
Agricultural machinery — Safety —
Part 10:
Rotary tedders and rakes

Matériel agricole — Sécurité —

Partie 10: Faneuses et andaineuses rotatives



Reference number
ISO 4254-10:2009(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 4254-10 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 144, in collaboration with ISO Technical Committee TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 7, *Equipment for harvesting and conservation*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO 4254 consists of the following parts, under the general title *Agricultural machinery — Safety*:

- *Part 1: General requirements*
- *Part 5: Power-driven soil-working machines*
- *Part 6: Sprayers and liquid fertilizer distributors*
- *Part 7: Combine harvesters, forage harvesters and cotton harvesters*
- *Part 8: Solid fertilizer distributors*
- *Part 9: Seed drills*
- *Part 10: Rotary tedders and rakes*
- *Part 11: Pick-up balers*
- *Part 12: Rotary disc and drum mowers and flail mowers*

Part 2, *Anhydrous ammonia applicators*, has been withdrawn.

Part 3, *Tractors*, has been cancelled and replaced by ISO 26322.

Part 4, *Forestry winches*, has been cancelled and replaced by ISO 19472.

Introduction

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

- a) type-A standards (basic standards) giving basic concepts, principles for design, and general aspects that can be applied to machinery;
- b) type-B standards (generic safety standards) dealing with one safety aspect or one type 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-hand control devices, interlocking devices, pressure-sensitive devices, guards);
- c) type-C standards (machinery safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

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 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 machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this part of ISO 4254. These hazards are specific to rotary tedders and rakes.

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 10: Rotary tedders and rakes

1 Scope

This part of ISO 4254, to be used together with ISO 4254-1, specifies the safety requirements and their verification for the design and construction of rotary tedders, rotary rakes and rotary tedder–rakes, including rotary drum rakes, used by one person (the operator) only, having one or several powered rotors, mounted, semi-mounted, trailed or self-propelled. In addition, it specifies the type of information on safe working practices, including residual risks, to be provided by the manufacturer.

This part of ISO 4254 is not applicable to:

- a) machines with ground-driven tines or ground-wheel–driven tines (e.g. sunflower rakes);
- b) parallel bar rakes;
- c) chain or endless belt type rakes;
- d) pedestrian-controlled tedders and rakes;
- e) machines equipped with a pick-up device.

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

This part of ISO 4254, taken together with ISO 4254-1, deals with all the significant hazards, hazardous situations and events relevant to rotary tedders, rotary rakes and rotary tedder–rakes when they are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4), excepting the hazards arising from:

- the environment, other than noise;
- electromagnetic compatibility;
- vibration;
- overturning in regard to the protection of the operator at the driving station of a self-propelled machine;
- moving parts for power transmission except strength requirements for guards and barriers;
- safety and reliability of control systems.

NOTE 1 ISO 14982 specifies test methods and acceptance criteria for evaluating the electromagnetic compatibility of all kinds of mobile agricultural machinery.

NOTE 2 Specific requirements related to road traffic regulations (e.g. lighting, dimensions, speed limit plate) are not taken into account in this part of ISO 4254.

This part of ISO 4254 is not applicable to rotary tedders and rakes which are manufactured before the date of publication of this document by ISO.

2 Normative references

The following referenced documents are indispensable for the application 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 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

ISO 4254-1:2008, *Agricultural machinery — Safety — Part 1: General requirements*

ISO/TR 11688-1:1995, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

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

ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

3 Terms and definitions

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

NOTE Examples of the machine types covered by this part of ISO 4254 are illustrated in Annex A.

3.1 tedder

machine designed to lift or raise, and spread mechanically, forage that has been cut and laid on the ground, to accelerate its drying

3.2 rake

machine designed to group together in continuous lines or in a swath, forage that has been cut and laid on the ground, in order to facilitate any further activity

3.3 rotary tedder

tedder having one or several rotors in the form of arms, each equipped with flexible tines, turning around a slightly inclined axis in relation to the vertical

3.4 rotary rake

rake having one or several rotors on the vertical axis equipped with tines constituting combs whose inclination can vary during rotation

3.5 tedder-rake

machine designed to throw forage lightly or to windrow depending on the position set for its tines and any deflectors

3.6**chain rake****endless belt type rake**

rake having tines constituting combs fitted on two powered parallel chains or belts perpendicular to the direction of motion

3.7**parallel bar rake**

rake with a rotor of horizontal axis, tilted in respect of the direction of motion, and equipped with tines constituting combs that are flexible and always vertical

3.8**sun flower rake****finger wheel rake**

rake having tine rotors on a near-horizontal axis that revolve owing to the travel of the rake and move the forage to the successive rotor

3.9**rotary drum rake**

rake with a rotor on a horizontal axis perpendicular to the direction of travel and with tines constituting a comb

3.10**machine equipped with a pick-up device**

machine that uses a collecting device to move the forage onto a conveyor

4 List of significant hazards

Table 1 gives the significant hazard(s), the significant hazardous situation(s) and hazardous event(s) covered by this part of ISO 4254 that have been identified by risk assessment as being significant for this type of machine, and which require specific action by the designer or manufacturer to eliminate or to reduce the risk.

Attention is drawn to the necessity to verify that the safety requirements specified in this part of ISO 4254 apply to each significant hazard presented by a given machine and to validate that the risk assessment is complete.

Table 1 — List of significant hazards associated with rotary tedders and rotary rakes with powered rotors

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|---|--|---|-------------------------------------|---|
| A.1 | Mechanical hazards | | | |
| A.1.1 | Crushing hazard | Clearance from adjacent parts when actuating controls | 4.4.3; 5.1.3.1; 5.1.3.3; 5.1.8; 6.1 | 5.4; 5.6 |
| Movement of boarding means | | 4.5.1.1.2; 4.5.1.2.5; 4.5.2.3; 4.6 | — | |
| Design of platforms | | 4.5.2.2 | — | |
| Working tools, contact with moving tines and tine arms | | 4.7 | 5.3; 5.4 ; 7.1; 7.3 | |
| Service points, service and maintenance operations, use of supports | | 4.8; 4.14.1 | 7.1 | |
| Movement of folding elements | | 4.14.3; 4.14.5; 4.14.6 | 5.6; 7.1; 7.3 | |
| Shearing and pinching points at the operator's work station | | 5.1.4 | 5.1.2 | |
| Construction of jack-up points, moving the machine, tie down and jacking operations | | 5.2 | — | |
| Lack of stability | | 6.2 | 7.1 | |
| Mounting of machines | | 6.2.2; 6.2.3; 6.3 | — | |
| A.1.2 | Shearing hazard | Clearance from adjacent parts when actuating controls | 4.4.3; 5.1.3.1; 5.1.3.3; 5.1.8; 6.1 | 5.4; 5.6 |
| Movement of boarding means | | 4.5.1.1.2; 4.5.1.2.5; 4.5.2.3; 4.6 | — | |
| Design of platforms | | 4.5.2.2 | — | |
| Working tools, contact with moving tines and tine arms | | 4.7 | 5.3; 5.4; 7.1; 7.3 | |
| Service points, service and maintenance operations, use of supports | | 4.8; 4.14.1 | 7.1 | |
| Movement of folding elements | | 4.14.3; 4.14.5; 4.14.6 | 5.6; 7.3 | |
| Shearing and pinching points at the operator's work station | | 5.1.4 | 5.1.2 | |
| Construction of jack-up points, moving the machine, tie down and jacking operations | | 5.2 | — | |
| Lack of stability | | 6.2 | 7.1 | |
| Mounting of machines | | 6.2.2; 6.2.3; 6.3 | — | |

Table 1 (continued)

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|------------------|--|---|-------------------------------------|---|
| A.1.4 | Entanglement hazard | Working tools, contact with moving tines and tine arms | 4.7 | 5.3; 5.4; 7.1; 7.3 |
| | | Starting/stopping the engine with engaged drive(s) | 5.1.8 | — |
| A.1.6 | Impact hazard | Movement of boarding means | 4.5.1.2.5 | — |
| | | Movement of folding elements | 4.14.5; 4.14.6 | 5.6; 7.1; 7.3 |
| | | Design of steering system | 5.1.3.2 | — |
| A.1.7 | Stabbing or puncture hazard | Working tools, contact with tines in storage position | 4.7 | 5.5; 7.1 |
| A.1.8 | Friction or abrasion hazard | Actuation of controls | 4.4.3; 5.1.3.2 | 5.4 |
| | | Electrical equipment, location of cables | 4.9.1 | — |
| | | Location of boarding means | 4.5.1.1.2 | — |
| A.1.9 | High-pressure fluid injection or ejection hazard | Hydraulic components and fittings (e.g. rupture) | 4.10; 6.5 | — |
| A.2 | Electrical hazards | | | |
| A.2.1 | Contact of persons with live parts (direct contact) | Uninsulated electrical equipment | 4.9; 5.3, 6.5 | — |
| A.2.2 | Contact of persons with parts which have become live under faulty conditions (indirect contact) | Electrical equipment | 4.9.1 | — |
| A.2.3 | Approach to live parts under high voltage | Contact with overhead power lines | 8.1.3, 8.2.1 | — |
| A.2.4 | Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc. | Failure of electrical equipment | 4.9.2 | — |
| | | Failure of battery | 5.3.1 | — |
| A.3 | Thermal hazards | | | |
| A.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) | 4.12 | — |
| | | Cabin material (in case of fire) | 5.1.6 | — |
| | | Hot surfaces (e.g. of engine and associated parts) | 5.5 | — |

Table 1 (continued)

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|------------------|--|---|-------------------------------------|---|
| A.4 | Hazards generated by noise | | | |
| A.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 | Working of the machine | 4.2; 8.1.3 | 5.2, 7.1 |
| A.5 | Hazards generated by materials and substances | | | |
| A.5.1 | Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts | Contact with operating fluids (fuel tank, hydraulic systems, engine cooling system) | 4.10; 4.12; 5.4; 8.1.3 | — |
| | | Cabin material (in case of fire) | 5.1.6 | — |
| | | Battery | 5.3.1 | — |
| | | Exhaust system | 5.6 | — |
| A.5.2 | Fire or explosion hazard | Cabin material | 5.1.6 | — |
| A.6 | Hazards generated by neglecting ergonomic principles in machinery design | | | |
| A.6.1 | Unhealthy postures or excessive effort | Location and design of controls | 4.4; 8.1.3 | 5.4; 5.6; 7.1 |
| | | Location and design of boarding means | 4.5.1; 4.6; 8.1.3 | — |
| | | Service and maintenance operations | 4.14.2; 4.14.4 | — |
| | | Design of folding elements | 4.14.5 | 5.3; 5.5; 5.6 |
| | | Design of operator's work station | 5.1.1; 5.1.2.1; 5.1.3; | — |
| A.6.2 | Non- or inadequate consideration of hand–arm or foot–leg anatomy | Location of controls | 4.4 | 5.4 |
| | | Design of boarding means | 4.5 ; 4.6 | — |
| | | Design of operator's work station | 5.1 | — |
| A.6.5 | Mental overload and under load, stress | Multifunction controls | 4.4 | 7.1 |
| A.6.6 | Human error, human behaviour | Identification, design and location of controls | 4.4 | 5.4; 5.6 |
| | | Missing or insufficient explanation of controls and signs in the operator's manual | 8.1 | 7.1 |
| | | Location and design of signs | 8.2 | 7.3 |
| A.6.7 | Inadequate design, location or identification of manual controls | Design, location and identification of controls | 4.4; 5.1.3; 6.1, 8.1.3.c) | 5.4; 5.6; 7.1 |

Table 1 (continued)

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|------------------|--|---|-------------------------------------|---|
| A.8 | Unexpected start-up, unexpected overrun/overspeed | | | |
| A.8.1 | Failure/disorder of the control system | All control systems | 4.8, 4.9 | — |
| | | Hydraulic, pneumatic and electrical connections | 6.5 | — |
| A.8.2 | Restoration of energy supply after an interruption | All control systems | 4.4; 6.1 | — |
| A.8.4 | Other external influences (gravity, wind, etc.) | Stability | 6.2.1.1; 6.2.1.2 | 7.1 |
| A.8.5 | Errors made by the operator (due to mismatch of machinery with human characteristics and abilities; see A.6.6) | Design and location of controls | 4.4; 6.1.2 | 5.4; 5.6; 7.1 |
| | | Design of boarding means | 4.5, 4.6 | — |
| | | Design of operator's work station | 5.1 | — |
| | | Operating system | 5.2 | — |
| | | Service and maintenance systems | 4.14 | — |
| | | Mounting system of machines | 6.2; 6.3 | 5.6 |
| | | Missing or insufficient instructions in the operator's manual | 8.1.3 | 7.1 |
| A.9 | Impossibility of stopping the machine in the best possible conditions | All control systems | 4.4; 5.1.8, 6.1 | 5.6 |
| A.11 | Failure of energy supply | Power-operated mechanical supports, hydraulic locking devices | 4.8 | 5.6; 5.7 |
| | | All control systems | 4.9; 4.10; 4.11; 4.12; 5.1.3; 5.1.8 | 5.6 |
| A.12 | Failure of the control circuit | All control systems | 4.9; 4.10; 4.11; 4.12; 5.1.3; 5.1.8 | 5.6 |
| A.13 | Errors of fitting | Mounting systems of machines | 6.2; 6.3 | 5.6 |
| | | Missing or insufficient instructions in the operator's manual | 8.1.3 | 7.1 |
| A.14 | Break-up (of parts) during operation | Guards and barriers (strength) | 4.7 | 5.3.1 |
| | | Supports (strength) | 4.8 | — |
| | | Hydraulic components | 4.10 | — |

Table 1 (continued)

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|--|--|--|-------------------------------------|---|
| A.15 | Falling or ejected objects or fluids | Detachable supports not in storage position | 4.8 | — |
| | | Rupture of hydraulic components | 4.10 | — |
| | | Folding elements not retained in transport position | 4.14.6 | 5.6; 5.7 |
| | | Operation of the machine/working tools | — | 7.1; 7.3 |
| A.16 | Overturning of the machine | Loss of stability of the machine | 6.2 | 7.1 |
| A.17 | Slip, trip and fall of persons (related to machinery) | Design of boarding means | 4.5; 4.6 | — |
| | | Design of platforms | 4.4.2 | — |
| | | Design of locations for service and maintenance | 4.6.3 | — |
| Additional hazards, hazardous situations or hazardous events linked with mobility | | | | |
| A.18 | Related to the travelling function | | | |
| A.18.1 | Movement when starting the engine | Activation of ground propulsion control system | 5.1.3 | — |
| | | Actuation of start/stop control system of the engine | 5.1.8 | — |
| A.18.2 | Movement without a driver at the driving position | Activation of ground propulsion control system | 5.1.3 | — |
| | | Actuation of start/stop control system of the engine | 5.1.8 | — |
| A.18.3 | Movement without all parts in a safe position | Folding elements securing system | 4.14.5 | 5.6; 5.7 |
| A.18.4 | Insufficient ability of machinery to be slowed down, stopped and immobilized | Actuation of ground propulsion control system | 5.1.3 | — |
| A.19 | Linked to the work position | | | |
| A.19.1 | Fall of persons during access to (or at/from) the work position | Boarding means | 4.5; 4.6 | — |
| | | Platforms | 4.5.2 | — |
| | | Locations for service and maintenance | 4.6.3 | — |
| A.19.2 | Exhaust gases/lack of oxygen at the work position | Cabin | 5.4.1; 5.6 | — |
| A.19.3 | Fire (flammability of the cab, lack of extinguishing means) | Cabin material (see 7.1 and 7.2) | 5.1.6 | — |

Table 1 (continued)

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|------------------|--|--|--|---|
| A.19.4 | Mechanical hazards at the working position: | Wheels | 4.5.1.1.2 | — |
| | a) contact with wheels | PTO (power take-off) drive shaft(s) | 4.6.4 | — |
| | b) break-up of parts rotating at high speed | | | |
| | c) rollover | | | |
| A.19.5 | Insufficient visibility from the work positions | Visibility (to the front, to the rear, to the working area) | 5.1.7 | — |
| A.19.6 | Inadequate lighting | Provisions for installing working lights | 5.1.7 | — |
| A.19.7 | Inadequate seating | Operator's seat | 5.1.2 | — |
| | | Instructional seat | — | — |
| A.19.8 | Noise at work position | Working of the machine | 4.2 | 5.2 |
| A.19.10 | Insufficient means of evacuation/emergency exit | Emergency exits of cabin | 5.1.5 | — |
| A.20 | Due to the control system | | | |
| A.20.1 | Inadequate location of manual controls | All manual controls | 4.4; 4.8.1.2; 5.1.2.1; 5.1.3.3; 6.1.1; 6.1.2 | 5.4; 5.6 |
| A.20.2 | Inadequate design of manual controls and their mode of operation | All manual controls | 4.4; 5.1.3; 5.1.8 | 5.6; 7.1 |
| A.21 | From handling the machine (lack of stability) | Lack of stability of the machine when in operation | 6.2 | — |
| A.22 | Due to the power source and to the transmission of power | | | |
| A.22.1 | Hazards from the engine and the batteries | Starting/stopping the engine | 5.1.8 | — |
| | | Battery | 5.3 | — |
| A.22.2 | Hazards from transmission of power between machines | Power transmission between self-propelled machine/tractor to recipient machine with exclusion of the PTO shaft | 6.4 | — |
| A.22.3 | Hazards from coupling and towing | Mounting system of machines, interchanging system of harvesting devices | 6.2.2; 6.2.3; 6.3 | 5.6; 5.7 |
| | | Missing or insufficient instructions in the operator's manual | 8.1.3 | 7.1 |
| A.23 | From/to third persons | | | |
| A.23.1 | Unauthorized start-up and use | Starting/stopping devices for the engine | 5.1.8 | — |
| A.23.2 | Lack or inadequacy of visual or acoustic warning means | Visibility from the operator's work station to the front and to the rear | 5.1.7 | — |

Table 1 (continued)

| No. ^a | Hazard, hazardous situation or hazardous event | Origin | Clause/subclause of ISO 4254-1:2008 | Clause/subclause of this part of ISO 4254 |
|--|---|---|-------------------------------------|---|
| A.24 | Insufficient instructions for the driver/operator | Missing or insufficient instructions in the operator's manual | 8.1 | 7.1 |
| | | Missing or insufficient safety and instructional signs | 8.2 | 7.3 |
| ^a With reference to ISO 4254-1:2008, Table A.1. | | | | |

5 Safety requirements and/or protective measures

5.1 General

5.1.1 Machinery shall comply with the safety requirements and/or protective measures of this clause.

In addition, the machine shall be designed according to the principles of ISO 12100-1:2003, Clause 5, for relevant but not significant hazards, which are not dealt with by this part of ISO 4254. For those hazards, ISO 12100-2 may be used for guidance.

The compliance with the safety requirements and/or measures shall be verified in accordance with Clause 6.

5.1.2 Unless otherwise specified in this part of ISO 4254:

- safety distances shall comply with ISO 13857:2008, Tables 1, 3, 4 or 6;
- the machine shall comply with the requirements of ISO 4254-1.

5.2 Noise

5.2.1 Noise reduction as a safety requirement

5.2.1.1 Reduction at source by design and by protective measures

The machine shall be designed to generate a noise level as low as practicable. The main sources causing noise are

- the engine, and
- the gearbox and other transmission parts.

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

NOTE ISO/TR 11688-2 gives useful information on noise generation mechanisms in machinery.

Appropriately designed gearwheels, drives and oil bath lubrication and cooling may be seen as measures for noise reduction at design stage.

5.2.1.2 Reduction by information

If, after taking all possible technical measures for reducing noise at the design stage, a manufacturer considers that further protection of the operator is necessary, then adequate information shall be given in the instruction handbook [see 7.1 o)].

5.2.2 Verification of requirements on noise based on noise emission values

For the determination of the sound power level and of the emission sound pressure level at the operator's position, the noise test code given in ISO 4254-1:2008, Annex B shall be used.

5.3 Protection against inadvertent contact with tines and tine arms

5.3.1 In order to avoid inadvertent contact with tines and tine arms, these shall be guarded within the area lying to the front in the travelling direction and which extends rearwards up to the vertical plane perpendicular to the forward direction of travel and passing through the axis of rotation in accordance with the dimensions given in Figure 1 a) and c) to g).

Within this area, a guard, shield or barrier shall be mounted to ensure a minimum distance, A , of 150 mm from the outer path of the tines or of arms — whichever is the outermost — to the front in the working position.

On the sides, the distance B may be reduced to 0 mm from the outer rotating path (see Figure 1). If the distance is less than 150 mm, the guard, shield or barrier is considered as a warning of the tine path and shall be in clear contrast with the machine through use of a safety colour associated with a contrast colour, yellow–black or red–white, according to ISO 3864-1.

The height of this protective device shall be between 400 mm and 1 000 mm from the ground when the machine is in working position (see Figure 2).

The guard, shield, barrier or fixed parts (see 5.3.4) of the machine shall be designed so as to satisfy the strength test specified in Annex B.

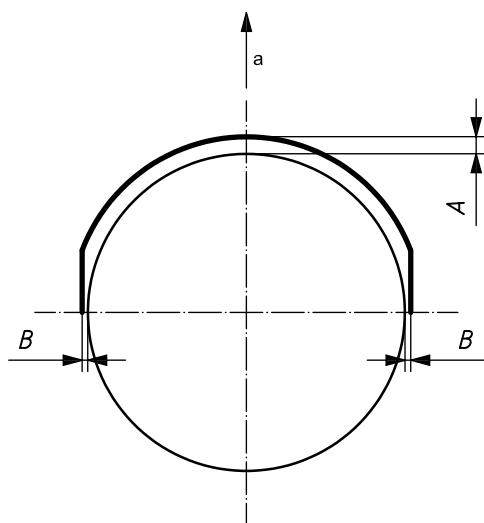
5.3.2 For transport folding or where the rotors follow the ground contours, the guard, shield or barrier on the front can be discontinuous, provided the horizontal distance perpendicular to travelling direction, C_1 , between the adjoining parts of the protective devices for the rotors does not exceed 70 mm, as specified in Figure 1 h).

Where the horizontal distance in the travelling direction between the adjoining parts of the protective devices of rotors, C_2 , exceeds 70 mm, the minimum overlap of the protective devices, C_1 , shall be at least equal to C_2 , as shown in Figure 1 i).

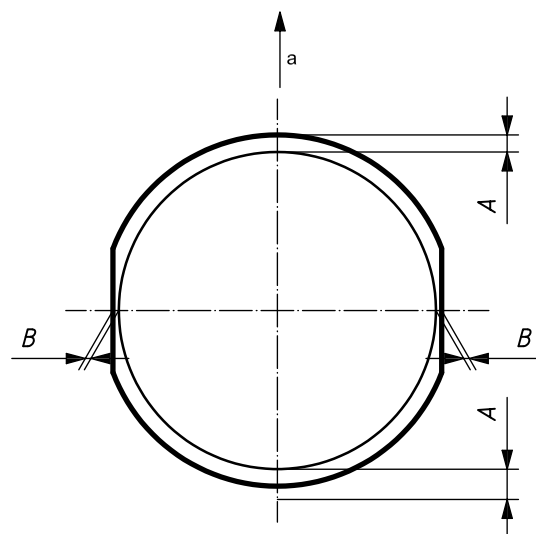
5.3.3 For machines that are mounted to the front of the propelling machine, the rear area in the driving direction shall also be guarded. The rearward minimum safety distance shall be 150 mm, in accordance with Figure 1 b). The height of this guard shall be between 400 mm and 1 000 mm from the ground when the machine is in its working position, in accordance with Figure 2.

5.3.4 Fixed parts of the machine (e.g. machine frame) may provide the protective function set out in 5.3.1 to 5.3.3, provided they comply with requirements of the corresponding subclause(s).

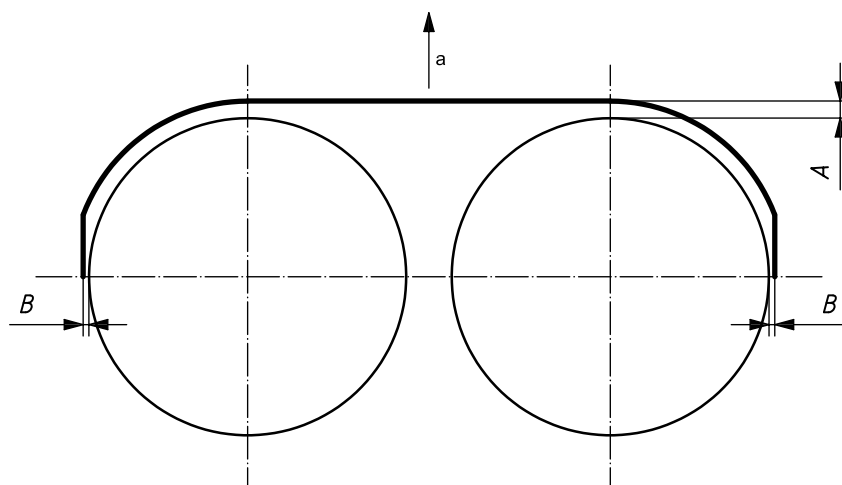
Dimensions in millimetres



a) Rear-mounted

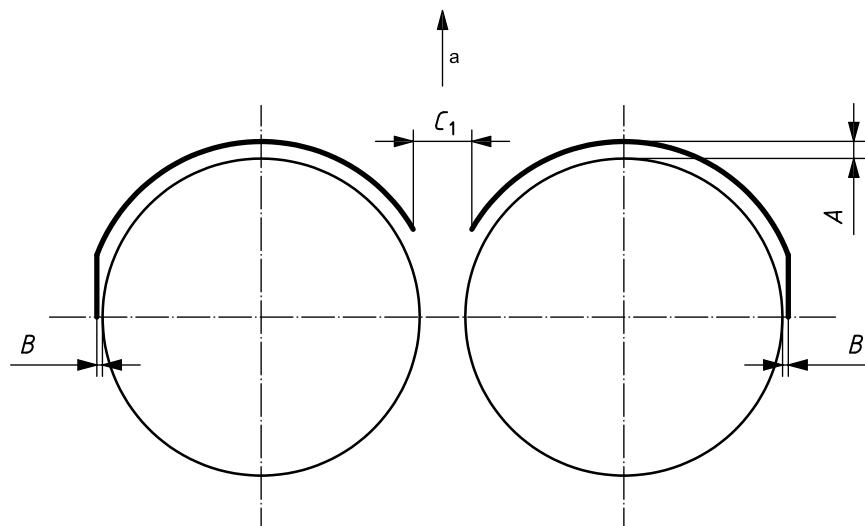


b) Front-mounted

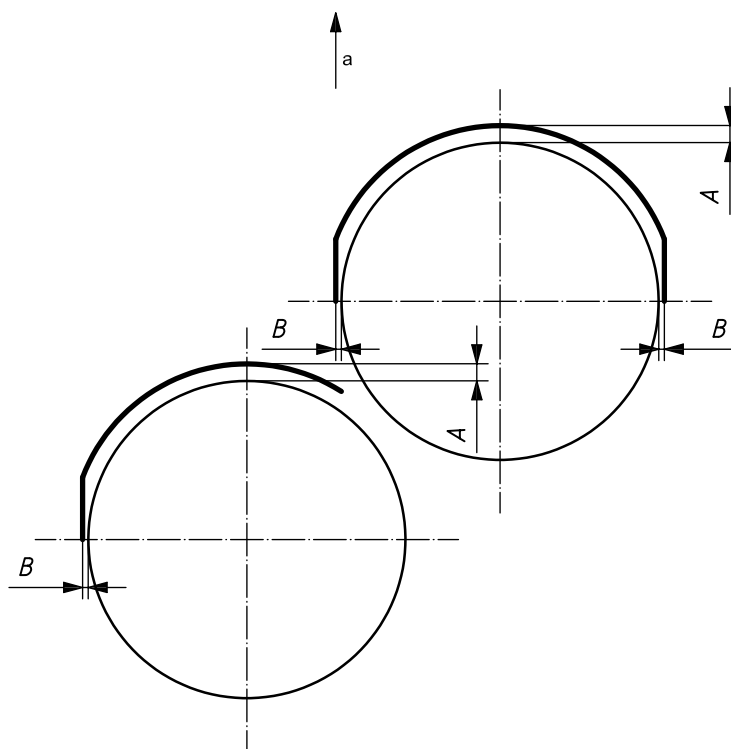


c) Global straight guard — Two rotors in-line

Figure 1 (continued)

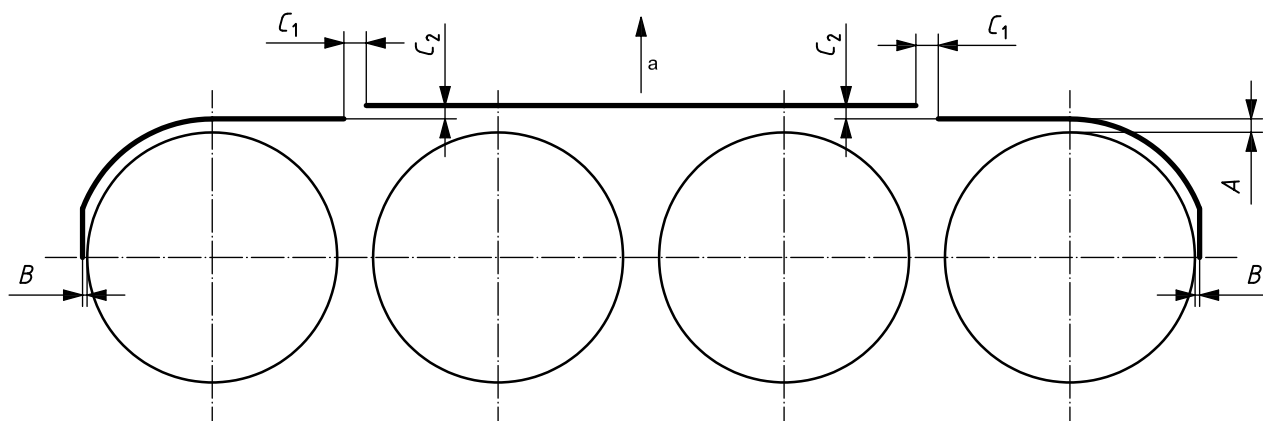


d) Bending guard

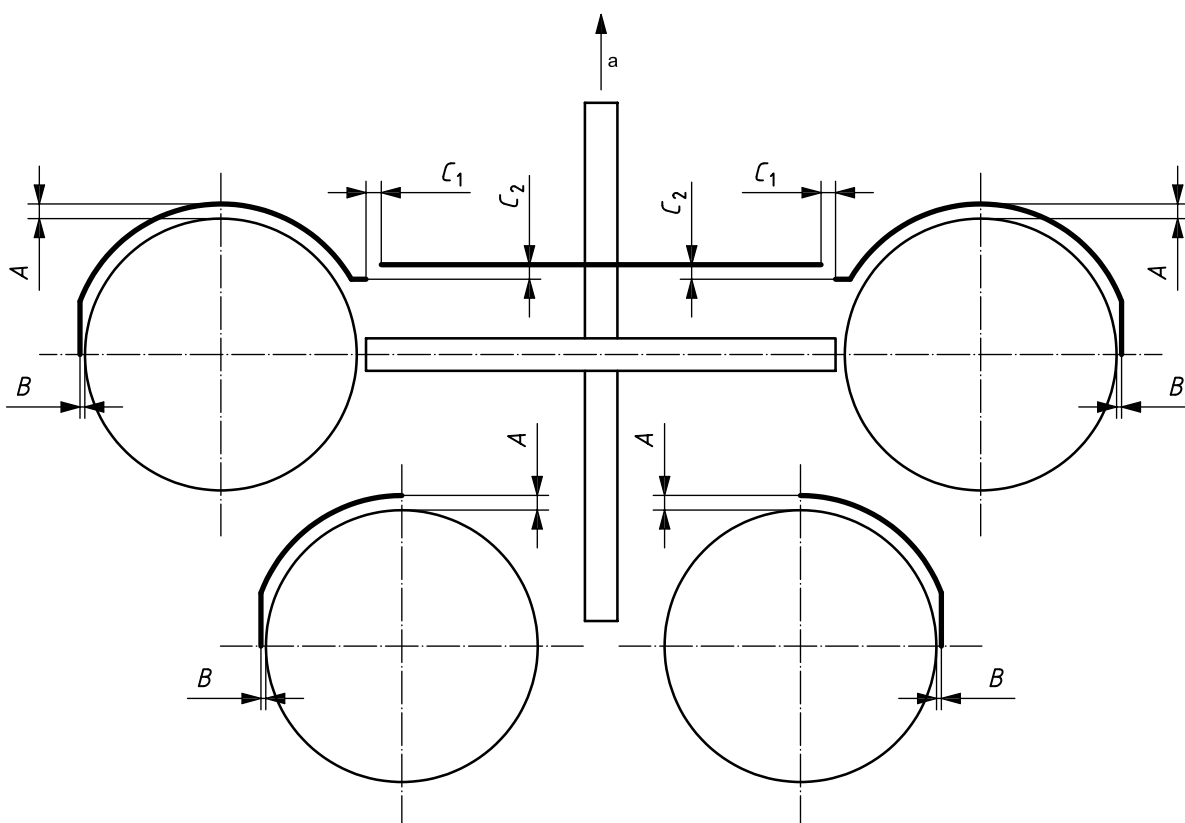


e) Rear rotors outside front rotors

Figure 1 (continued)

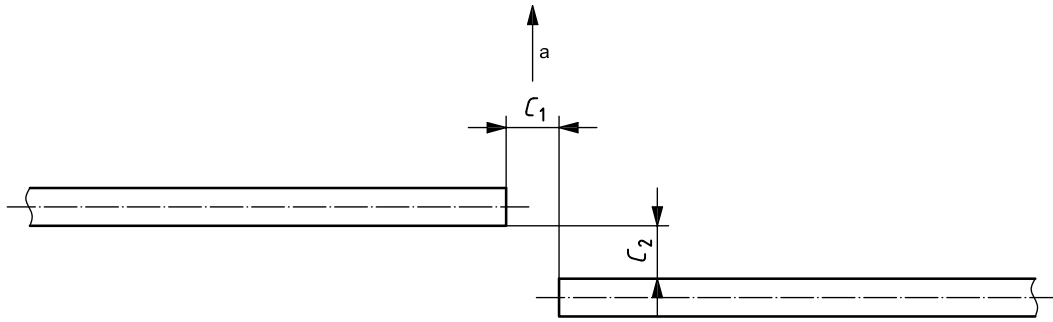


f) Several rotors in-line



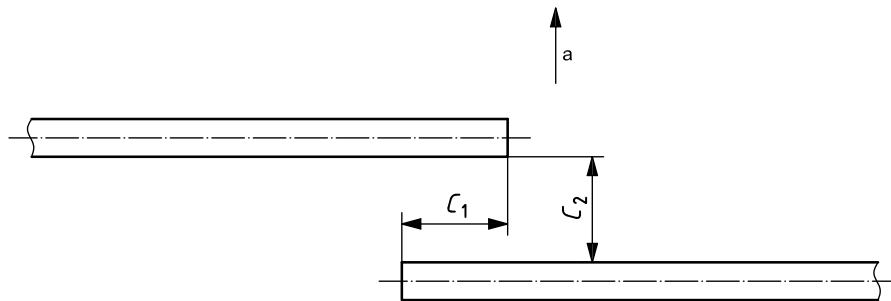
g) Rear rotors inside front rotors

Figure 1 (continued)



$C_1 > C_2$ ($C_1 \leq 70$ mm and $C_2 \leq 70$ mm)

h) Distance between two parts of guard



$C_1 \geq C_2$ ($C_2 > 70$ mm)

i) Distance between two parts of guard

Key

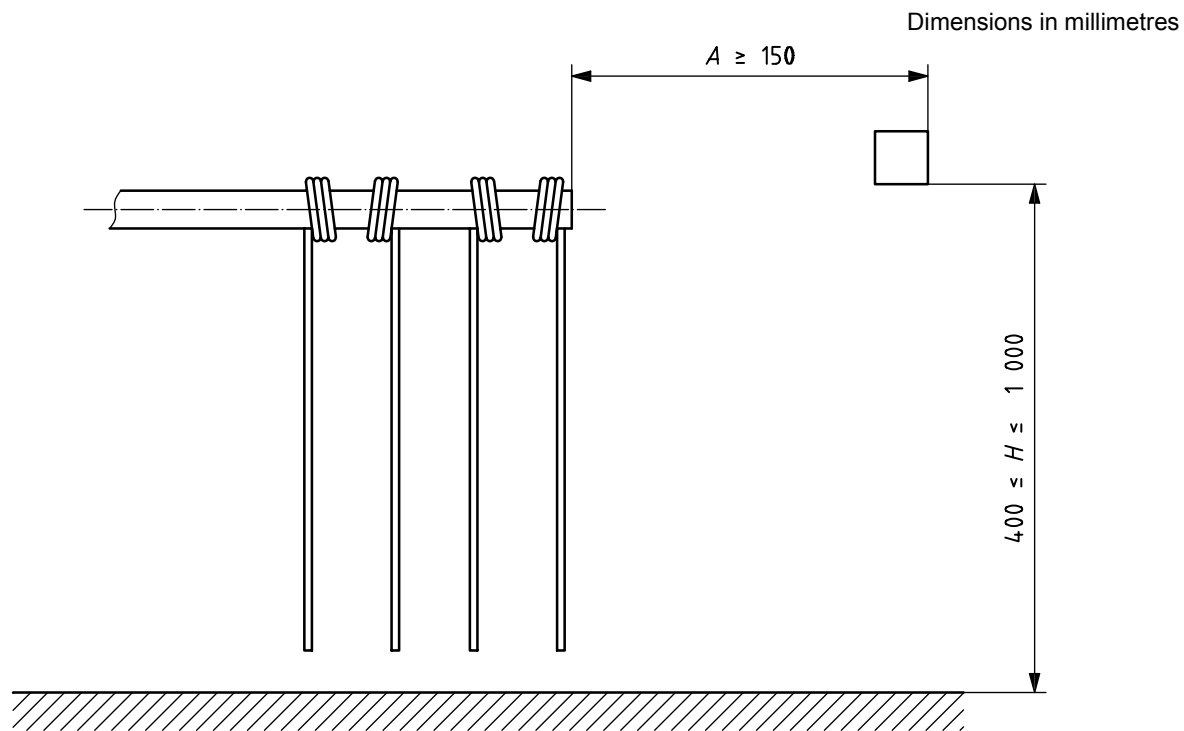
$A \geq 150$ mm

$B \geq 0$ mm

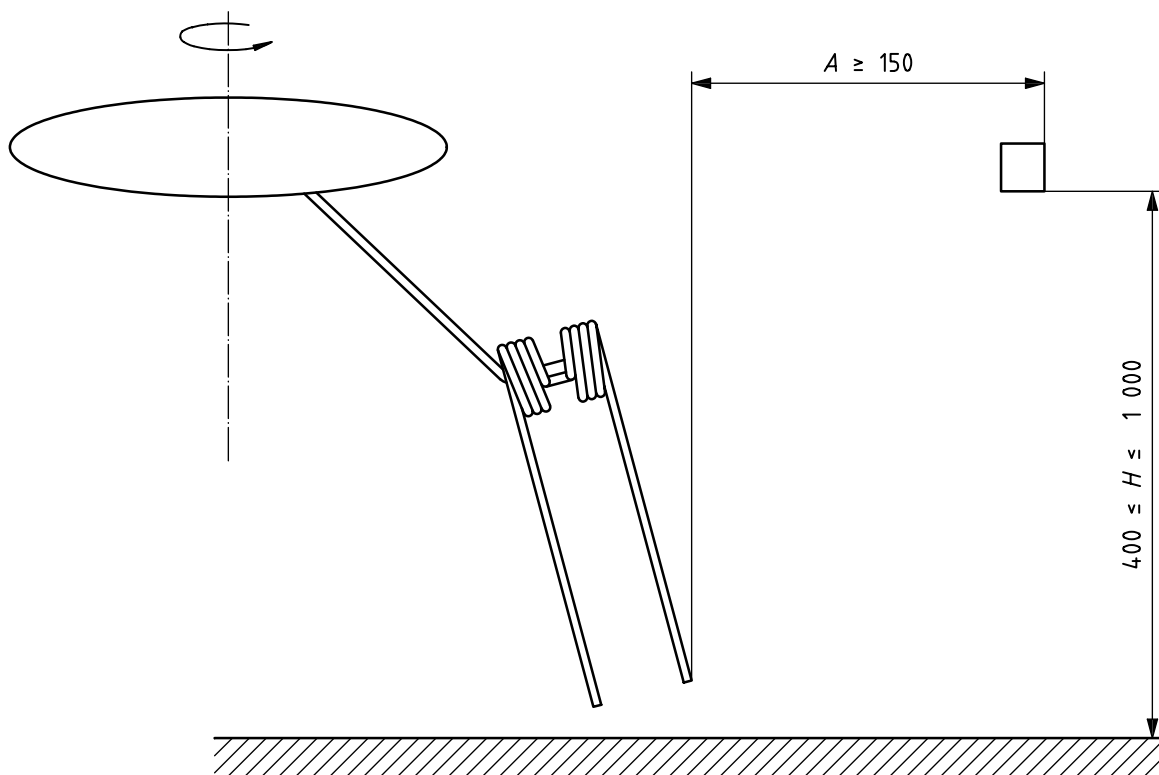
C_1, C_2 distance between two parts of guard

a Travelling direction.

Figure 1 — Types of guard, shield or barrier — Distance from outer path of rotating components



a) Rotary rake



b) Rotary tedder

Figure 2 — Position of guard, shield or barrier

5.4 Controls

5.4.1 General

Hand-operated control(s) which are to be actuated for adjusting the working height and the inclination of rotors shall comply with 5.4.2 and 5.4.3.

5.4.2 Location of controls

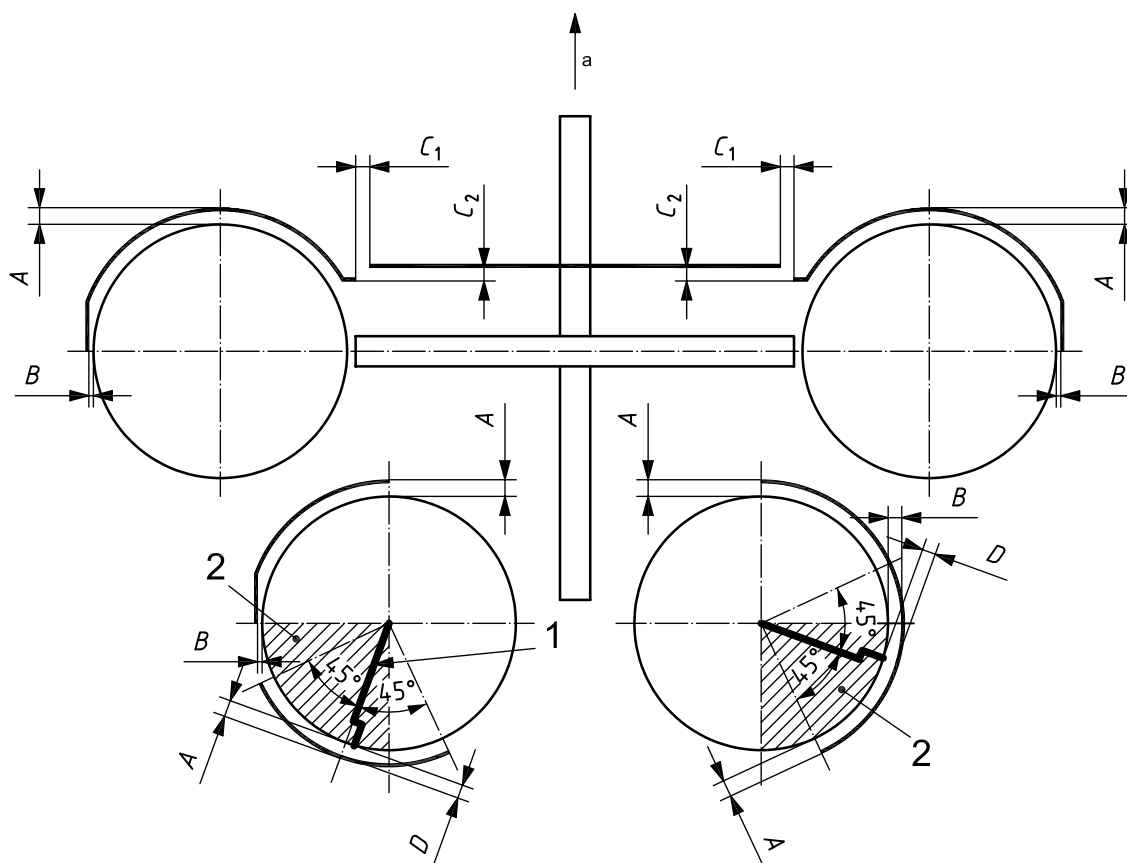
It shall be possible for the operator to adjust the machine by means of hand-operated control(s) located either

- on the tractor or self-propelled machine, with actuation possible only from the driving position, or
- outside the driving position, with actuation possible by the operator standing on the ground and where 1) to 4) below are applicable:
 - 1) the end of the control shall be located outside the outer part of the guard, shield or barrier, or alternatively the horizontal distance, D , between the end of the control and the guard, shield or barrier shall not exceed 150 mm if the control is inside the guard, shield or barrier;
 - 2) the control shall be located above the guard, shield or barrier plane;
 - 3) the minimum vertical distance between the control and the upper rotor plane shall be 150 mm;
 - 4) the control shall be located at a maximum height of 1 500 mm from the ground.

The controls shall be located either on the front of the machine or at the rear rotor level, where there is a guard, shield or barrier as specified in 5.3.1.

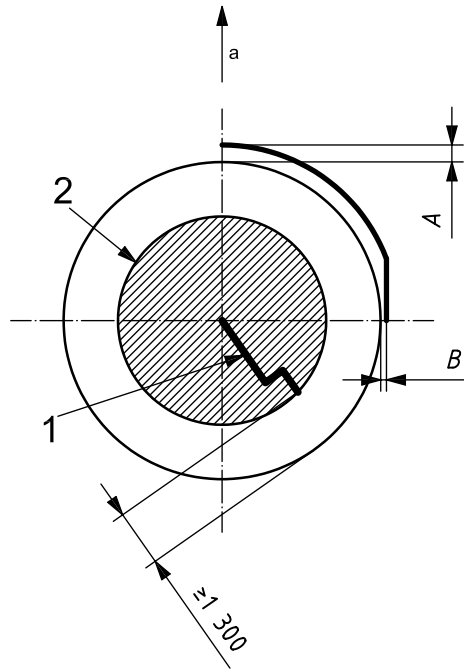
For machines with rear rotors inside the front rotors, and where controls are present at the rear rotors, the controls shall be located at the rear of the rear rotors, within the sectors shown in Figure 3 a), and the guard, shield or barrier shall extend 45° to the left and right of the controls.

The foregoing requirements do not apply to controls located at least 1 300 mm inside the outer path of the rotating components [see Figure 3 b)] or under the rotor plane.



a) Control located < 1 300 mm inside outer path of rotating components

Figure 3 (continued)



b) Control located $\geq 1\,300$ mm inside outer path of rotating components

Key

- 1 control device
- 2 sector in which control is located
- $A \geq 150$ mm
- $B \geq 0$ mm
- C_1, C_2 distance between two guarding parts
- $D \leq 150$ mm (horizontal distance between end of control device and guard, shield or barrier)
- a Travelling direction.

Figure 3 — Guarding of rotors with controls located at rear of rear rotors

5.4.3 Operation of controls

The operation of hand-operated controls shall be possible with the rotors stopped.

5.5 Machine in storage position

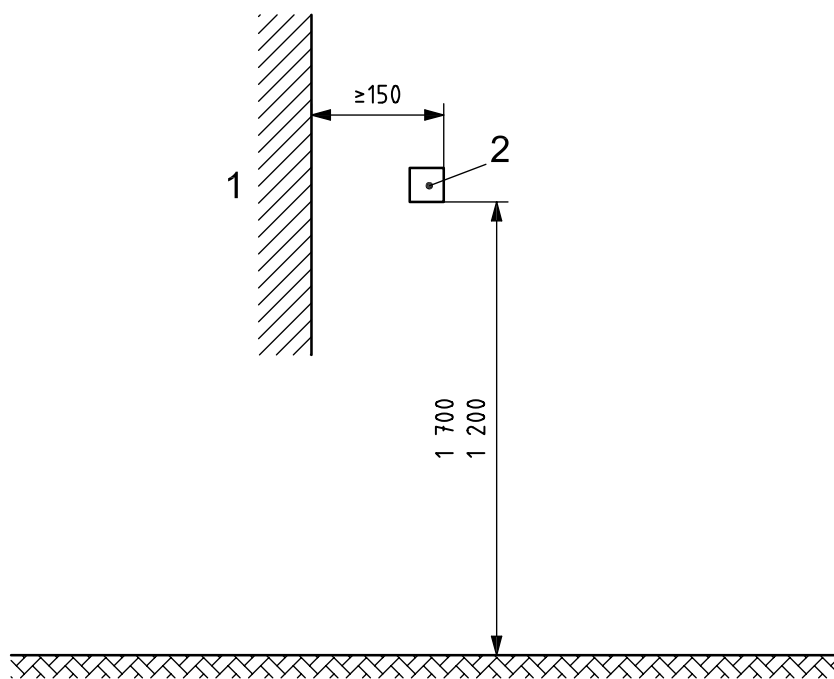
When the machine is on the ground in the storage position and when the rotors are raised into that position, the tines shall either

- a) be so arranged that they are not protruding away from the machine, or
- b) be removable, in which case it shall be possible to remove the tines without using a tool, and a facility shall be provided to store them on the machine [see 7.1 n)], or
- c) be protected
 - 1) on the sides by a barrier, which may be movable, located between 1 200 mm and 1 700 mm from the ground and which
 - ensures a minimal distance of 150 mm from the tip of the tines [see Figure 4 a)], or

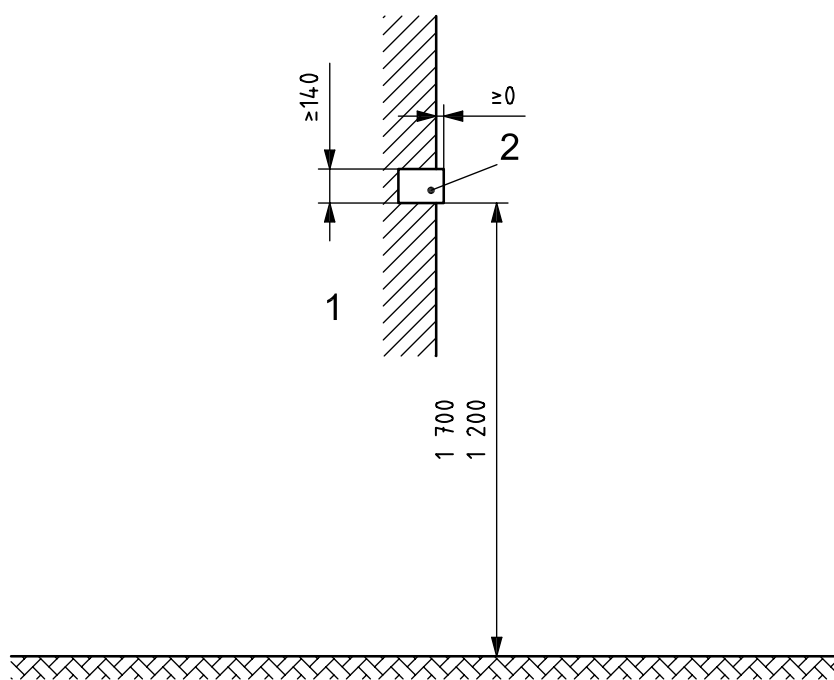
- covers the tines over a minimum height of 140 mm [see Figure 4 b)], in which case, the barrier shall be in clear contrast with the machine through use of a safety colour associated with a contrast colour, yellow–black or red–white, according to ISO 3864-1, and
 - can be discontinuous for machines with several rotors, provided that protection is given against contact with tines located between 500 mm and 2 000 mm above the ground and inclined by more than 30° from the vertical plane, and provided that the minimum length of the segment of barrier is 300 mm (see Figure 5), in which case the barrier shall be in clear contrast with the machine through the use of a safety colour associated with a contrast colour, yellow–black or red–white according to ISO 3864-1, or
- 2) by devices covering the tips of the tines that are located below an elevation of 2 000 mm above the ground, measured when the machine is in the unhitched and stored position, in which case the setting of the protective devices shall be made without the use of tools and a storage area for these devices shall be provided on the machine, or
- d) be located inside the vertical plane connecting front and rear side limiting devices (see Figure 6), for machines where the distance between these devices is not greater than 3 000 mm.

Side limiting devices shall make the external limits of the machine apparent at the front and at the rear, with devices (for example bars) located at a maximum distance of 250 mm from the path of the most protruding tine on the sides, whose lower point is located at a maximum of 1 300 mm from the ground and upper point at a minimum of 1 600 mm from the ground (see Figure 6). These devices may be foldable. Removal of these devices shall be possible only by means of a tool. The 300 mm minimum height of the side limiting device shall be in clear contrast with the machine through use of a safety colour associated with a contrast colour, yellow–black or red–white, according to ISO 3864-1.

Dimensions in millimetres



a)

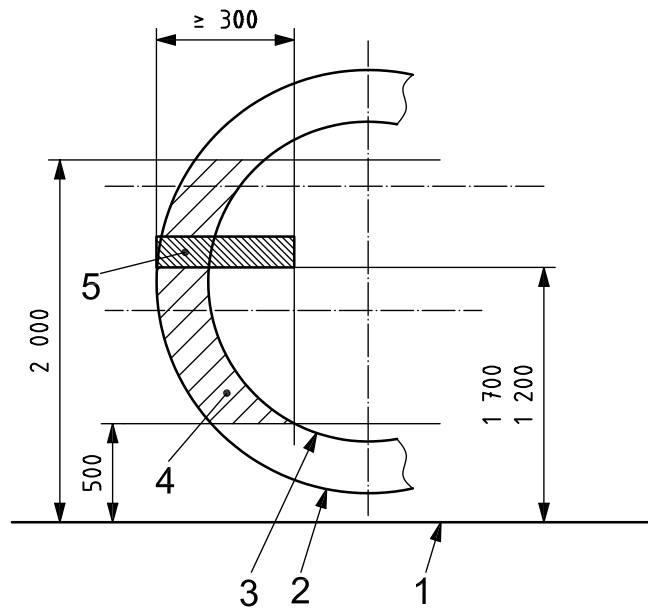


b)

Key

- 1 tines
- 2 barrier

Figure 4 — Position of barrier in storage position

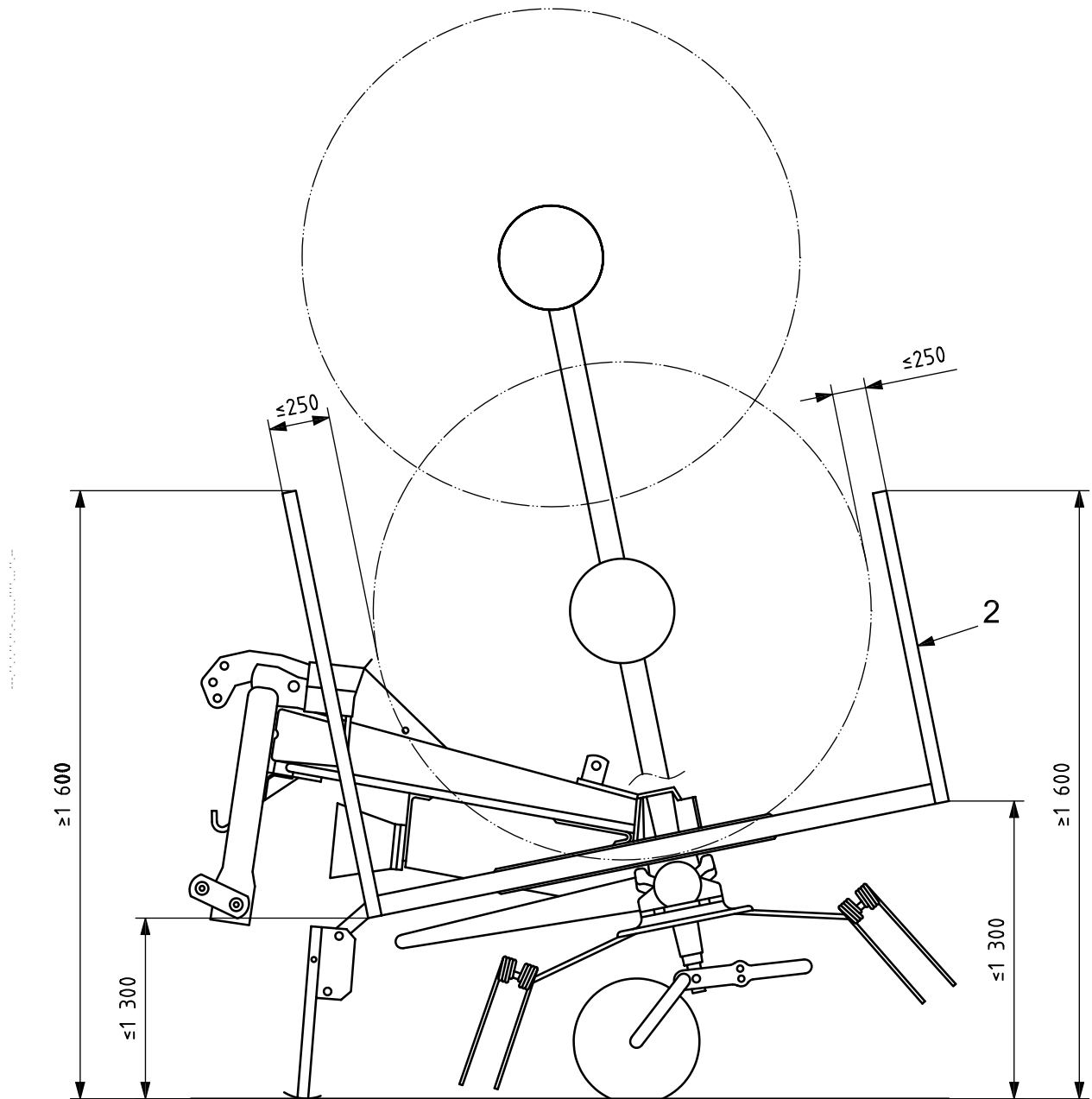


Key

- 1 ground
- 2 outer tine path
- 3 inner tine path
- 4 area between 500 mm and 2 000 mm from ground in which inclination of tines is > 30° from vertical plane
- 5 barrier located between 1 200 mm and 1 700 mm from ground

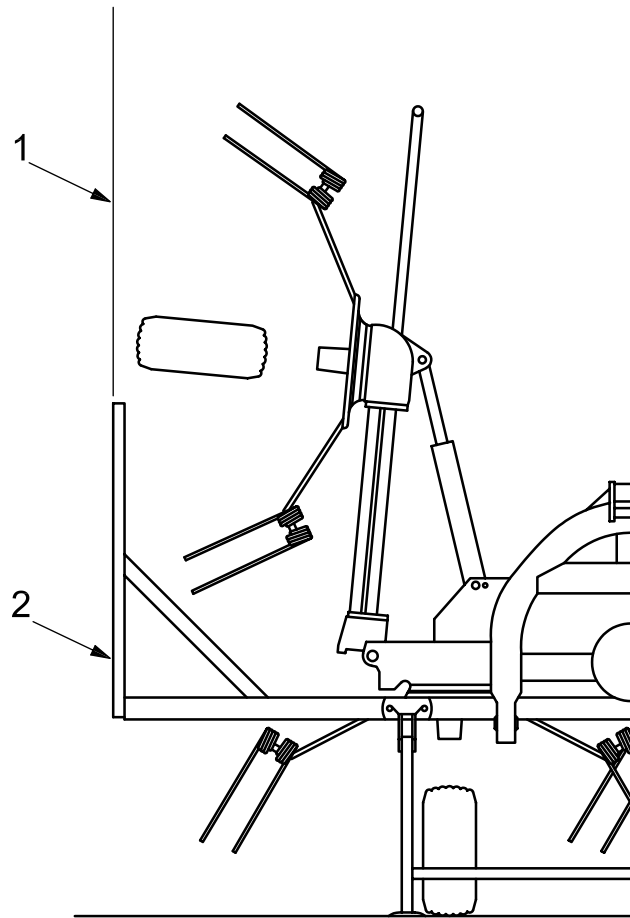
Figure 5 — Discontinuous barrier in storage position

Dimensions in millimetres



a) Side view

Figure 6 (continued)



b) End view

Key

- 1 vertical plane connecting both front and rear side limiting devices
- 2 side limiting device

Figure 6 — Rotor in storage position

5.6 Swivelling and movable components for transport

To reduce the width or height for transportation, the protective device may be movable (e.g. foldable). The folding operation shall be possible without the need to use a tool; removal of the folding device shall not be possible without the use of a tool.

Machines with rotors folded in the transport position shall be equipped with an automatic locking system, which may be mechanical or hydraulic and which locks them in the transport position to prevent any unintentional unfolding of the rotors.

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.

The unlocking and unfolding of the rotor shall be controlled by separate actions from the operator.

Unlocking from the transport position shall not cause the lowering of rotors without an intentional action of the operator. This shall be verified by testing (see Clause 6).

If the folding/unfolding operation is secured by a hydraulic device, it shall be possible to actuate the unlocking of the automatic locking system from the driving position of the tractor or the self-propelled machine.

The movement of foldable components shall be assisted when the required manual actuating force exceeds 250 N.

5.7 Drawbar hitch and/or carrier frame

When the drawbar hitch and/or carrier frame has different lateral positions for transport and working, or a different vertical position where failure may lead to an uncontrolled change of direction, it shall be fitted with a mechanical or hydraulic locking device (e.g. pin, latch or hydraulic valve) that requires an intentional action for changing from the transport position to the working position and vice versa. When a hydraulic device is used, the drawbar hitch shall remain in position in case of a failure of the hydraulic circuit.

6 Verification of the safety requirements and/or protective measures

Verification of the requirements given in Clause 5 may be made by means of inspection, calculation, or testing.

The means of verification for the requirements given in ISO 4254-1 are specified in that part of ISO 4254.

For the requirements given in this part of ISO 4254, the means of verification are either self-evident or verification is made via the additional means given in Table 2.

Table 2 — Checking conformity with the safety requirements given in Clause 5 of this part of ISO 4254

| Subclause | Verification of | Visual inspection | Test performance checking | Measurement | Procedure/reference |
|-----------|---|-------------------|---------------------------|-------------|--|
| 5.2.2 | Noise | | X | X | Shall be verified in accordance with ISO 4254-1:2008, Annex B |
| 5.3.1 | Protection against inadvertent contact with tines and tine arms | X | X | X | Specific requirement for strength test is given in Annex B |
| 5.3.2 | Discontinuous guard | | | X | |
| 5.3.3 | Front-mounted machines | X | | X | |
| 5.3.4 | Fixed parts of the machine | X | X | X | |
| 5.4 | Controls | X | | X | |
| 5.5 | Protection for storage | X | | X | |
| 5.6 | Unlocking from the transport position | | X | | The machine shall be positioned at an inclination of 8,5° in the unfolding direction |
| 5.7 | Drawbar hitch and/or carrier frame | X | | | |

7 Information for use

7.1 Instruction handbook

An instruction handbook shall be supplied with each machine.

Comprehensive instructions and information on all aspects of maintenance and the safe use of the machine, including suitable clothing and personal protective equipment (PPE) requirements and the need for training, if necessary, shall be provided in the instruction handbook. Useful information for the drafting of the instruction handbook is given in ISO 3600 and ISO 12100-2:2003, 6.5.

In particular, the following information shall be included (residual risks):

- a) hazards caused by the rotating tines (see 5.3);
- b) information on adjustments (see 5.4);
- c) hazards caused by ejection of materials;
- d) risks of working under a machine not supported by mechanical supports (see ISO 4254-1:2008, 4.8);
- e) hazards caused by bumps that can bring the machine into contact with the tractor rear window when the machine is in its raised transport position;
- f) information to the effect that the machine could influence the controllability of the tractor, especially during transport, and on the method to be used to check whether the addition of a counterweight is necessary; for mounted machinery, the horizontal distance between the centre of gravity of the machine (in transport position) and the lower attachment points to the three-point lifting system, as well as the mass of the machine, shall be given (see Annex C for information on the possible loss of stability of the tractor due to the connection with the tedder and rake);
- g) the procedure to be followed for safe adjustments and maintenance operations, in particular the necessity to stop the engine before any intervention (see 5.1 and 5.4.3);
- h) the hazards of climbing onto the machine while it is in operation;
- i) instructions to keep any person other than the operator clear of the machine (see 5.3);
- j) the procedure to follow to change from the working to the transport position and vice versa, including instructions on how to check the position and attachments of the tines and arms;
- k) the means for ensuring that all protective devices are in position before working with the machine;
- l) when and how to check the safe state of the mechanical locking devices specified in 5.6;
- m) the precautions to be taken when unfolding rotors when working on tilted ground (see 5.3.2);
- n) instructions for removal and storage of the tines [see 5.5 b)].

In addition, the instruction handbook and the technical documentation describing the machine prepared by the manufacturer for the information of potential users shall provide:

- o) the declared noise emission values of the machinery, including
 - the A-weighted emission sound pressure level at workstations, where this exceeds 70 dB, and, where the sound pressure level does not exceed 70 dB, an indication of this,
 - the peak C-weighted emission sound pressure level at workstations, where this exceeds 63 Pa (130 dB in relation to 20 μ Pa),

- the A-weighted emission sound power level emitted by the machinery, as determined, where the A-weighted emission sound pressure level at the workstation/operator position exceeds 80 dB,
 - reference to the noise test code specified in ISO 4254-1:2008, Annex B,
 - the uncertainty of measurement, and
 - a recommendation for the use of low-noise operating modes, and/or limited time of operation, when necessary;
- p) instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided, and in particular, a recommendation for the use of ear protection when necessary;
- q) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;
- r) specifications of the spare parts to be used where these could affect the health and safety of operators.

7.2 Marking

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

- business name and full address of the manufacturer and, where applicable, his authorized representative;
- designation of the machinery;
- designation of the series or type;
- serial number, if any;
- rated maximum hydraulic pressure;
- nominal rotational frequency (in min^{-1}) and direction of rotation of the power input connection (marked by an arrow), when applicable;
- nominal rotational frequency (in min^{-1}) of the auxiliary motor, if any, and nominal power in kilowatts (for self-propelled machines).

NOTE Legal requirements could require additional information, e.g. year of construction, rating information on voltage, and, for mobile machinery, the mass in kilograms.

7.3 Safety and instructional signs

In addition to the provisions of ISO 4254-1:2008, 8.2, safety signs or instructional signs shall be provided on the machine, drawing particular attention to

- residual risks of contact with moving parts (for example rotors),
- the risk of bystanders being struck by thrown materials,
- instructions for positioning and locking rotors for transport and storage,
- instructions for moving rotors from the raised transport position to the working position, and
- the risk of being struck by a falling rotor assembly.

Annex A
(informative)

Tedders and swath rakes — Examples

See Figures A.1 to A.5.

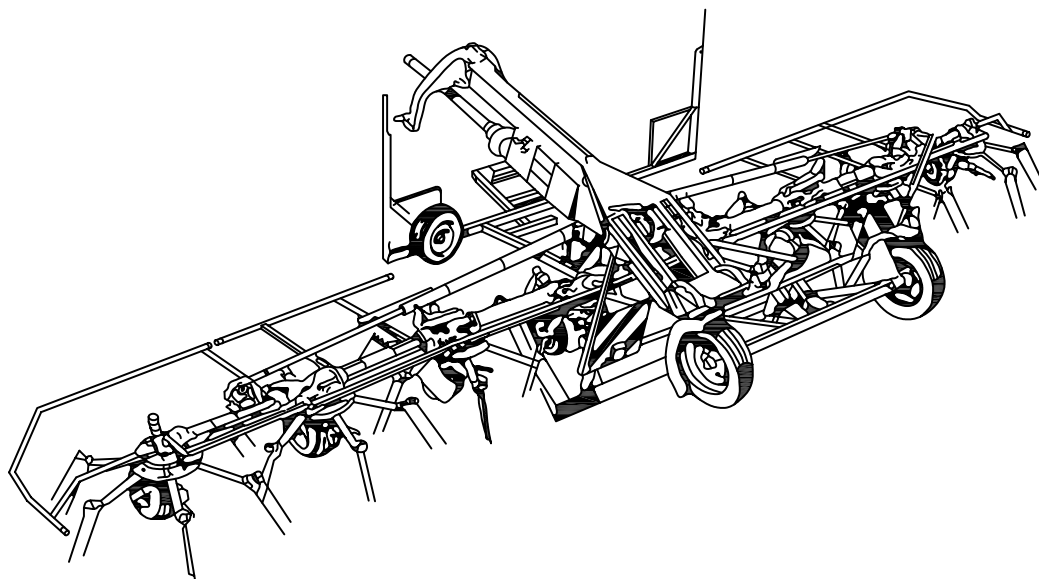


Figure A.1 — Semi-mounted tedder

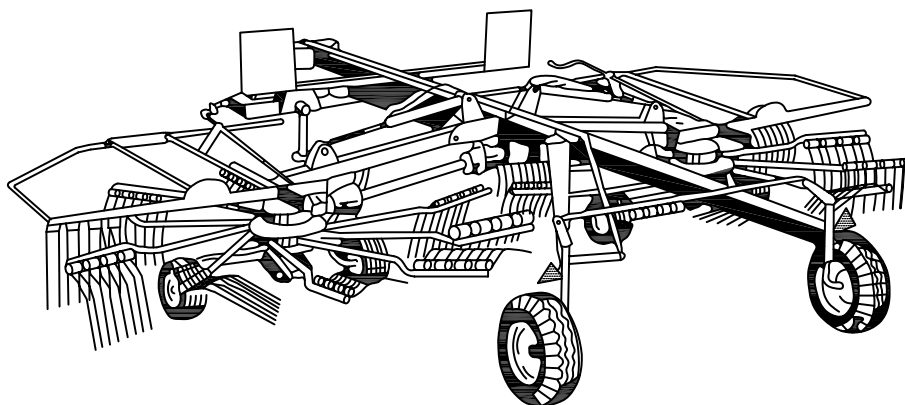


Figure A.2 — Semi-mounted rake with two rotors

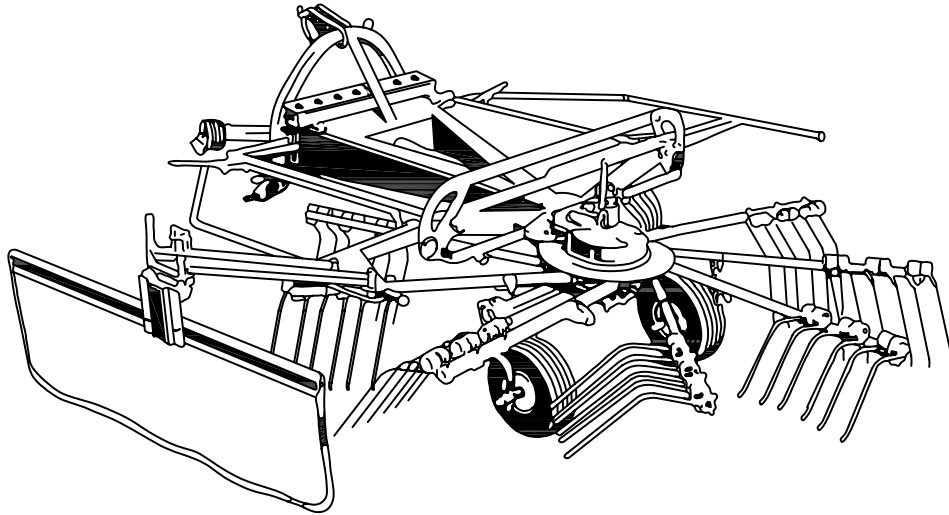


Figure A.3 — Rear-mounted rake with single rotor

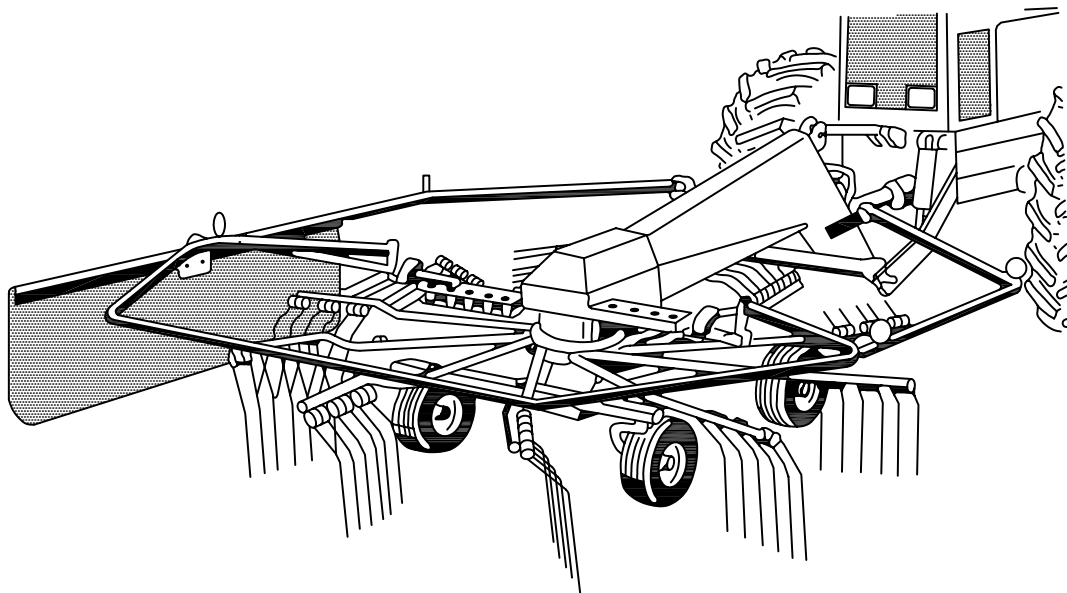


Figure A.4 — Front-mounted rake with single rotor

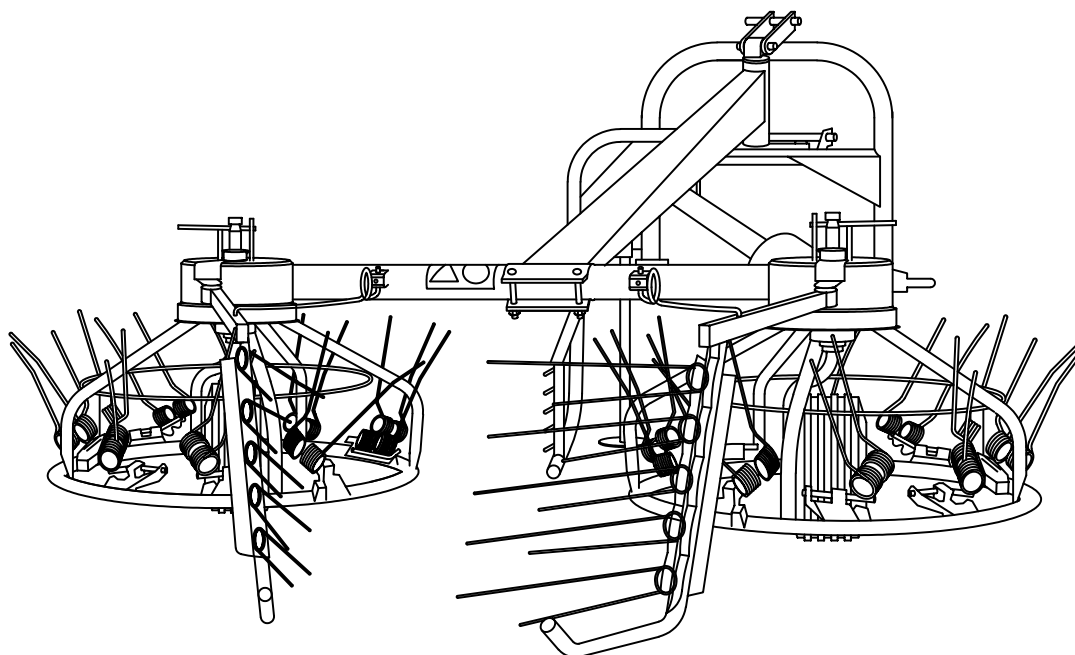


Figure A.5 — Rotary drum rake

Annex B **(normative)**

Strength test

This annex is included as a complement to ISO 4254-1:2008, C.2.3, on requirements on the test acceptance of barriers that are not permitted to move more than 20 mm horizontally.

The following applies to protective devices that move horizontally by more than 20 mm.

When applying the horizontal load, the safety distances specified in this part of ISO 4254 shall continue to be met. At the end of the test, the protective device shall not have any permanent deformation that could decrease a safety distance.

Annex C (informative)

Stability of tractor-rotary tedder and rake combination

This annex is related to 7.1 f), which contains a requirement to give information concerning the possible loss of stability of the tractor due to its connection with the machine.

The following is recommended to the manufacturer to enable him to provide adequate and complete information.

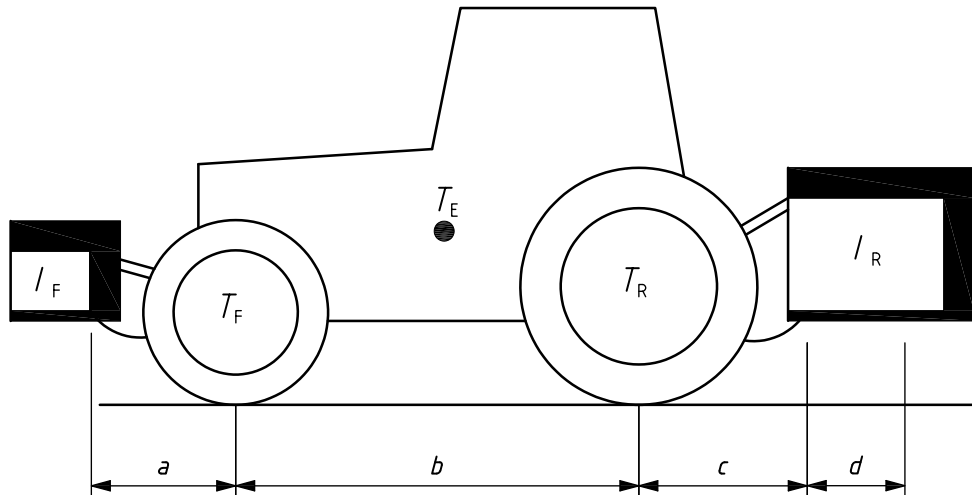
The example given refers to a rotary tedder and rake mounted on a tractor.

Due to the mass of the machine itself, the tractor-rotary tedder and rake combination can become unstable. In order to verify the total stability, the following expression can be applied for the calculation of the minimum ballasting at the front, $I_{F,min}$, in kilograms, permits a load on the front axle equal to 20 % of the unladen mass of the tractor:

$$I_{F,min} = \frac{[I_R \times (c + d)] - (T_F \times b) + (0,2 \times T_E \times b)}{a + b}$$

NOTE Rear-mounted implement and front/rear combinations are considered for this calculation.

See Figure C.1.

**Key**

T_E unladen mass of tractor, kg ^a

T_F front axle load of unladen tractor, kg ^a

T_R rear axle load of unladen tractor, kg ^a

I_F combined mass of front-mounted implement/front ballast, kg ^b

I_R combined mass of rear-mounted implement/rear ballast, kg ^b

a distance from centre of gravity for combined front-mounted implement/front ballast to front axle centre, m ^{b, c}

b tractor wheelbase, m ^{a, c}

c distance from rear axle centre to centre of lower link balls, m ^{a, c}

d distance from centre of lower link balls to centre of gravity for combined rear-mounted implement/rear ballast, m ^b

^a See the tractor instruction handbook.

^b See the implement price list and/or instruction handbook.

^c To be measured.

Figure C.1 — Example of a stability calculation for the tractor-rotary tedder and rake combination

Bibliography

- [1] ISO 3600:1996, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and presentation*
- [2] ISO 11684:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*
- [3] ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*
- [4] ISO/TR 11688-2, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design*
- [5] ISO 14982, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*

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