.

Environmental aspects have not been considered in this document. Noise has been considered partly in this document.

This document applies primarily to machines which are manufactured after the date of its publication.

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 4254-1:2013/AMD 1:2021, *Agricultural machinery — Safety — Part 1: General requirements*

ISO 9533:2010, *Earth-moving machinery — Machine-mounted audible travel alarms and forward horns — Test methods and performance criteria*

ISO 11684:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*

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

ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design*

ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 15534-3:2000, *Ergonomic design for the safety of machinery — Part 3: Anthropometric data*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4254-1:2013, ISO 4254-1:2013/AMD 1:2021, ISO 12100:2010 and the following apply.

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

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

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

3.1
sieving harvester
harvesting machine which digs the crops together with a bed of soil and which separates the crops from the soil by sieving

Note 1 to entry: These machines are typically used for harvesting of potatoes.

3.2
root lifting harvester
harvesting machine which lifts individual crops of a row and which separates remaining adhering soil from the crops

Note 1 to entry: These machines are typically used for harvesting of beets.

3.3
top lifting harvester
harvesting machine which lifts crops of a row mainly by the leaf or haulm by using a clamping belt and which separates remaining adhering soil from the crops

Note 1 to entry: These machines are typically used for harvesting of carrots or leeks.

3.4
haulm/leaf conveying device
device for transport of haulms/leaves to haulm/leaf spreader or to the loading device, if any, or to the outside of the machine

3.5
cleaning device
device mainly intended to separate the crop from the soil adhering to it

3.6
crop conveying device
device which transports the crop from one part of the machine to another

3.7
unloading device
device which transfers the crop out of the machine

3.8
bunker
device to collect the crop on the machine which can be equipped with a system to raise and combined with an *unloading device* (3.7)

3.9
haulm/leaf topping device
device to remove and to evacuate the haulm/leaf prior to lifting the crop

Note 1 to entry: This device can be used also individually as haulm/leaf topper.

3.9.1
rotor
rotating device intended to remove the haulm/leaf of crops and/or to clean the top part of the crop still in the ground

3.9.2
leaf spreading device
device which distributes leaves evenly on the soil surface

3.9.3
haulm spreading device
device which distributes haulms evenly on the soil surface

3.10
haulm de-vining device
device to separate haulm from the potatoes after lifting

3.11
digging device
device of a *sieving harvester* (3.1) to dig the crop together with soil from the field

3.12
clod and stone removal devices
devices to remove unwanted soil, stones and clods from the lifted crop

3.13
sorting platform
workplace for sorting on the machine

3.14
packing platform
workplace on the machine for manual packing of crops in bags or boxes with an area for transfer of the bags or boxes to a transport vehicle

3.15
inspection platform
workplace on the machine for observing of the crop flow and the quality of the crop harvested

3.16
haulm/leaf loading device
device which transports haulms/leaves collected at the discharge outlet

3.17
root lifting device
device of a *root lifting harvester* (3.2) which extracts roots crops from the soil

3.18
haulm/leaf cutting device
device to remove the haulm/leaf by cutting after lifting the crop located just at the begining of the clamping belt

3.19
haulm/leaf removing device
device to remove the residual haulm/leaf after lifting the crop located in upper area of the clamping belt

3.20
top lifting device
clamping belt in combination with a share as support for lifting the crop from the soil by lifting the crop by the haulm/leaf

3.21
torpedo
tapered or cone-shaped device for raising haulm/leaf before lifting

Note 1 to entry: See Figures 15 and B.15.

4 Safety requirements and/or protective/risk reduction measures for all machines

4.1 General

4.1.1 Machinery shall conform with the safety requirements and/or protective/risk reduction measures of this clause. In addition, the machine shall be designed in accordance with the principles of ISO 12100:2010, Clause 4, for hazards relevant, but not significant, which are not dealt with by this document.

4.1.2 Except where otherwise specified in this document, the machine shall be in accordance with the requirements of ISO 4254-1:2013, ISO 4254-1:2013/AMD 1:2021 and with ISO 13857:2019, Tables 1, 3, 4 and 6 as appropriate.

4.2 Controls

4.2.1 The starting and the stopping of the moving parts shall be controllable only from the driver's station of the self-propelled machine and in case of trailed and mounted machines only from the driver's station of the towing machine. If this is not possible for particular functions or not useful (e.g. for removing of blockages), the controls for these particular functions may be located on the machine provided they can be operated from a safe position.

4.2.2 The lowering of the bunker shall be controllable from the driver's station and the control shall be of hold-to-run-type.

4.2.3 On machines with a sorting platform, emergency stop equipment in accordance with ISO 13850:2015 shall be accessible from each workplace on the platform to stop hazardous movements, but at least the conveyor of the sorting platform. The accessibility of the emergency stop equipment shall be determined according to ISO 15534-3:2000. In case of an emergency stop activation, a clear signal shall be transmitted to the driver in order alert the driver to stop further movements by switching off the power transmission.

4.2.4 The controls for the adjustment of moving parts shall be located so that they can be operated from the driver's station and/or the sorting platform and with the guards in guarding position. The operator's manual shall include an appropriate notice on the need to adjust the driving speed and/or the speed of the functional components of the machine to the conditions of work.

4.3 Visibility

4.3.1 Self-propelled machines shall be fitted with an audible warning alarm in accordance with ISO 9533:2010. This alarm shall be automatically engaged during reversing manoeuvres.

4.3.2 This alarm is not required if the machine is equipped with a closed-circuit television (CCTV) which permits the driver to have a clear view on the rear of the machine.

4.3.3 In direction of travel lateral visibility to view the outermost edges of the machine shall be provided. If this is not possible by direct view, mirrors or any other equivalent means shall be provided.

4.4 Haulm/leaf topping device

4.4.1 Protection against unintentional contact with the rotating tools

4.4.1.1 General

Machines shall be designed or guarded in such a way that any unintentional contact with the rotating tools at the front, at the rear, at the sides and on the top is avoided.

4.4.1.2 Protection on the top, at the front and the rear

4.4.1.2.1 On the top, the protection shall be achieved by an imperforate guard. The front and rear edge of this imperforate guard shall be located at a maximum height of 400 mm from the lowest point of the tools path and at a minimum horizontal distance of 200 mm from the tools path [see Figure 1 a)].

4.4.1.2.2 The protection at the front and the rear shall be achieved by the extension of the upper imperforate guard to the front and to the rear [see Figure 1 a)].

4.4.1.2.3 For rotors with a vertical drive shaft, the protection on the front and back can alternatively be achieved by covering the bottom edge of the top cover by at least 3 mm downwards (see Figure 2) and stopping the tools when the rotor is in the highest position.

4.4.1.3 Protection at the sides

4.4.1.3.1 In the accessible zone, the lateral protection shall be:

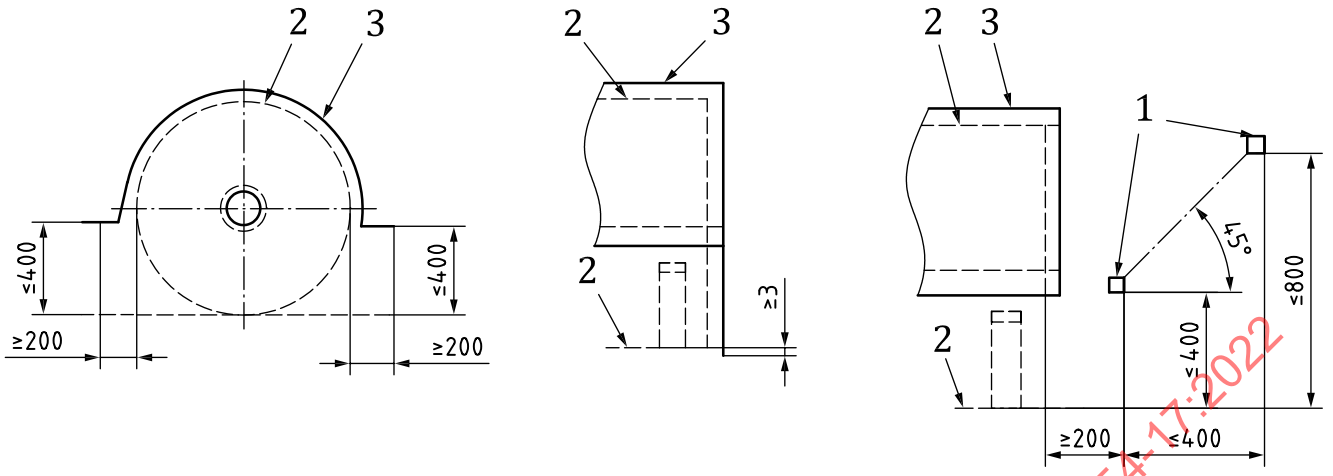
— an imperforate guard, located near the tools and in such a way that its lower edge extends by a minimum of 3 mm below the tools path [see Figure 1 b)]; or

— in case the lower edge of the imperforate guard does not extend by a minimum of 3 mm below the tools path, the lower edge of this imperforate guard shall be located at a maximum height of 400 mm from the lowest point of the tools path and additionally by a barrier located at a maximum height of 400 mm from the lowest point of the tools path and at a minimum horizontal distance of 200 mm from the tools path [see Figure 1 c)]. If the height of the barrier is more than 400 mm from the lowest point of the tools path the barrier shall be located along a contour with angle of 45° to the exterior whereby the maximum height of the barrier shall not exceed 800 mm. Barriers at the sides can be foldable for transport. They shall remain attached to the machine and shall be kept fixed in their position. The operation of the tools shall be avoided when the barrier is not in protective position (e.g. by restriction of the function of the machine components in this situation); or

— a combination of these two previous protective devices.

4.4.1.3.2 The projection on a horizontal plane of these protective devices shall be continuous.

Dimensions in millimetres



a) Protection at the top, front and rear by an imperforate guard

b) Protection at the sides by an imperforate guard

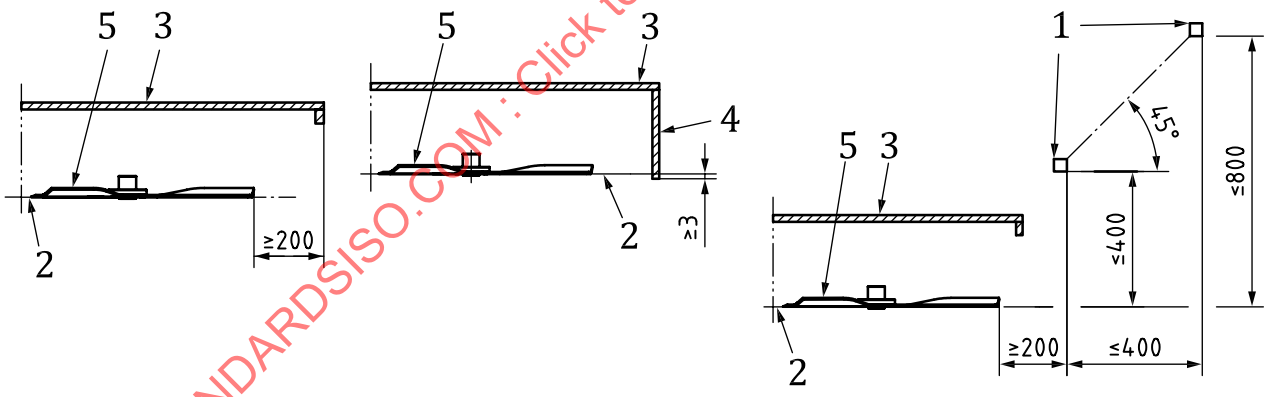
c) Protection at the sides by a barrier

Key

1 barrier
2 tools path
3 imperforate guard

Figure 1 — Haulm/leaf topping device with horizontal axis — Protective devices

Dimensions in millimetres



a) Protection at the top, front and rear by an imperforate guard

b) Protection at the sides by an imperforate guard

c) Protection at the sides by a barrier

Key

1 barrier
2 tools path
3 imperforate guard on the top
4 imperforate at the side
5 tools

Figure 2 — Haulm/leaf topping device with vertical axis — Protective devices

4.4.2 Haulm/leaf conveying device of a haulm/leaf topping device

4.4.2.1 General

Any mobile elements of the haulm/leaf conveying device located less than 850 mm from the outer contour of the machine shall be guarded except the discharge outlet. There shall be no crushing and shearing points at the discharge outlet.

4.4.2.2 Protection of the discharge outlet at the top

On the top, the protection shall be achieved by an imperforate guard which extends beyond the outer part of the haulm/leaf conveying device by a minimum of 150 mm (see Figure 3). When a conveyor belt is used, the lower edge of the top guard shall be placed at 200 mm maximum above the upper plane of the conveyor belt (see Figure 4).

4.4.2.3 Protection of the discharge outlet at the sides

The lateral part of conveying belts itself shall be guarded against unintentional contact. The lateral part of augers shall be guarded with imperforate guards.

4.4.2.4 Protection of the discharge outlet at the front

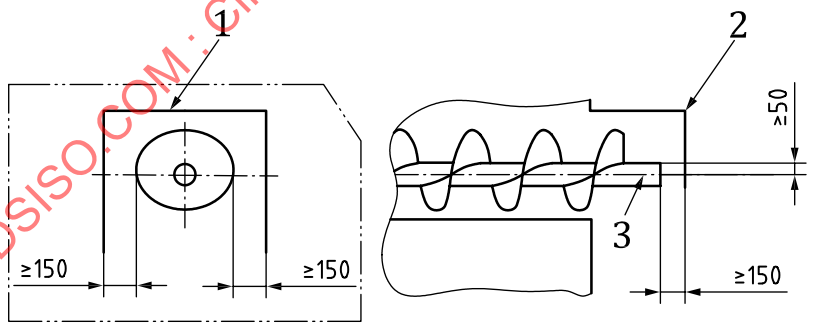
The protection at the front shall be achieved by:

— when an auger is used, a fixed guard, the lower end of which shall extend at least 50 mm below the axis of the screw (see Figure 3);

— when a conveyor belt is used, the guard on the top (see Figure 4); or

— a mobile guard which completely seals the discharge outlet and automatically returns to the closed position when no more material is ejected (see Figure 5).

Dimensions in millimetres

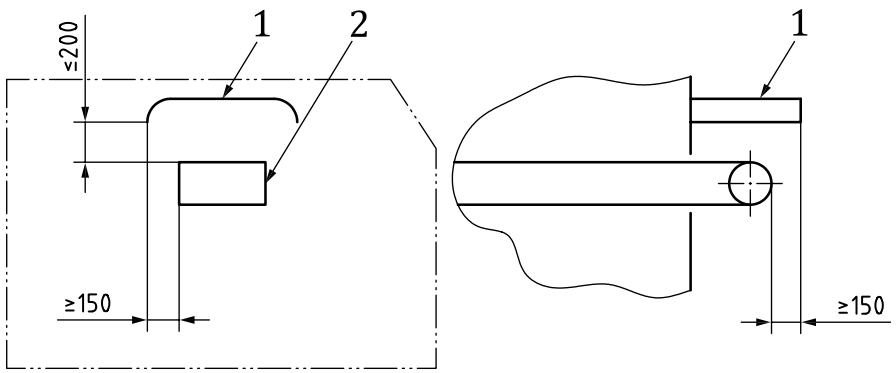


Key

1 imperforate top guard
2 fixed guard
3 axis of the screw

Figure 3 — Protection of the discharge outlet in case of an auger

Dimensions in millimetres



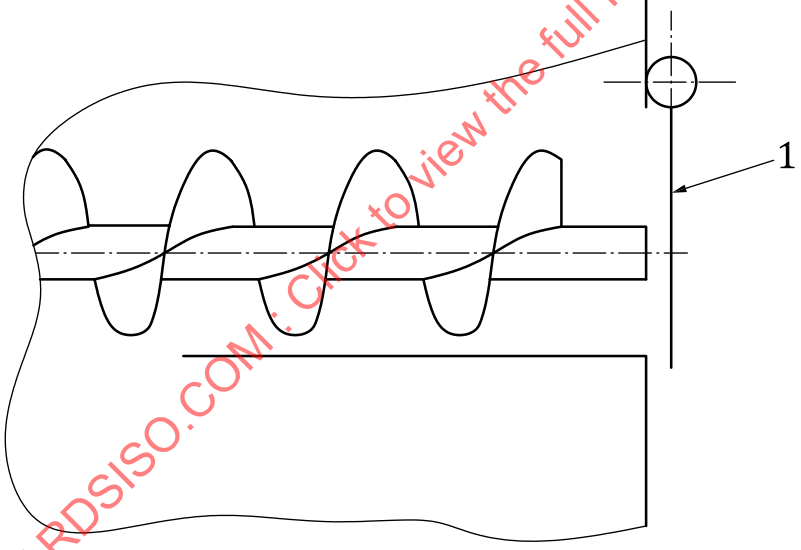
Key

1 imperforate top guard

2 conveyor belt

Figure 4 — Protection of the discharge outlet in case of a conveyor belt

Dimensions in millimetres



Key

1 mobile guard

Figure 5 — Protection of the discharge outlet by a mobile guard

4.4.3 Haulm/leaf loading device of a haulm/leaf topping device

The haulm/leaf loading device shall meet 4.1.

4.4.4 Protection against thrown objects

Sufficient protection against thrown parts shall be ensured. A warning of residual hazards according to 9.2.2 shall be provided.

4.5 Bunker

4.5.1 Within accessible zones, between moving parts of the bunker and the bunker and other parts of the machine, there shall be no shearing or pinching points. This does not apply for supporting points for stabilization of the bunker located within the machine at a minimum distance of 550 mm from the outer contour of the machine and which are not accessible from workplaces on the machine.

4.5.2 Supports in accordance with ISO 4254-1:2013, 4.11 shall be provided in order to enable maintenance and service operations to be carried out by the operator under the bunker in raised position.

4.5.3 The distribution auger shall be guarded to prevent any contact from the driver's station, from the ground or from any platform.

4.6 Unloading

4.6.1 The machine shall be so designed that the operator can supervise the unloading process from the driver's station.

4.6.2 Supports in accordance with ISO 4254-1:2013, 4.11 shall be provided in order to enable maintenance and service operations to be carried out by the operator under unloading devices in raised position. It shall be possible for the operator to fit and to remove the mechanical supports from outside the hazard zone.

4.6.3 The unloading devices shall be supplied with a device to lock them in the transport position according to ISO 4254-1:2013, 4.9 and ISO 4254-1:2013/AMD 1:2021.

4.6.4 Machines shall be stable during unloading. This requirement is checked in the following conditions:

— the machine is placed on a slope of 5°, with its longitudinal axis positioned across the slope;

— in the case of lateral unloading, the unloading shall be directed down slope;

— in the case of rear unloading, the machine shall be placed successively up the slope and across the slope;

— when the unloading device is lifted and/or tilted at its maximum position, a vertical force equal to the load capacity of the unloading device is applied downwards at the centre of the unloading device.

4.7 Prevention of hazards related to blockages

Following the general principles for risk reduction, the most effective way to avoid risks related to blockages is to remove the risk by taking measures to ensure that no interruption in crop flow takes place. If this is not possible in all working conditions, including reasonably foreseeable misuse, examples for the prevention of hazards related to blockages and the removal of blockages are given in Annex C.

4.8 Prevention of risks of unintentional contact with power-driven functional elements

Self-propelled machines which have an electrically activated power-driven functional elements engagement mechanism shall have a system that prevents engagement of the power-driven functional elements mechanism if the operator is not in the operator's work station and that automatically disengages the power-driven functional elements mechanism when the operator leaves the operator's work station. The maximum delay time for triggering the disengagement shall be 7 s. Power-driven

functional elements starting shall require intentional reactivation by means other than the automatic power-driven functional elements disengagement control after stopping.

4.9 Platforms used as workplace on the machine

4.9.1 General

4.9.1.1 Platforms used as workplace on the machine used during machine travel shall meet the requirements of ISO 4254-1:2013, 4.7 and ISO 4254-1:2013/AMD 1:2021. This concerns for example sorting platforms, packing platforms and inspection platforms.

4.9.1.2 Unintentional contact between feet and the moving parts of the wheel shall be prevented. Boarding means shall be distant from the wheel profile at least 150 mm (see Figure 6) or it shall be ensured by design that it is not possible to go up or down during travel. The lowest step of boarding means located in front of the wheel in travelling direction for harvesting and with steerable wheels in straight line position shall not reach in the track of the wheel, whatever the adjustment of the machine track width or it shall be ensured by design that it is not possible to go up or down during travel.

4.9.1.3 The access to the platform shall be capable of being closed during operation. When closing with a bar this bar shall be at a height of between 1 000 mm and 1 100 mm. In addition, an intermediate rail shall be mounted such that the vertical distance between two bars does not exceed 500 mm. The opening of access shall be towards the platform, an opening towards the outside of the platform shall be prevented. The means for closing the access shall close automatically.

4.9.1.4 The handrail/handhold shall fulfil the requirements of ISO 4254-1:2013, 4.7.1.3.

4.9.1.5 The minimum size of the platform shall be 400 mm by 500 mm per intended person.

4.9.1.6 The platform shall be flat. If there are steps in the platform in the area of the workstations, technical measures such as barriers shall be provided to prevent from tripping or falling in case of sudden machine movement.

4.9.1.7 A two-way communication system to convey a message/acoustical signal, etc. in either direction between platforms and the machine or tractor operator shall be provided.

4.9.1.8 Dangerous moving parts accessible from a platform shall be guarded either by fixed guards or fixed parts of the machine.

4.9.1.9 If these requirements cannot be met for dangerous moving parts that are involved in the work process, for functional reasons, the danger points shall at least be guarded against unintentional contact. This can be achieved for example by a safety distance of at least 850 mm.

4.9.1.10 If, for technical or functional reasons, the work at the workplaces of the platforms can only be carried out standing up, no seats are necessary.

4.9.2 Sorting platform

Machines with a sorting platform shall be fitted with an audible warning alarm intended to draw the attention on the starting of the moving parts. A sufficient delay time for the engagement of the alarm shall be provided. For self-propelled machines, this warning alarm shall be automatically engaged.

NOTE Requirements for the ergonomic aspects of the sorting platform will be added in a future revision of this document. This document covers only those hazards people working at the sorting platform are exposed to.

4.9.3 Packing platform

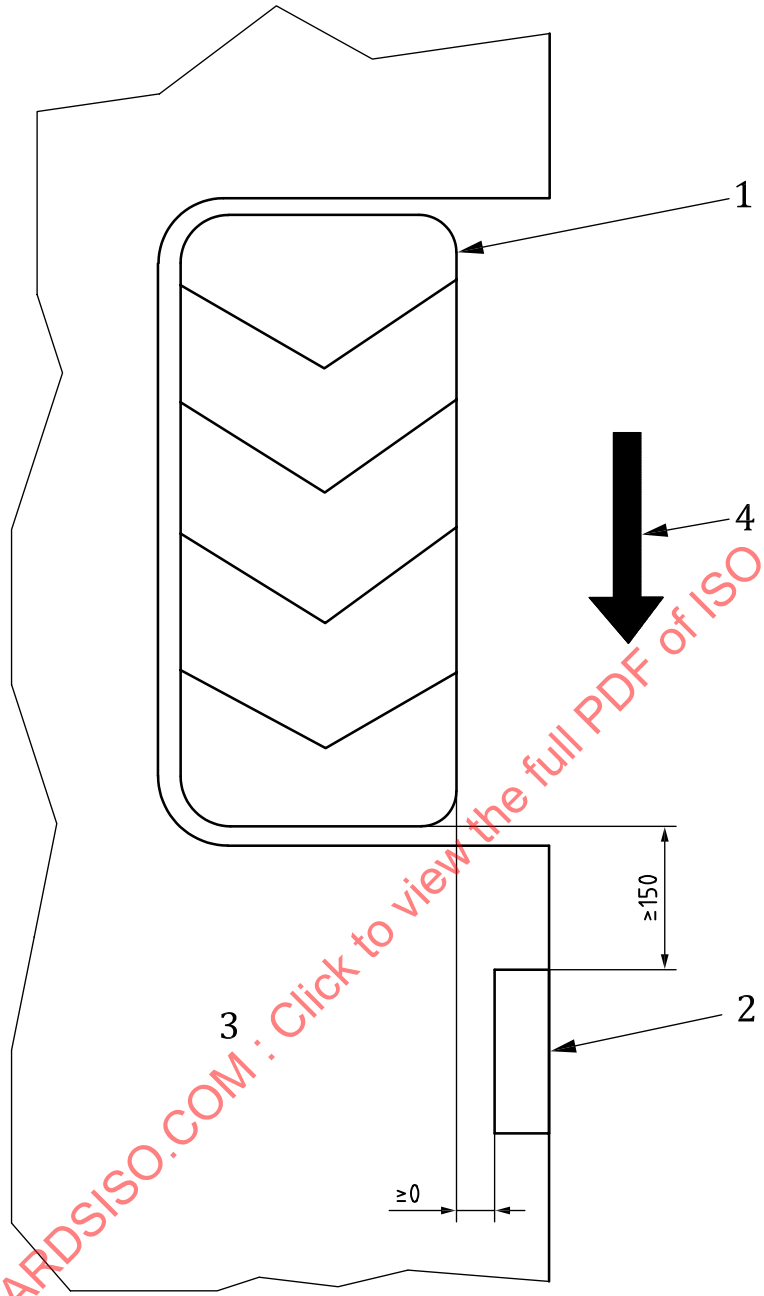
4.9.3.1 In the area for transfer of the bags or boxes to a transport vehicle

— it shall be possible to open the railing, and

— there shall be no foot guard in order to avoid hazards due to trip.

4.9.3.2 The access to the packing platform shall be capable of being closed during operation.

Dimensions in millimetres



Key

1 wheel
2 boarding means
3 machine
4 travel direction

Figure 6 — Location of boarding means (top view)

4.10 Other places than the operator's stations

4.10.1 Places for service operations with a machine standing shall fulfil the requirements ISO 4254-1:2013, 4.8 and ISO 4254-1:2013/AMD 1:2021.

4.10.2 Mobile boarding means are to be attached to the boarding point in such a way that safe use is guaranteed independent of the ground conditions.

4.11 Leaf spreading device

4.11.1 General

4.11.1.1 To reduce the width for transportation the leaf spreading device may be moveable (e.g. foldable) according to ISO 4254-1:2013, 4.9.

4.11.1.2 On machines with haulm/leaf spreading devices folded in the transport position, the haulm/leaf spreading device either shall be located such that gravity prevents a movement or shall be equipped with an automatic locking device. This locking device may be mechanical or hydraulic and shall lock the haulm/leaf spreading device in transport position to prevent any unintentional unfolding of the haulm/leaf spreading device.

4.11.1.3 If this locking device is a hydraulic valve not directly fitted to the cylinder, the lines connecting the valve to the cylinder shall be designed to withstand at least four times the rated maximum hydraulic pressure.

4.11.1.4 The unlocking and unfolding of the haulm/leaf spreading device shall be controlled by separate actions by the operator.

4.11.1.5 Unlocking from the transport position shall not cause the lowering of haulm/leaf spreading device without an intentional action of the operator.

4.11.1.6 The change from the working position to the transport position and vice versa shall occur without causing crushing or pinching hazards. The movement of the foldable haulm/leaf spreading device shall be powered if the manual force needed for the manoeuvre exceeds 250 N as an average value when moving from the start to the stop position. The peak(s) shall not exceed 400 N.

4.11.1.7 In case of powered operation, it shall be controlled from the driver's station of the self-propelled machine, or it shall be controllable from the driver's station of the towing vehicle for mounted and trailed machines. The control shall be of hold-to-run type.

4.11.2 Protection against unintentional contact

4.11.2.1 General

The protection against unintentional contact with any of the accessible moving parts at the front and at the sides of the haulm/leaf spreading device shall be ensured by protective devices the projection of which on a horizontal plane shall be continuous.

4.11.2.2 Haulm/leaf spreading devices with a vertical axle (see Figure 7)

4.11.2.2.1 Protection on the top

The protection on the top shall be ensured by an imperforate guard located such above the mobile parts of the haulm/leaf spreading device that it covers the horizontal plane of the mobile parts and prevents access to the leaf conveying device.

4.11.2.2.2 Protection at the sides and at the front

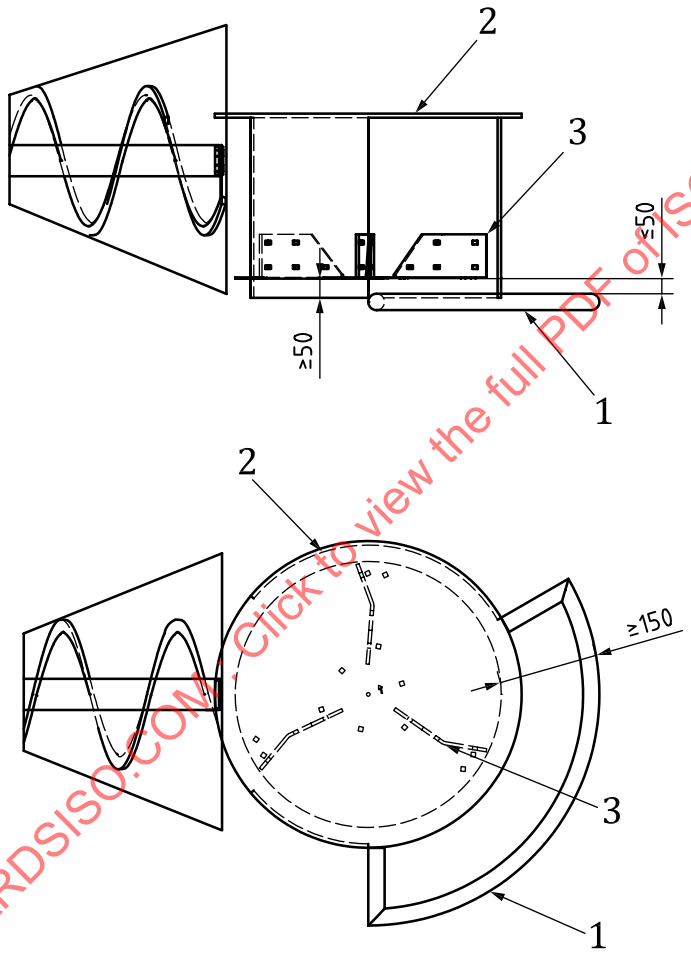
The protection shall be ensured with:

— a barrier located in the horizontal plane at a minimum distance of 150 mm from mobile parts and in the vertical plane at a maximum distance of 50 mm below the lower plane of the haulm/leaf spreading device; or

— an imperforate guard which extends below the lower plane of the haulm/leaf spreading device by 50 mm minimum; or

— a combination of the two previous protective devices.

Dimensions in millimetres



Key

1 barrier
2 imperforate guard
3 leaf spreading device

Figure 7 — Haulm/leaf spreading device with a vertical axle

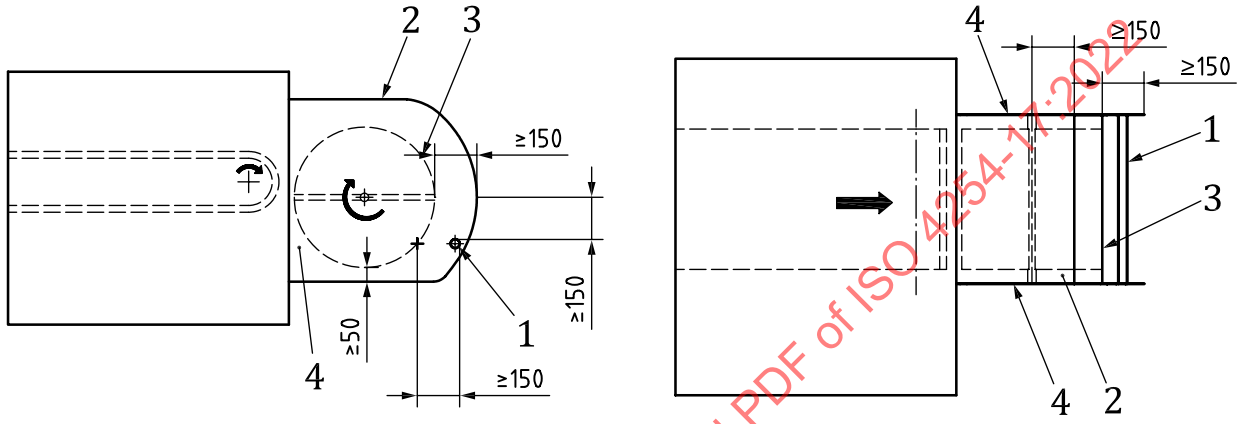
4.11.2.3 Leaf spreading devices with a horizontal axle

4.11.2.3.1 Leaf spreading devices with discharge above rotating axle

4.11.2.3.1.1 Protection on the top

The protection on the top shall be achieved by an imperforate guard with a horizontal distance of at least 150 mm from the rotating axis of the leaf spreading device (see Figure 8).

Dimensions in millimetres



a) Side view
(in conveying direction)

b) Top view

Key

1 barrier at the front of the leaf spreading device
2 imperforate guard on the top
3 outer path of the tools of leaf spreading device with horizontal axis
4 imperforate guard at the side

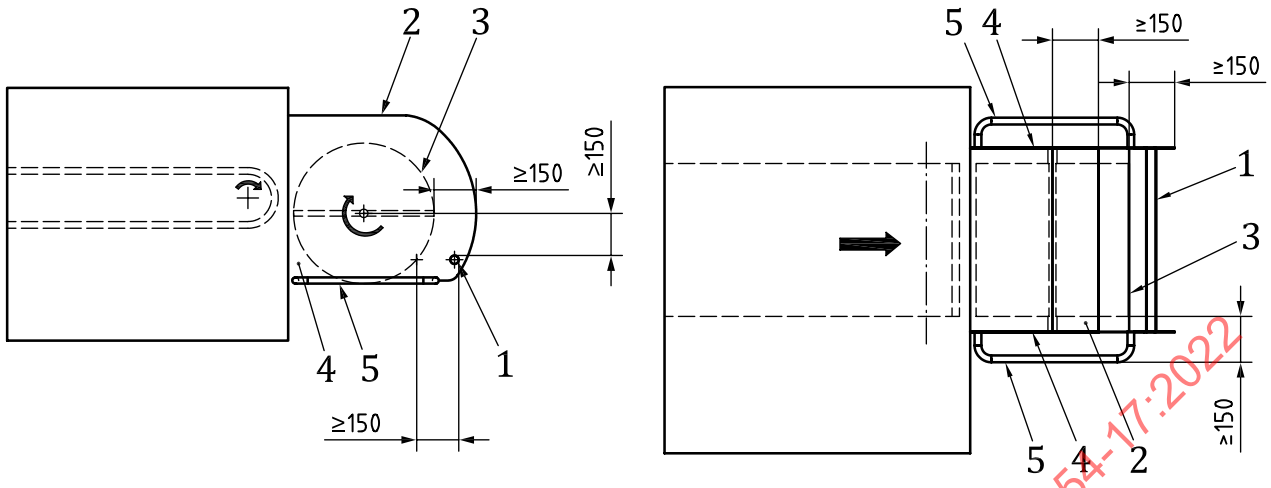
Figure 8 — Protection of leaf spreading device with horizontal axis with discharge above the rotating axis of the leaf spreading device

4.11.2.3.1.2 Protection at the sides

The protection at the sides shall be achieved by imperforate guards located in such a way that at the discharge opening it extends the outer path of the tools of the leaf spreading device by at least 150 mm and by at least 50 mm downwards (see Figure 8).

If the vertical dimension of minimum 50 mm downwards is not possible due to functional reasons, the lateral guard shall extend at least to the lower edge of the outer path of the tools and lateral barriers shall be provided located at a distance of at least 150 mm from the tool plane at the lower outer path of the tools towards the front and the rear (see Figure 9).

Dimensions in millimetres



a) Side view
(in conveying direction)

b) Top view

Key

1 barrier at the front of the leaf spreading device
2 imperforate guard on the top
3 outer path of the tools of leaf spreading device with horizontal axis
4 imperforate guard at the side
5 lateral barriers

Figure 9 — Protection of leaf spreading device with horizontal axis with discharge above the rotating axis of the leaf spreading device with lateral barriers

4.11.2.3.1.3 Protection at the front

The protection at the front shall be achieved by a barrier parallel to the axis of rotation of the leaf spreading device located below the axis of rotation at a maximum vertical distance of 150 mm from the axis of rotation and at a horizontal distance of at least 150 mm from the outer path of the tools of the leaf spreading device (see Figure 8).

4.11.2.3.2 Leaf spreading devices with discharge below rotating axle

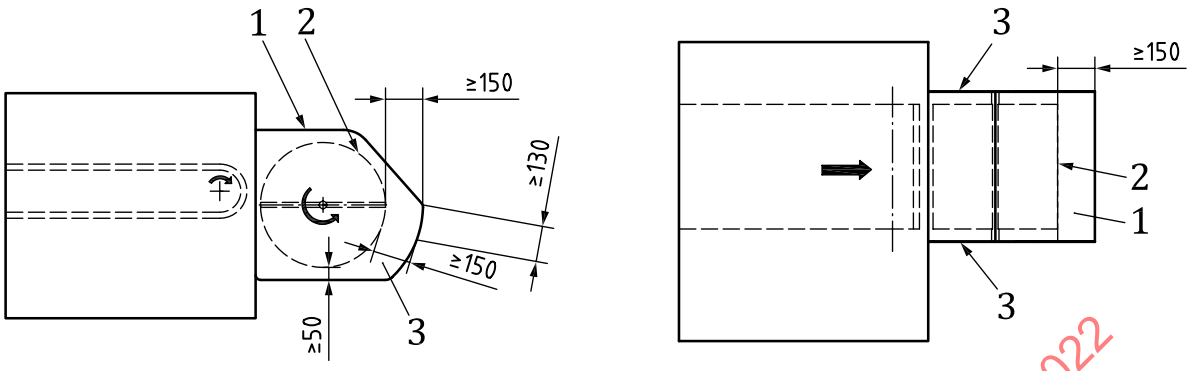
4.11.2.3.2.1 Protection on the top

The protection on the top shall be achieved by an imperforate guard (see Figure 10) the front edge of which

— vertically extends at least to the rotating axle of the leaf spreading device, and

— is located at a horizontal distance of at least 150 mm from the outer path of the tools.

Dimensions in millimetres



a) Side view
(in conveying direction)

b) Top view

Key

1 imperforate guard on the top
2 outer path of the tools of leaf spreading device with horizontal axis
3 imperforate guard at the side

Figure 10 — Leaf spreading device with horizontal axis with discharge below the rotating axis of the leaf spreading device — Protection on the top

4.11.2.3.2.2 Protection at the sides

The protection at the sides shall be achieved by imperforate guards located in such a way that in the zone below the rotating axle they extend the outer path of the tools of the leaf spreading device horizontally by at least 150 mm and by at least 50 mm downwards (see Figure 10).

4.11.2.3.2.3 Protection at the front

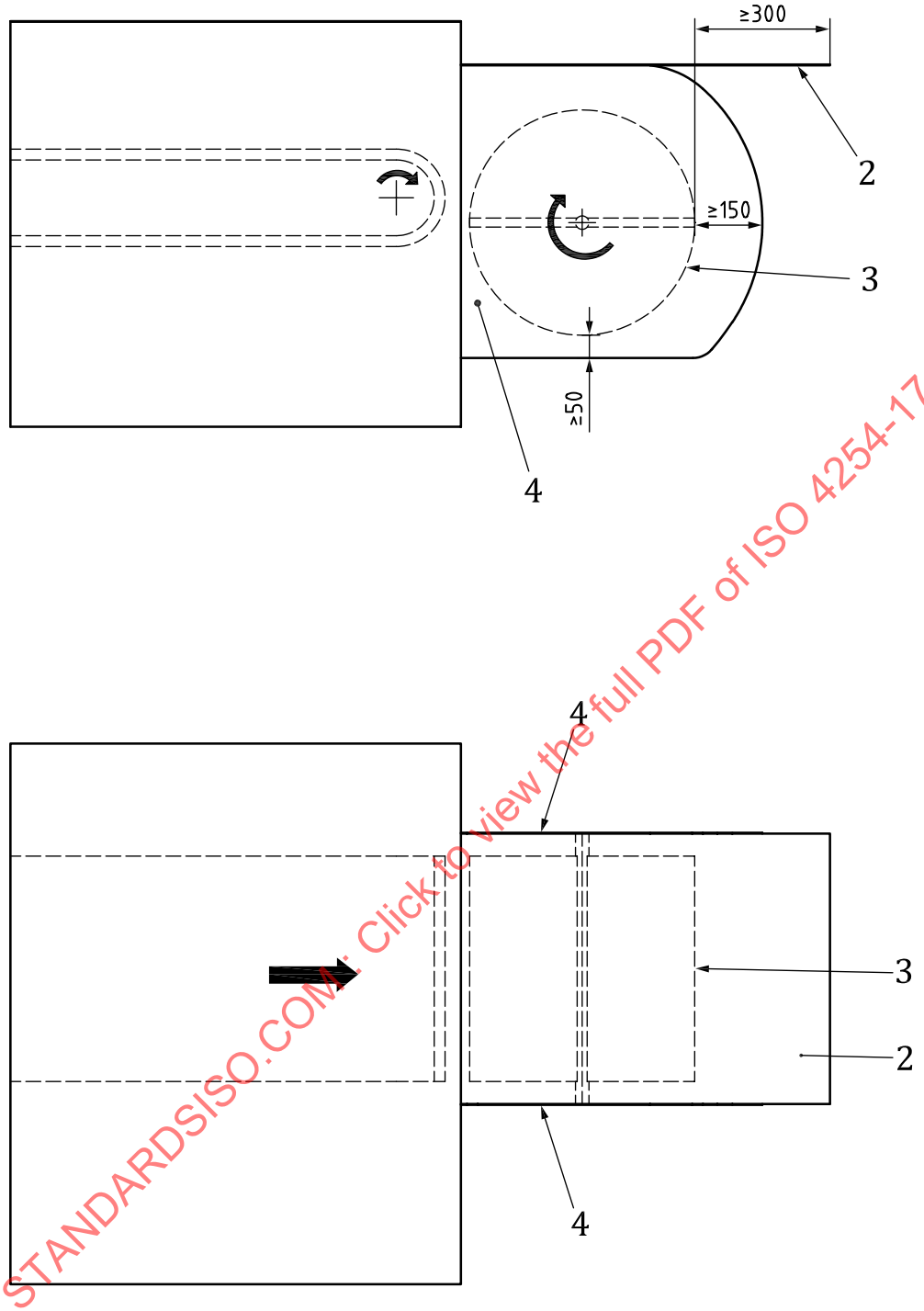
The protection at the front shall be achieved by the extension of the top protection downwards (see 4.11.2.2.2). The horizontal distance of at least 150 mm from the outer path of the tools of the leaf spreading device shall be met over a length of at least 130 mm (see Figure 10).

4.12 Haulm spreading devices

4.12.1 Protection on the top and at the front

The protection shall be achieved by an imperforate guard on the top with a horizontal distance of at least 300 mm from the the outer path of the tools of the haulm spreading device (see Figure 11).

Dimensions in millimetres



Key

1 barrier at the front of the haulm spreading device
2 imperforate guard on the top
3 outer path of the tools of haulm spreading device
4 imperforate guard at the side

Figure 11 — Protection of haulm spreading device

4.12.2 Protection at the sides

The protection at the sides shall be achieved by imperforate guards located in such a way that at the discharge opening it extends the outer path of the tools of the leaf spreading device by at least 150 mm and by at least 50 mm downwards (see Figure 11).

4.13 Noise reduction as safety requirement

4.13.1 The machine shall be in accordance with ISO 4254-1:2013, 4.3.

4.13.2 Machines shall be designed and constructed taking into account the available information and technical measures to control noise at source at the design stage, as described in ISO/TR 11688-1.

4.13.3 For machines equipped with a cabin, the operator's manual shall include a recommendation to operate the machine with all the doors and windows closed [see 9.1.2 o)].

5 Additional requirements for sieving harvesters

5.1 Digging devices

The rotating parts of the powered digging devices shall stop when the digging devices are in the uppermost position.

5.2 Cleaning and conveying devices

5.2.1 General

5.2.1.1 Cleaning and conveying devices shall be protected either by fixed guards preventing the access to crushing and pinching locations or by fixed parts of the machine provided the safety distances according to ISO 13857:2019, Tables 1, 3, 4 and 6 as appropriate are met.

5.2.1.2 If due to functional reasons these requirements cannot be met, the cleaning and conveying devices shall be protected against unintentional contact according to the requirements as specified in 5.2.2, 5.2.3 and 5.2.4.

5.2.2 Cleaning belts

Cleaning belts shall be in accordance with 6.2.3.

5.2.3 Other cleaning devices

5.2.3.1 The rotating parts of cleaning rollers, haulm devining devices, clod and stone removal devices shall be guarded against contact from above and on the sides as follows.

— If they do not need to be opened for cleaning and removal of blockages:

  — fixed guards (according to ISO 12100:2010, 3.27.1); or

  — fixed parts of the machine providing at least an equivalent level of protection.

— In other cases:

  — fixed guards needing a tool for their opening. These guards shall remain attached to the machine when opened (for example by means of hinges) and automatically lock in the closed position without the use of a tool; or

— interlocking movable guards (according to ISO 12100:2010, 3.27.4); or

— movable guards fitted with a device which prevents their opening so long as the parts are moving.

5.2.3.2 The side guards shall extend below the moving parts for a distance of at least 130 mm.

5.2.3.3 The parts of cleaning rollers, haulm de-vining devices and clod and stone removal devices which are accessible from the sorting platform and which presents a hazard shall be guarded against contact.

5.2.4 Conveying devices

Conveying devices shall be in accordance with 6.3.

6 Additional requirements for root lifting harvesters

6.1 Root lifting devices

The rotating parts of the powered root lifting devices shall stop when the lifting devices are in the uppermost position.

6.2 Cleaning devices

6.2.1 General

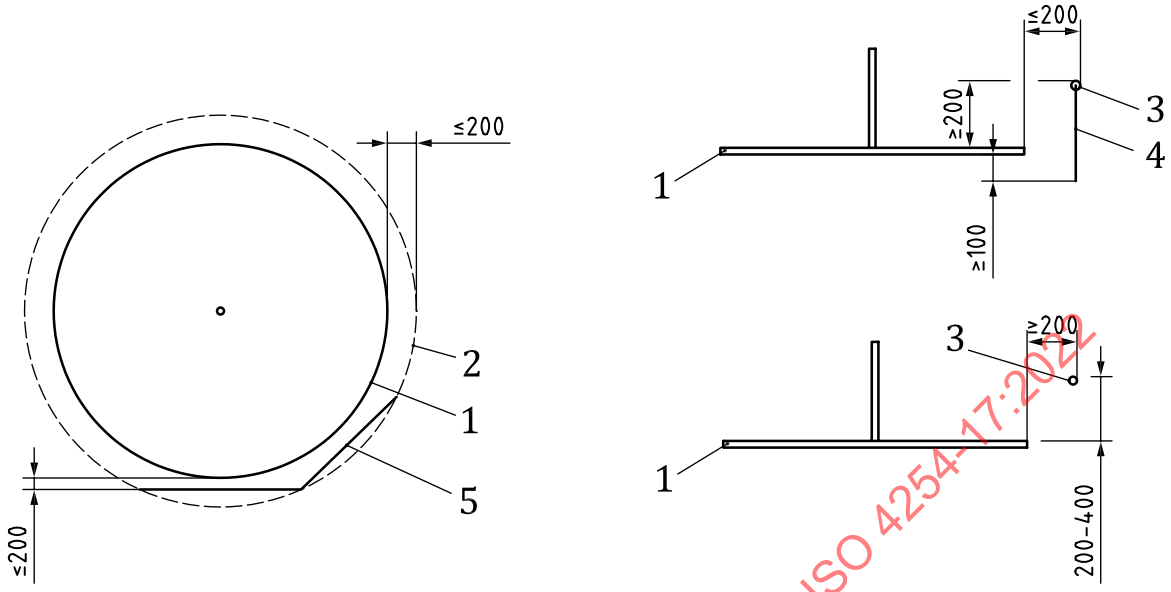
6.2.1.1 Cleaning devices shall be protected either by fixed guards preventing the access to crushing and pinching locations or by fixed parts of the machine provided the safety distances according to ISO 13857:2019, Tables 1, 3, 4 and 6 as appropriate are met.

6.2.1.2 If due to functional reasons these requirements cannot be met, the cleaning devices shall be protected against unintentional contact according to the requirements as specified in the following clauses.

6.2.2 Cleaning turbines

6.2.2.1 Cleaning turbines (see Figures B.10, B.11 and B.12) may be protected by a combination of a barrier with a protective skirt. The barrier shall be located in a horizontal distance of maximum 200 mm from the outer path of the tool and in a vertical distance of minimum 200 mm above the outer path of the tool. The protective skirt shall extend the outer path of the tool by minimum of 100 mm downwards. See Figure 12.

Dimensions in millimetres



a) Top view **b) Side view**

Key

1 cleaning turbine
2 horizontal distance from the outer path of the cleaning turbine
3 barrier
4 protective skirt
5 partial protection of the cleaning turbine

Figure 12 — Protection of the cleaning turbine

Where a protection by combination of a barrier with a protective skirt is not possible for functional reasons, the cleaning turbines may be protected by a barrier. In this case, the barrier shall be located in a horizontal distance of minimum 200 mm from the outer path of the tool and in a height between 200 mm and 400 mm above the outer path of the tool.

A barrier is not necessary if the power supply of the cleaning turbines is automatically switched off when the operator leaves the operator's work station with a maximum delay for triggering the switch-off of 7 s. The run-down time of the cleaning turbines after switch-off is limited to 5 s.

6.2.2.2 Crushing and pinching locations on cleaning turbines in the area of the articulated steering which cannot conform with the above-mentioned requirements due to the required clearance for steering shall be protected by a combination of a barrier with a protective skirt in such a way that direct access to crushing and pinching locations is prevented. The vertical distance between cleaning turbines and protective skirt shall not exceed 50 mm. The horizontal distance to crushing and pinching locations shall be at least 150 mm.

6.2.2.3 The protective skirt shall have a sufficient strength and stiffness. This is given for example if the protective skirt consists of armoured/reinforced rubber having a minimum thickness of 4 mm.

6.2.3 Cleaning belts

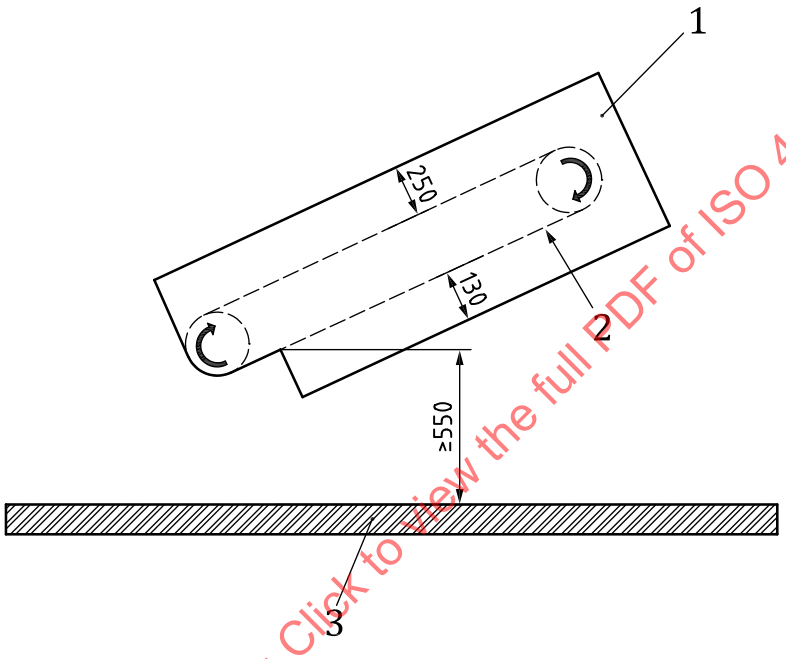
6.2.3.1 General

6.2.3.1.1 The moving path of the cleaning belts shall be covered on the sides over its whole length. The vertical protrusion shall be (see Figure 13):

— downwards at least 130 mm when the height of the bottom run of the cleaning belt in working position is more than 550 mm from the ground; and

— upwards at least 250 mm.

Dimensions in millimetres



Key

1 guard of the cleaning belt
2 path of the cleaning belt
3 ground

Figure 13 — Protection of the cleaning rolls

6.2.3.1.2 If due to functional reasons the sides of the moving path of the cleaning belts cannot be covered and vertical protrusion downwards of 130 mm cannot be met, the entry points of the cleaning belts (e.g. drive wheels, deflection rolls, support rolls) shall be protected. The protection shall prevent direct access and shall have impeding function.

6.2.3.1.3 For remaining crushing and pinching hazards which cannot be avoided due to functional reasons, safety signs on the machine and instructions in the operator's manual shall be provided (see 9.1.4).

6.2.3.2 Cleaning belts immediately behind the root lifting device

For cleaning belts located immediately behind the root lifting device a protection of the front deflection is not necessary.

6.2.4 Cleaning rollers

6.2.4.1 General

If access is possible to crushing and pinching locations of the cleaning rolls, the crushing and pinching locations shall be protected by a guard located parallel to the direction of conveying of the cleaning rolls or by parts of the machine. For this purpose (see Figure 14):

— in case the lower edge of the guard or parts of the machine:

— are located not more than 800 mm above the ground the distance between the lower edge of the lateral guard and the outer path of the cleaning rollers shall be at least 230 mm;

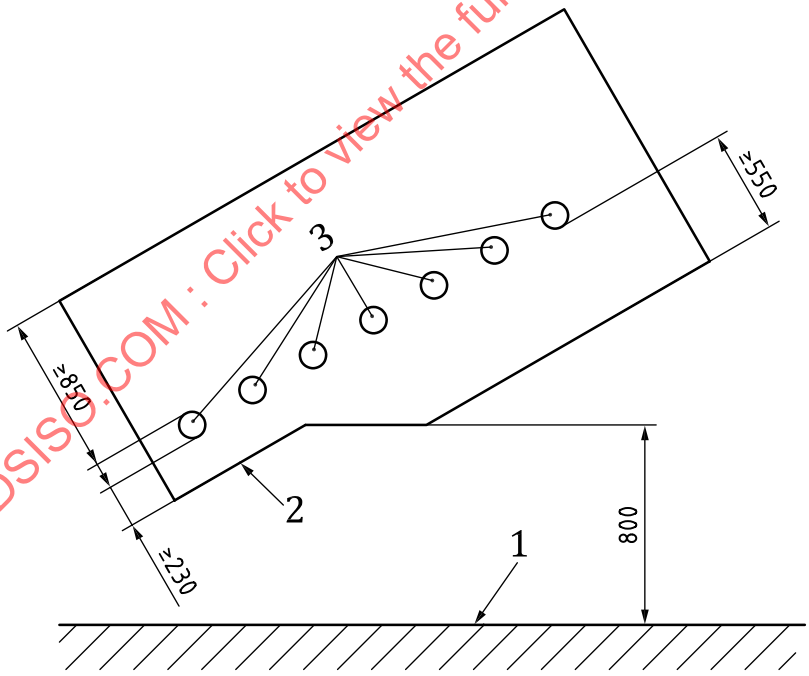
or

— are located more than 800 mm above the ground the distance between the lower edge of the lateral guard and the outer path of the cleaning rollers shall be at least 550 mm.

— a safety distance of at least 850 mm from crushing and pinching locations shall be met above the cleaning rollers.

If the lateral guard is located in the area of the wheels or tracks the vertical distances of 230 mm respectively 550 mm may be reduced provided the horizontal distance between the guard and the cleaning rollers is at least 230 mm respectively 550 mm in this area.

Dimensions in millimetres



Key

1 ground
2 lower edge of the guard
3 cleaning rolls

Figure 14 — Protection of the cleaning rollers

6.2.4.2 Cleaning rollers immediately behind the beet lifting device

6.2.4.2.1 For cleaning rollers located immediately behind the beet lifting device the moving path of the cleaning rollers shall be covered on the sides over its whole length. In addition, access from the side with the lower limbs shall be prevented up to height of at least 550 mm above the moving path of the cleaning rollers. This can be achieved by a guard or fixed parts of the machine or by a combination of a guard and fixed parts of the machine.

6.2.4.2.2 Crushing and pinching locations at the rear of the cleaning rollers located less than 550 mm from the outer contour of the machine shall be protect against unintentional contact. This requirement is deemed to be fulfilled if

— the access to rear of the cleaning rollers is prevented by other parts of the machine; or

— for prevention of unintended contact, a barrier shall be located in the height of the plane of the upper moving path of the cleaning rollers and in a horizontal distance of at least 200 mm from the moving path of the cleaning rollers.

6.3 Conveying devices

To ensure protection against unintentional contact with the accessible mobile elements, the conveying devices shall be fitted with fixed guards (according to ISO 12100:2010, 3.27.1) if they do not need to be opened for cleaning and clearing blockages.

When frequent access is foreseen, the conveying devices shall be fitted with guards needing a tool to open them. These guards shall remain attached to the machine when open (for example by means of hinges) and automatically lock in the closed position without the use of a tool.

If this type of guards is not used, the conveying devices shall be fitted with:

— interlocking movable guards (according to ISO 12100:2010, 3.27.4); or

— movable guards fitted with a device which prevents their opening so long as the parts are moving.

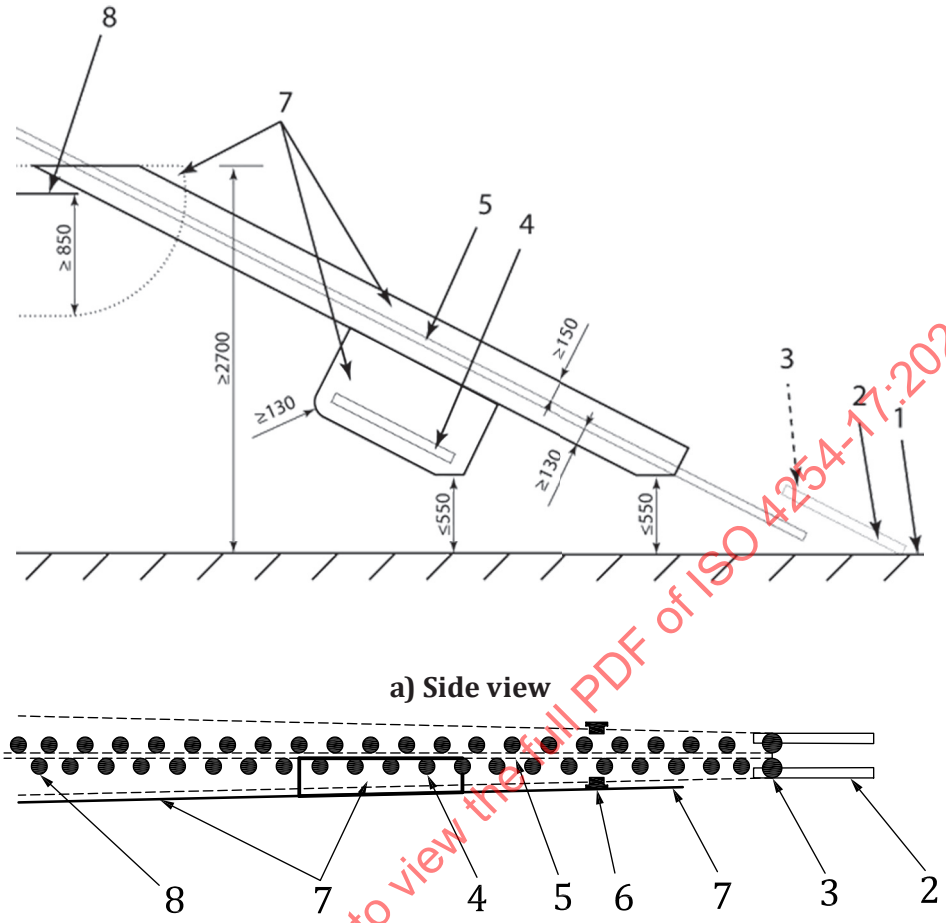
For the elements of these devices located less than 550 mm from the ground, guarding from below is not required when the side guard extends downwards for a distance of at least 130 mm below their path.

7 Additional requirements for top lifting harvesters

7.1 Top lifting devices

7.1.1 If access is possible to crushing and pinching locations of the top lifting devices, the crushing and pinching locations shall be protected on the outer sides of the outer top lifting devices by a guard located parallel to the direction of conveying of the top lifting devices or by parts of the machine (see Figure 15).

Dimensions in millimetres



a) Side view

b) Top view

Key

1	ground level	5	clamping belt
2	torpedo	6	roller
3	haulm/leaf cutting device	7	guard
4	cleaning device	8	haulm/leaf removing device

Figure 15 — Top lifting device and haulm/leaf removing device — Guarding

7.1.2 The moving path of the clamping belt shall be covered on the outer sides of the outer top lifting devices. The vertical protrusion shall be (see Figure 15):

— downwards at least ≥ 130 mm when the height of the lower edge of the clamping belt in working position is more than 550 mm from the ground; and

— upwards at least ≥ 150 mm when the height of the lower edge of the clamping belt in working position is more than 550 mm from the ground.

7.1.3 If protective skirts are used to avoid contact with moving parts of the top lifting device the protective skirts shall have a sufficient strength, stiffness and durability.

7.1.4 For remaining crushing and pinching hazards occurring at the entry points which cannot be avoided due to functional reasons, safety signs on the machine and instructions in the operator's manual shall be provided (see 9.1.5).

7.2 Cleaning devices

7.2.1 Cleaning devices, other than conveying and cleaning belts (see 7.3) shall be protected either by fixed guards preventing the access to crushing and pinching locations or by fixed parts of the machine provided the safety distances according to ISO 13857:2019, Tables 1, 3, 4 and 6 as appropriate are met.

7.2.2 If due to functional reasons these requirements cannot be met, the cleaning devices shall be protected against unintentional contact according to the requirements as specified in the following clauses.

7.2.3 The crushing and pinching locations and rotating parts of cleaning devices shall be guarded against contact from above and on the sides by:

— if they do not need to be opened for cleaning and for removal of blockages
  — fixed guards (according to ISO 12100:2010, 3.27.1); or
  — fixed parts of the machine providing at least an equivalent level of protection;
— in other cases, by
  — fixed guards needing a tool for their opening. These guards shall remain attached to the machine when opened (for example by means of hinges) and automatically lock in the closed position without the use of a tool; or
  — interlocking movable guards (according to ISO 12100:2010, 3.27.4); or
  — movable guards fitted with a device which prevents their opening so long as the parts are moving.

7.2.4 The side guards shall extend below the moving parts for a distance of at least 130 mm when the height of the lower edge of the cleaning device in working position is more than 550 mm from the ground.

7.2.5 The parts of rotary cleaners which are accessible from the sorting platform and which presents a hazard shall be guarded against contact.

7.2.6 If due to functional reasons (e.g. for providing a sufficient self-cleaning effects) a fixed guard is not possible, a protection by a protective skirt is possible. In this case, the protective skirt shall have a sufficient strength and stiffness.

7.3 Cleaning belts

7.3.1 Cleaning belts shall be in accordance with 6.2.3.

7.3.2 The lateral part of conveying belts shall be guarded against unintentional contact.

7.4 Conveying devices

Conveying devices shall be in accordance with 6.3.

7.5 Devices in front of the top lifting devices

Powered devices in front of the top lifting device (for example torpedos, haulm/leaf cutting devices, haulm/leaf topping devices) which cannot be protected for functional reasons, shall stop when the top lifting devices are in uppermost position.

7.6 Haulm/leaf removing device

The rotating tools of the haulm/leaf removing device located at the upper area within the machine, if not guarded by location or other parts of the machine, shall be in accordance with ISO 13857:2019, Tables 1, 3, 4 and 6 as appropriate.

8 Verification of the safety requirements and/or protective/risk reduction measures

See Table 1.

Table 1 — List of safety requirements and/or protective/risk reduction measurements and their verification

Subclause	Inspection[a]	Verification measurement[b]	Test	Requirement
4.2.2	—	—	X	Shall be verified by carrying out hold-to-run control and testing for functionality.
4.2.3	—	X	—	Shall be verified by measuring the distance between work-places and emergency stop equipment in accordance with ISO 15534-3:2000.
4.2.3	—	—	X	Shall be verified by testing emergency stop equipment whether the machine functions stop immediately. Requirements for functionality of emergency stop equipment are given in ISO 13850:2015.
4.3.1	—	X	—	Shall be verified by measurements in accordance with ISO 9533:2010.
4.4	—	X	—	Shall be verified by measuring the dimensions and safety distances.
4.6.4	—	X	—	Shall be verified by testing the machine in the specified conditions and ensuring stability.
4.8	—	X	X	Shall be verified by operating the disengagement system for all relevant power-driven functional elements and measuring the delay time. Intentional reactivation shall be tested for functionality.
4.9.1	—	X	—	Shall be verified by measurements in accordance with the given safety dimensions as well as ISO 4254-1:2013, 4.7.1 and 4.7.2 and ISO 4254-1:2013/AMD 1:2021.
4.9.2	—	X	—	Shall be verified by measurements in accordance with the safety dimensions given in ISO 4254-1:2013, 4.7.2.
4.9.3	—	X	—	Shall be verified by measurements in accordance with the given safety dimensions as well as ISO 4254-1:2013, 4.7.2.
4.11.1.6	—	X	—	Shall be verified by measuring the actuating force.
4.11.1.7	—	—	X	Shall be verified by carrying out hold-to-run control and testing for functionality.
4.11.2.1	—	X	—	Shall be verified by measurements in accordance with the given safety dimensions.
4.11.2.2	—	X	—	Shall be verified by measuring the dimensions and safety distances.
4.12	—	X	—	Shall be verified by measuring the dimensions and safety distances.

[a] Visual check of the machine to see that all elements are in place.

[b] Determination of a value by using some form of device or instrument.

Table 1 *(continued)*

Subclause	Inspection[a]	Verification measurement[b]	Test	Requirement
5.2	—	X	—	Shall be verified by measuring the dimensions and safety distances.
6.2	—	X	—	Shall be verified by measuring the dimensions and safety distances.
6.3	—	X	—	Shall be verified by measuring the dimensions and safety distances.
7.1	—	X	—	Shall be verified by measuring the dimensions and safety distances.
7.2	—	X	—	Shall be verified by measuring the dimensions and safety distances.
7.6	—	X	—	Shall be verified by measuring the dimensions and safety distances.

[a] Visual check of the machine to see that all elements are in place.

[b] Determination of a value by using some form of device or instrument.

9 Information for use

9.1 Operator's manual

9.1.1 General

Comprehensive instructions and information on all aspects of maintenance and the safe use of the machine shall be provided in the instruction handbook. The information and items given in ISO 4254-1:2013, Clause 8 and ISO 4254-1:2013/AMD 1:2021 apply.

9.1.2 All machines

In particular, the following points shall be emphasized:

a) residual hazards caused by operating mobile elements;

b) the hazards related to lack of stability when working due to conditions of soil;

c) that the machine travel and powered parts shall be stopped before any intervention;

d) the need to set the machine into a safe status before clearing of blockages;

e) how to set the machine into a safe status for clearing of blockages;

f) the tools (if provided with the machine) to be used for clearing of blockages;

g) the procedures to be followed for clearing of blockages;

h) hazards related to the clearing of blockages of the machine, especially in case the crop lifting device and the removal devices (for stones, clods, haulm, leafs, admixtures) despite blockage are still running, the procedures to be followed for clearing of the blockage and the tools (supplied with the machine) to be used for that purpose;

i) the need to apply mechanical locking devices to support raised parts before carrying out maintenance underneath;

j) the need to close guards before restarting the machine;

k) the precautions to be taken when connecting the mounted and trailed machines to the electric and hydraulic circuits of the towing machine;

l) the precautions to be taken for the fitting and the use of the machine controls which are to be operated from the driver's station of the towing machine;

m) that where tipping is controlled from a hydraulic valve of the towing vehicle, the control of this valve shall be of the hold-to-run type where possible;

n) safety instruction for the transport of the machine and/or equipment;

o) recommendations on how to operate machines equipped with a cabin with all doors and windows closed;

p) residual risks associated with overhead power lines, when the machine exceeds 4 m in height during any mode of operation including information on the maximum height of the machine;

q) the need for the operator on the platform to inform the driver by use of the 2-way communication if there is a need to adjust the driving speed and/or the speed of functional components of the machine to the conditions of work;

r) regarding vibration, the instruction handbook and the technical documentation describing the machine prepared by the manufacturer for the information of potential users shall:

— give the vibration total value to which the hand-arm system, if it exceeds 2,5 m/s^2. Where this value does not exceed 2,5 m/s^2, this shall be mentioned;

— give the highest root mean square value of weighted acceleration to which the whole body, if it exceeds 0,5 m/s^2. Where this value does not exceed 0,5 m/s^2, this shall be mentioned;

— specify the uncertainty of measurement;

— describe the operating conditions during measurement and the measurement codes used;

NOTE The declared vibration values can be either those actually measured for the machinery in question or those established on the basis of measurements taken for technically comparable machinery which is representative of the machinery to be produced.

9.1.3 Sieving harvesters

In particular, the following points shall be emphasized:

a) the hazards of stones being ejected from the front of the haulm topping device;

b) the need to ensure that the emergency stop equipment functions correctly;

c) the need to ensure that the two-way communication, where provided, functions correctly;

d) on trailed machines with a sorting platform, that the driver of the tractor shall activate the audible warning alarm intended to draw the attention on the starting of the moving parts, when the engagement of this warning alarm is not automatic;

e) the hazard resulting from dust for the operators on the sorting platform;

f) that operators are allowed on the sorting platform only during the harvesting process and that they shall not go up or down the boarding means when the machine is moving.

9.1.4 Root lifting harvesters

In particular, the following points shall be emphasized:

a) the hazard of stones being ejected from the front of the leaf topping device under the effect of the rotor with its knife blades, and on the side from the leaf spreading system;

b) that the leaf spreader shall not be operated when it is in the transport position;

c) residual hazard caused by operating cleaning belts.

9.1.5 Top lifting harvesters

In particular, the following points shall be emphasized:

a) the hazard of stones being ejected from the front of the haulm/leaf topping device;

b) that the haulm topping device shall not be operated when it is in the transport position;

c) the need to ensure that the emergency stop equipment functions correctly;

d) the need to ensure that the two-way communication, where provided, functions correctly;

e) on trailed or mounted machines with a sorting platform, bagging/transfer platform and/or inspection platform, that the driver of the tractor shall activate the audible warning alarm intended to draw the attention on the starting of the moving parts, when the engagement of this warning alarm is not automatic;

f) the hazard resulting from dust for the operators on the sorting platform, bagging/transfer platform and/or inspection platform;

g) that operators are allowed on the sorting platform, bagging/transfer platform and/or inspection platform only during the harvesting process and that they shall not go up or down the boarding means when the machine is moving;

h) residual hazards caused by operating the top lifting device.

9.2 Marking

9.2.1 General

The machine shall be in accordance with ISO 12100:2010, 6.4.4.

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

— the business name and full address of the manufacturer and, where applicable, his authorized representative;

— year of construction;

— the designation of the machinery;

— designation of series or type;

— serial number, if any;

— nominal rotation frequency and direction of rotation of the power input connection (marked by an arrow), when applicable;

— service mass empty, in kilograms;

— nominal power, in kilowatts (for self-propelled machine).

9.2.2 Warnings

In addition, warnings shall be affixed on the machine drawing attention to:

— the prohibition against going up or down the boarding means when the machine is moving;

— hazards caused by moving parts: a warning shall be placed on the haulm/leaf topping device immediately next to the discharge outlet for haulms/leaves and to the spreading device;

— hazards caused by ejection: a warning shall be placed on the haulm/leaf topping device;

— the need to apply the mechanical supports in case of maintenance and servicing works.

When parts of a machine exceed the height of 4 m during normal operation, a warning sign visible from the driver station shall warn about the hazards associated with overhead hazards such as power lines or bridges.

Safety signs shall conform to the requirements of ISO 11684:1995 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.

Annex A
(informative)

List of significant hazards

Table A.1 gives the significant hazard(s), the significant hazardous situation(s) and hazardous event(s) covered by this document 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 reduce the risk.

Attention is drawn to the necessity to verify that the safety requirements specified in this document apply to each significant hazard presented by a given machine and to validate that the risk assessment is complete.

Table A.1 — List of significant hazards associated with root crop harvesters

No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
1	**Mechanical hazards**			
1.1	Crushing hazard	Actuation of controls	4.5.3; 5.1.3.2; 5.1.8; 6.1	4.2
		Access to platforms or other places	4.7; 4.8	4.9; 4.10
		Work on platforms	4.7; 5.1.4	4.7; 4.9; 5.2.3.3; 7.2.5
		Contact with power driven parts	4.10; 6.4	4.4; 4.8; 4.11; Clauses 5, 6, 7; 9.1
		Perform service and maintenance operations	4.9.2; 4.9.3; 4.11; 4.17.1; 4.17.3	4.5; 4.6; 9.1
		Roll-over	5.1.2.3; 5.7	—
		Moving the machine	5.2	4.3; 4.9; 9.1
		Lack of stability	6.2	9.1
		Mounting of machines/coupling area	6.2.2; 6.2.3; 6.3	9.1
		Bunkermovement	—	4.5
		Unloading	4.9	4.6
		Work under raised parts	4.11	4.5; 4.6; 9.1
		Remove of blockages	—	4.7; 9.1
		Leaving the operator workstation	—	4.8; 6.2.2.1

[a] According to ISO 4254-1:2013.

Table A.1 *(continued)*

No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
1.2	Shearing hazard	Actuation of controls	4.5.3; 5.1.3.1; 5.1.3.4; 5.1.8; 6.1	4.2
		Access to platforms or other places	4.7; 4.8	4.9; 4.10
		Work on platform	4.7; 5.1.4	4.7; 4.9; 5.2.3.3, 7.2.5
		Contact with power driven parts	4.10; 6.4	4.4; 4.5; 4.8; 4.11; Clauses 5, 6, 7; 9.1
		Perfom service and maintenance operations,	4.9.2; 4.9.3; 4.11; 4.17.1; 4.17.3	4.6; 9.1
		Roll-over	5.1.2.3; 5.7	—
		Moving the machine	5.2	4.3; 4.9; 9.1
		Lack of stability	6.2	4.6; 9.1
		Mounting of machines	6.2.2; 6.2.3; 6.3	—
		Bunker movement	—	4.5; 4.6
		Unloading	4.9	4.6
		Working under raised parts	4.11	4.5; 4.6; 9.1
		Remove of blockages	—	4.7; 9.1
		Leaving the operator workstation	—	4.8; 6.2.2.1
1.3	Cutting or severing hazard	Contact with power driven parts	4.9.2; 4.9.3	4.2; 4.4; 4.8; 4.10; Clause 7; 9.1
		Work on platform	4.7	4.9; 5.2.3.3; 7.2.5
		Remove of blockages	—	4.7; 9.1
		Leaving the operator workstation	—	4.8; 6.2.2.1
1.4	Entanglement hazard	Contact with power driven parts	4.9.2; 4.9.3; 6.4	4.2; 4.4; 4.8; 4.10; 4.11; Clauses 5, 6, 7
		Starting/stopping the engine with engaged drive(s)	5.1.8	—
		Work on platform	—	4.9; 5.2.3.3; 7.2.5
		Remove of blockages	—	4.7; 9.1
		Leaving the operator workstation	—	4.8
1.5	Drawing-in or trapping hazard	Contact with power driven parts	4.9.2; 4.9.3; 6.4	4.4; 4.5; 4.11; Clauses 5, 6, 7
		Starting/stopping the engine with engaged drive(s)	5.1.8	—
		Work on platform	—	4.9; 5.2.3.3; 7.2.5
		Remove of blockages	—	4.7; 9.1
		Leaving the operator workstation	—	4.8; 6.2.2.1

[a] According to ISO 4254-1:2013.

Table A.1 *(continued)*

No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
1.6	Impact hazard	Actuation of controls	4.5.3; 5.1.3.1; 5.1.3.4; 5.1.8; 6.1	4.2
		Access to platform or other places	4.7; 4.8	4.9; 4.10
		Steering system	5.1.3.1	—
		Folding elements	4.9	4.11
		Bunker movement	—	4.5
		Unloading	4.9	4.6
		Work under raised parts	4.11	4.5; 4.6; 9.1
		Remove of blockages	—	4.7; 9.1
		Leaving the operator workstation	—	4.8; 6.2.2.1
1.9	High-pressure fluid injection or ejection hazard	Fail of hydraulic components and fittings (e.g. rupture)	4.13; 6.5	—
1.10	Ejection of parts	Actuation of controls	4.5.3; 5.1.3.1; 5.1.3.4; 5.1.8; 6.1	4.2
		Foreign object in haulm/leaf	—	4.4.4; 6.2.2
		Leaving the operator workstation	—	4.8; 6.2.2.1
2	**Electrical hazards**			
2.1	Contact of persons with live parts (direct contact)	Electrical equipment	4.12; 5.3; 6.5	—
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	Electrical equipment	4.12.1	—
2.3	Approach to live parts under high voltage	Overhead power lines	8.2.3; 8.3.4	9.1.2 p)
2.5	Electromagnetic phenomena	Electrical equipment	4.18	—

[a] According to ISO 4254-1:2013.

Table A.1 *(continued)*

No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
3	**Thermal hazards**			
3.1	Burns, scalds and other injuries by possible contact between persons and objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	Hydraulic system, operating fluids (e.g. fuel, hydraulic oil, engine coolant)	4.15	—
		Cab material	5.1.6	—
		Hot surfaces	5.5	—
4	**Hazards generated by noise**			
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness), accidents due to interference with speech communication and acoustic warning signals	Noise	4.3	9.1.2 o)
		Work on platform	—	4.9
5	**Vibration hazards**			
5.1	Discomfort, low-back morbidity	Machine design	4.4	—
		Seat	5.1.2	9.1.2 o)
6	**Hazards generated by materials and substances**			
6.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	Operating fluids	4.15; 5.4	—
		Cab material	5.1.6	—
		Battery	5.3.1	—
		Exhaust system	5.6	—
		Work on platform	—	9.1.3 e)
6.2	Fire or explosion hazard	Cab material	5.1.6	—
7	**Hazards generated by neglecting ergonomic principles in machinery design**			
7.1	Unhealthy postures or excessive effort	Actuation of controls	4.5	—
		Access to platform or other places	4.7; 4.8	4.9; 4.10
		Perfom service and maintenance operations	4.11; 4.17.4	4.10
		Operator's station	5.1.1; 5.1.3.1; 5.1.5.2	—
		Leaf spreading device	—	4.10
		Work on platform	4.7	4.9
7.2	Non- or inadequate consideration of hand–arm or foot–leg anatomy	Actuation of controls	4.5	4.2
		Access to platform or other places	4.7; 4.8	4.9; 4.10
		Operator's station	5.1	—
		Work on platform	4.7	4.9
7.3	Neglected use of personal protective equipment	Operator's manual	8.2.3	—
7.4	Inadequate local lighting	Visibility	5.1.7.3	—
7.5	Mental overload and under load, stress	Actuation of controls	4.5	—

[a] According to ISO 4254-1:2013.

Table A.1 *(continued)*

No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
7.6	Human error, human behaviour	Actuation of controls	4.5	—
		Operator's manual	8.2	9.1
		Location and design of signs	8.3	9.2
7.7	Design, location or identification of manual controls	Actuation of controls	4.5; 5.1.3; 6.1	4.2
8	**Combination of hazards**	Operator's manual	8.1; 8.2	9.1
9	**Unexpected start-up, unexpected overrun/overspeed**			
9.1	Failure/disorder of the control system	Actuation of controls	4.5; 4.6	4.2
		Perfom service and maintenance operations	4.11	—
		Electrical equipment	4.12	—
		Connections	6.5	—
		Bunker movement	—	4.5
		Unloading	4.9	4.6
		Work under raised parts	4.11	4.5; 4.6
		Remove of blockages	—	4.7
		Folding elements	4.9	4.11
9.2	Restoration of energy supply after an interruption	Actuation of controls	4.5; 6.1	4.2
9.3	External influences on electrical equipment	Cables	4.12.1	—
9.4	Other external influences (gravity, wind, etc.)	Stability	6.2.1.1; 6.2.1.2	9.1
9.5	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities)	Actuation of controls	4.5; 6.1.2	—
		Access to platform or other places	4.7; 4.8	4.9; 4.10
		Operator's station	5.1	4.2; 4.7; 4.8
		Moving the machine	5.2	—
		Mounting of machines	6.2; 6.3	9.1
		Perform service and maintenance operations	4.17	—
		Operator's manual	8.2.3	9.1
10	**Impossibility of stopping the machine in the best possible conditions**	Actuation of controls	4.5; 4.19; 6.1	4.2
		Starting/stopping the engine	5.1.8	—
12	**Failure of energy supply**	Work under raised parts	4.11	4.6; 9.1
		Electrical equipment	4.12	—
		Connections	6.5	—

[a] According to ISO 4254-1:2013.

Table A.1 *(continued)*

No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
13	**Failure of the control circuit**	Electrical equipment	4.12; 4.20	—
14	**Errors of fitting**	Mounting of machines	6.2; 6.3	—
		Operator's manual	8.1; 8.2	9.1; 9.2
15	**Break-up (of parts) during operation**	Work under raised parts	4.11	4.6
		Fail of hydraulic components	4.13	4.11
		Pneumatic components	4.14	—
16	**Falling or ejected objects or fluids**	Actuation of controls	4.5; 5.1.3; 6.1	4.2
		Work under raised parts	4.11	4.6
		Fail of hydraulic components	4.13	4.11
		Folding elements	4.9.2; 4.9.3	—
		Foriegn objects in haulm/leaf	—	4.4
17	**Loss of stability/ Overturning of the machine**	Unloading	4.9; 6.2	4.6; 9.1
		Roll-over	5.1.2.3; 5.7	—
18	**Slip, trap and fall of persons (related to machinery)**	Access to platform or other places	4.7; 4.8	4.9; 4.10
Additional hazards, hazardous situations or hazardous events linked with mobility				
19	**Related to the travelling function**			
19.1	Movement when starting the engine	Propulsion of the machine	5.1.3.2	—
		Starting/stopping the engine	5.1.8	—
19.2	Movement without a driver at the driving position	Propulsion of machine	5.1.3.2	—
		Starting/stopping the engine	5.1.8	—
19.3	Movement without all parts in a safe position	Folding elements	4.9.2; 4.9.3	—
		Guards	—	9.1; 9.2
19.4	Inability of machinery to be slowed down, stopped and immobilized	Propulsion of the machine	5.1.3.2	—
20	**Linked to the work position**			
20.1	Fall of persons during access to (or at/from) the work position	Access to platform or other places	4.7; 4.8	—
		Work on platform	4.7	4.9
20.2	Exhaust gases/lack of oxygen at the work position	Gases	5.4.1; 5.6	—
20.3	Fire (flammability of the cab, lack of extinguishing means)	Cab material	5.1.6	—

[a] According to ISO 4254-1:2013.

Table A.1 *(continued)*

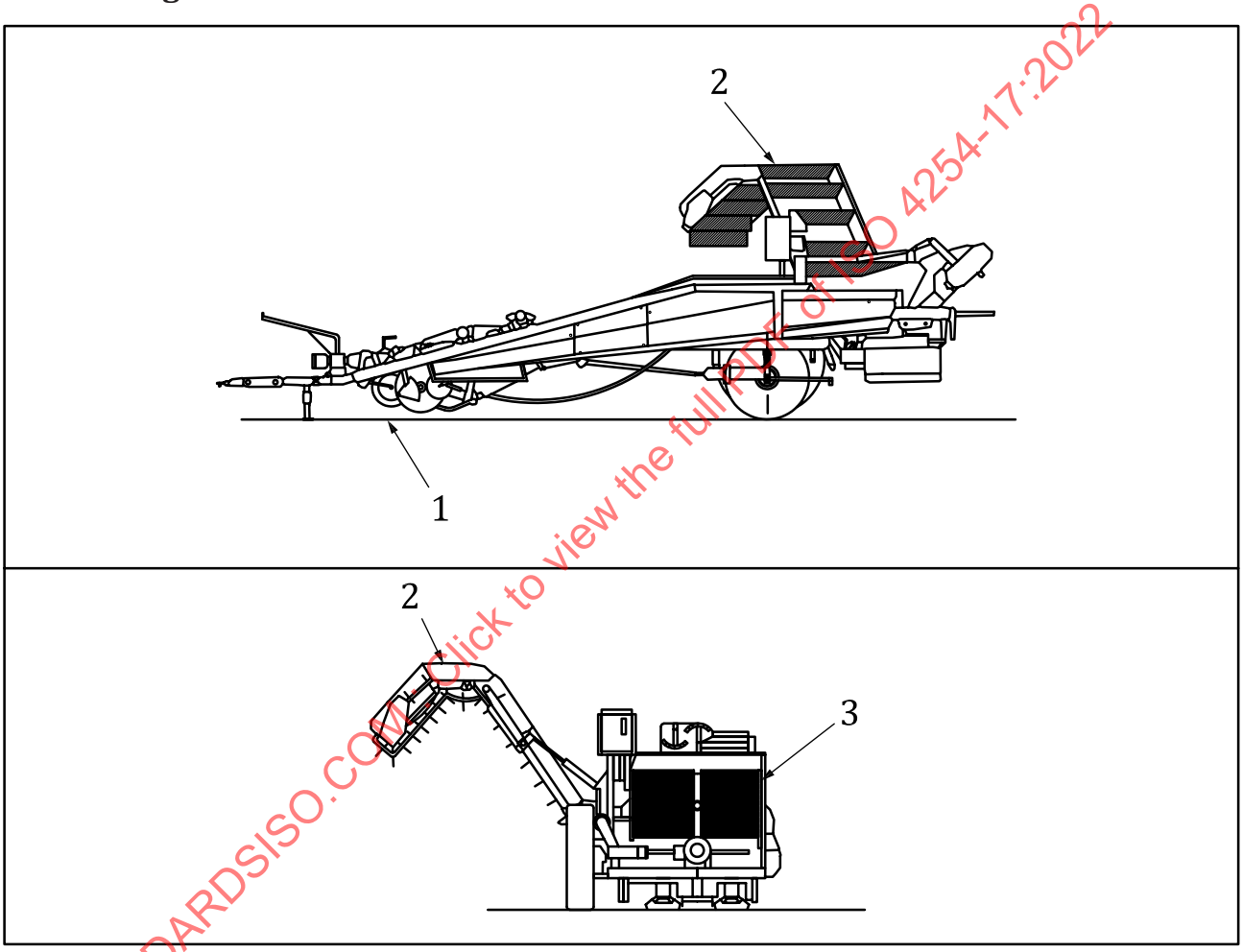
No.[a]	Hazard	Hazardous situation or hazardous event	Clause/subclause of ISO 4254-1:2013	Clause/subclause of this document
20.4	Mechanical hazards at the working position: a) contact with wheels b) rollover c) break-up of parts rotating at high speed	Shearing /pinching points	4.5.3; 4.7.1.2.5; 5.1.4	4.7; 4.9
		PTO drive shaft(s)	4.8.2.3	—
		Work under raised parts	4.11	—
		Roll-over	5.1.3.2; 5.7	—
20.5	Insufficient visibility from the work positions	Moving the machine	5.1.7	4.3
20.6	Inadequate lighting	Moving the machine	5.1.7.3	4.3
20.7	Inadequate seating	Operator's seat	5.1.2	
20.8	Noise at work position	Operator's station	4.3	—
20.10	Means of evacuation/ emergency exit	Emergency exits	5.1.5	—
21	**Due to the control system**			
21.1	Inadequate location of manual controls	Actuation of controls	4.5; 4.11.1.2; 5.1.2.1; 6.1.1; 6.1.2	4.2
21.2	Inadequate design of manual controls and their mode of operation	Actuation of controls	4.5; 5.1.3; 5.1.8	4.2
22	**From handling the machine (lack of stability)**	Lack of stability of the machine when in operation	6.2	9.1
		Roll-over	5.1.2.3; 5.7	—
23	**Due to the power source and to the transmission of power**			
23.1	Hazards from the engine and the batteries	Starting/stopping the engine	5.1.8	—
		Battery	5.3	—
23.2	Hazards from transmission of power between machines	Contact with power driven parts	6.4	—
23.3	Hazards from coupling and towing	Mounting of machines	6.2.2; 6.2.3; 6.3	—
		Missing or insufficient instructions in the operator's manual	8.1.3	9.1
24	**From/to third persons**			
24.1	Unauthorized start-up and use	Starting/stopping the engine	5.1.8.1	—
24.2	Lack or inadequacy of visual or acoustic warning means	Actuation of controls	4.5.3; 5.1.3.2; 5.1.8; 6.1	4.2
		Moving the machine	5.1.7	4.3
25	**Insufficient instructions for the driver/ operator**	Operator's manual	8.1; 8.1; 8.2	9.1

[a] According to ISO 4254-1:2013.

Annex B
(informative)

Examples of machines and components

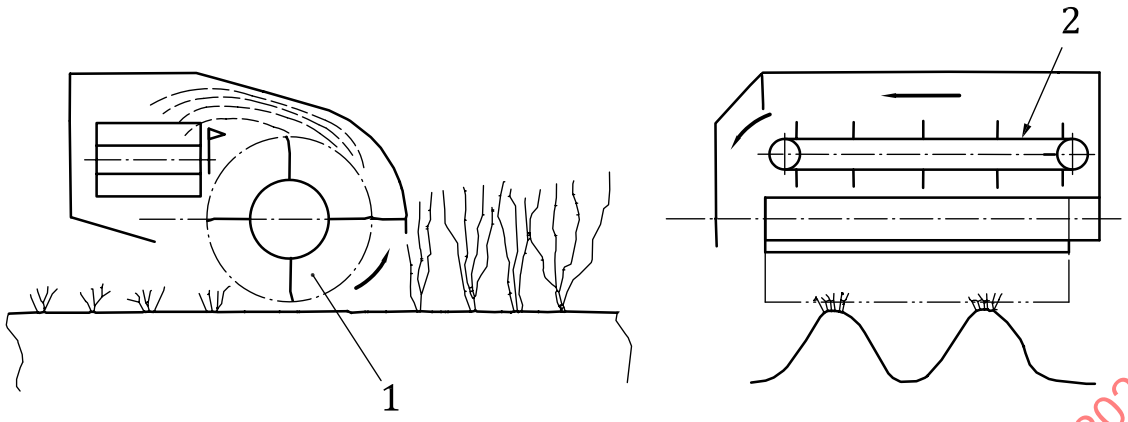
B.1 Sieving harvester



Key

1 crop lifting devices
2 unloading device
3 cleaning device

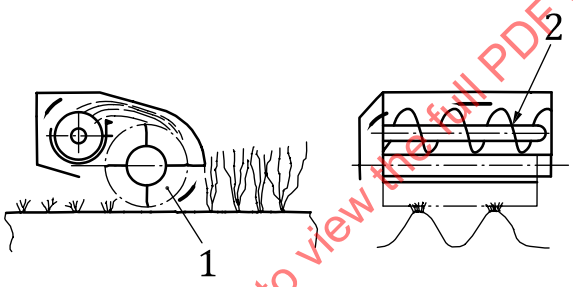
Figure B.1 — Example of sieving harvester for harvesting of potatoes



Key

1 shredder
2 belt

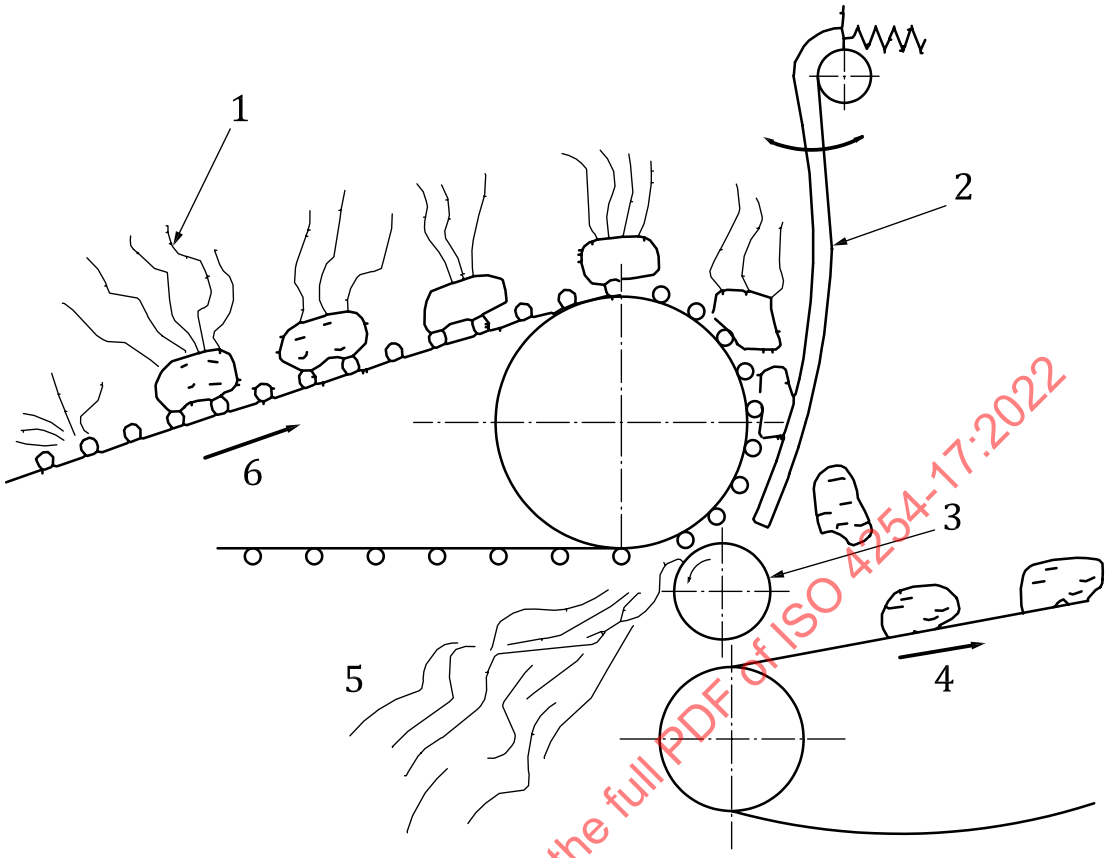
Figure B.2 — Haulm topping device — Mechanical haulm topping device with evacuation of haulms by belt



Key

1 shredder
2 feed auger

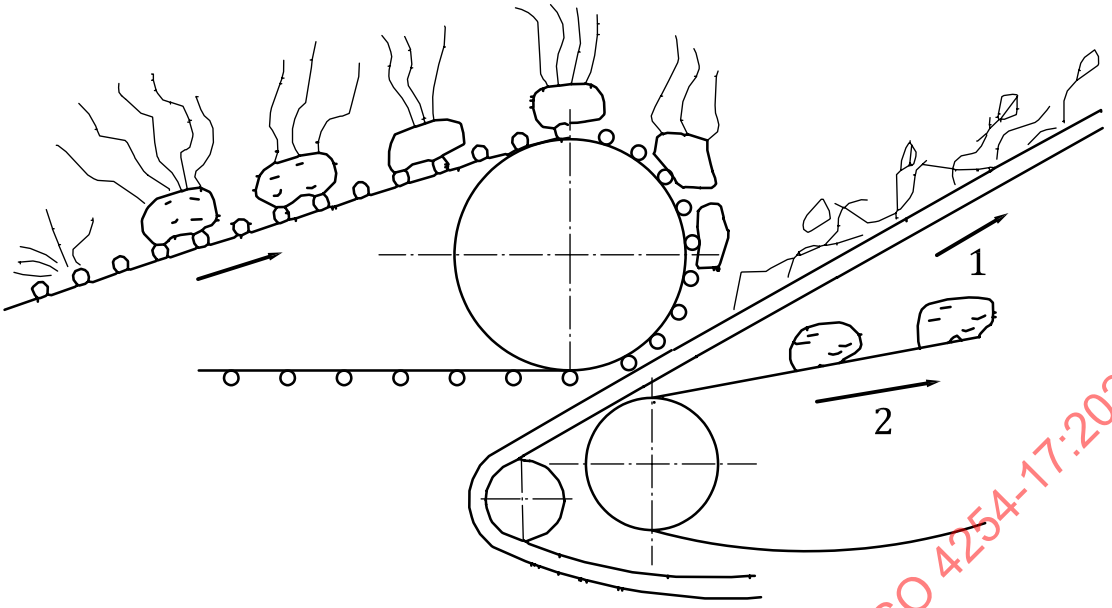
Figure B.3 — Haulm topping device — Mechanical haulm topping device with evacuation of haulm by feed auger



Key

1 haulms
2 haulm stripping fingers
3 haulm stripping rollers
4 transport chain
5 ejected haulms
6 lifter chain

Figure B.4 — Haulm stripping devices — Separation of haulm by rollers

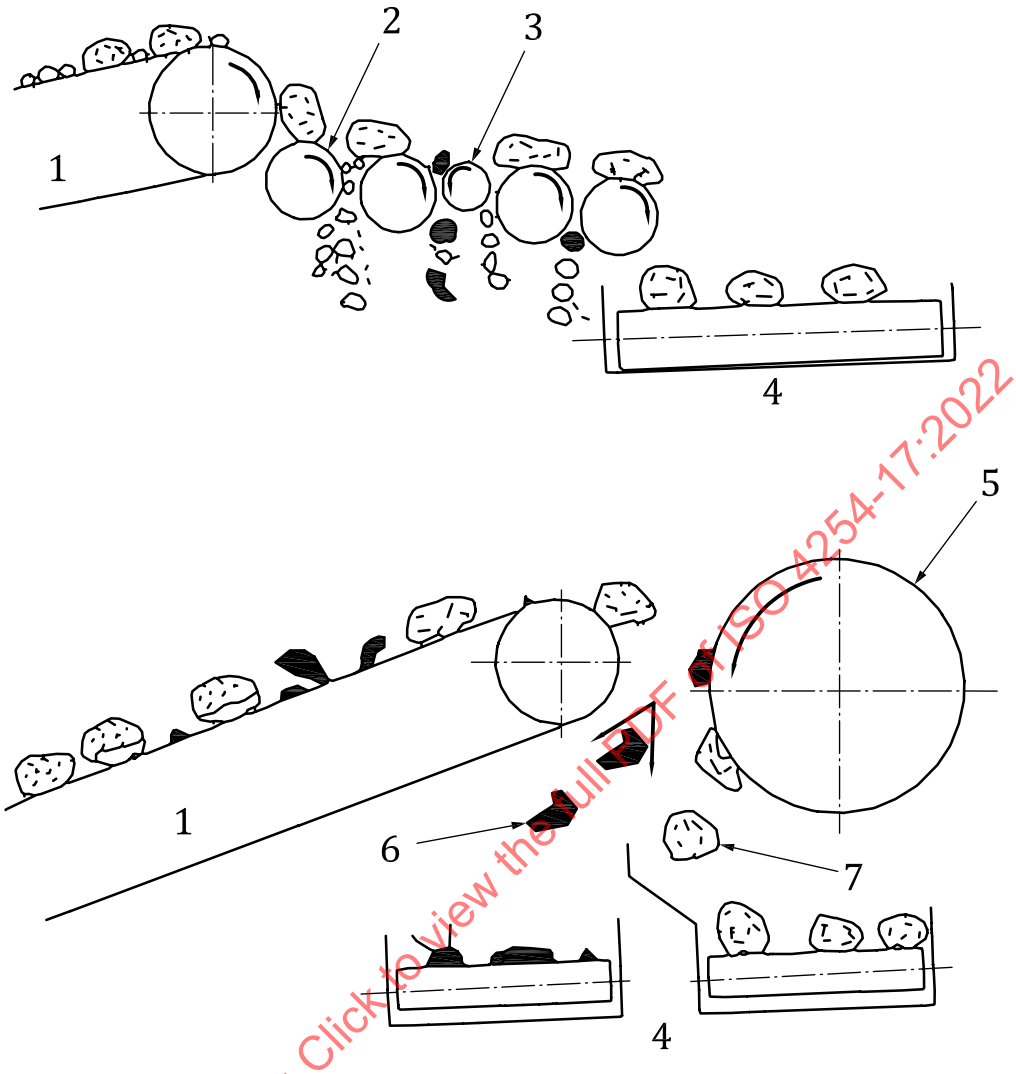


Key

1 haulm stripping chain

2 transport chain

Figure B.5 — Haulm stripping devices — Separation of haulm by chain



Key

1 transport chain
2 smooth or spiral cylinders or stars
3 stone trap
4 transport belt
5 iron cylinder
6 clods or stones
7 potatoes

Figure B.6 — Clods and stones removal devices