INTERNATIONAL STANDARD

ISO 4254-6

Second edition
2009-09-15

Agricultural machinery — Safety —

Part 6: Sprayers and liquid fertilizer distributors

Matériel agricole — Sécurité —

Partie 6: Pulvérisateurs et distributeurs d'engrais liquides

Reference number
ISO 4254-6:2009(E)

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Published in Switzerland

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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 4254-6 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

This second edition cancels and replaces the first edition (ISO 4254-6:1995), which has been technically revised.

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, *Tractors for agriculture and forestry — Safety*

Part 4, *Forestry winches*, has been cancelled and replaced by ISO 19472, *Machinery for forestry — Winches — Dimensions, performance and safety*

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 sprayers and liquid fertilizer distributors.

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 6: Sprayers and liquid fertilizer distributors

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 mounted, semi-mounted, trailed and self-propelled agricultural sprayers for use with pesticide products and liquid fertilizer application, designed for use by one operator only. 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:

— pedestrian-controlled sprayers;

— knapsack sprayers;

— aerial sprayers;

— handheld spraying devices (e.g. spray guns).

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 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 sprayers and liquid fertilizer distributors when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4), excepting the hazards arising from:

— automatically actuated height adjustment systems;

— electrostatic phenomena;

— electromagnetic compatibility;

— the environment, other than noise;

— inhalation of spraying chemical products due to a lack of effective methods to maintain breathing air quality inside the cab;

— roll-over and tip-over of self-propelled machines with a ride-on driver;

— vibration (except the declaration);

— dust emission;

— burns;

— moving parts for power transmission except strength requirements for guards and barriers;

— safety and reliability of control systems;

— travelling function of self-propelled machines.

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

This part of ISO 4254 is not applicable to sprayers and liquid fertilizer distributors 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 4254-1:2008, *Agricultural machinery — Safety — Part 1: General requirements*

ISO 5353:1995, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

ISO 5681:1992, *Equipment for crop protection – Vocabulary*

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

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

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 5681 and ISO 12100-1, and the following apply.

3.1
sprayer
appliance for application of pesticide products and liquid fertilizer

3.2
aerial sprayer
sprayer designed to be mounted to a plane or helicopter

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 sprayers and liquid fertilizer distributors

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	Folding or unfolding of the boom, calibration, insufficient clearance zone when hitching, failure of control system	4.7, 4.14.5, 5.1.3.3, 5.2	5.1, 5.3, 5.3.3, 5.11, 7.1
A.1.2	Shearing hazard	Folding or unfolding of the boom, calibration, failure of control system	4.4, 4.8, 5.1.4	5.1, 5.3.2, 5.3.3, 7.1
A.1.3	Cutting or severing hazard	Folding or unfolding of the boom, calibration	4.1, 4.14.5, 6.4	5.1, 5.3.2
A.1.4	Entanglement hazard	Drawing-in by the fan, power take-off drive shaft	4.1, 4.14.5, 5.1.4, 5.2	5.1, 5.7
A.1.6	Impact hazard	Movement of the boom when it is folded in transport position, insufficient clearance zone when hitching	4.1, 4.14.3, 5.1.4, 5.2	5.1, 5.3.2, 5.11
A.1.9	High pressure fluid ejection hazard	Rupture of pressurized components (e.g. hoses)	4.10.2	5.6, 5.8
A.2	**Electrical hazards**			
A.2.2	Contact of persons with live parts (direct contact) or with parts which have become live under faulty conditions (indirect contact)	Contact of the boom with overhead power line	—	5.3.2, 7.1, 7.2
A.4	**Hazards generated by noise**		4.2, 8.1.q), Annex B	5.13
A.5	**Hazards generated by materials and substances**			
A.5.1	Hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	Contact with chemical products (when spraying with self-propelled machines with front booms, filling or draining the spray tank, handling)	4.10, 4.12, 5.4, 5.6, 8.1	5.1, 5.3.1, 5.4, , 5.8, 5.9, 5.10, 5.12
A.6	**Hazards generated by neglecting ergonomic principles in machinery design**			
A.6.1	Unhealthy postures or excessive efforts	High actuating forces for adjusting the height of the boom, inadequate location of the filling hole of the spray tank, insufficient clearance zone when hitching	4.4.3, 4.4.5, 4.5.1, 4.5.1.2.3, 4.14.3, 5.2	5.3.3, 5.4.1, 5.11
A.6.2	Inadequate consideration of hand-arm or foot-leg anatomy	Inadequate location of the filling hole of the spray tank, insufficient clearance zone when hitching	4.5.2.3,4.6.1, 4.6.3, 5.1.1, 5.1.4, 5.1.5,	5.4.1, 5.11
A.6.7	Inadequate design, location or identification of manual controls	Inadequate location of the filling hole of the spray tank, contact of the boom	4.4, 4.6, 5.1.1, 6.1	5.3.2, 5.3.3, 5.9

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**			
A.8.2	Restoration of energy supply after an interruption		4.4, 6.1	—
A.11	**Failure of the power supply**	Fall of the boom	4.8, 6.5	5.3.3, 7.1
A.14	**Break-up during operation**		4.7, 4.8, 4.9, 4.10	5.1.2
A.15	**Falling or ejected objects or fluids**	Failure of pressurized hoses	4.10	5.6, 5.8
A.16	**Loss of stability/overturning of machinery**	Lack of stability due to the unfolded booms, when parked or for manual handling	5.2, 6.2	5.2, 7.1
A.16.1	Insufficient ability of machinery to be slowed down, stopped and immobilized	Propulsion of machine	5.1.3.2	5.1.2
A.17	**Slip, trip and fall of persons (relating to machinery)**	Inadequate location of the filling hole of the spray tank, access to operator's station or other boarding means	4.6.1, 4.6.2.3, 4.6.3, 4.6.4, 4.14, 5.4	5.4.1
Additional hazards, hazardous situations and hazardous events due to mobility				
A.18	**Relating to the travelling function**			
A.18.1	Movement when starting the engine	Unlocking of the boom when the machine is in transport position	5.1.8	5.3.2
A.19	**Linked to the work position**			
A.19.1	Fall of persons during access to (or at/from) the work position	Inadequate location of the filling hole of the spray tank	4.6.1, 4.6.2 c)	5.4.1
A.19.5	Insufficient visibility from the work position		5.1.7	5.1.2
A.19.6	Inadequate lighting		5.1.7.3	5.1.2
A.20	**Due to the control system**			
A.20.1	Inadequate location of manual controls	Contact of the boom with the operator	6.1	5.3.3
A.20.2	Inadequate design and marking of manual controls and their mode of operation	Inadequate location of the filling hole of the spray tank, contact of the boom, actuation forces not adapted, contact of the boom with overhead power line	4.4, 6.1	5.3.2, 5.3.3, 5.9
A.22	**Due to the power source and to the transmission of power**			
A.22.1	Hazards from coupling	Insufficient clearance zone when hitching	5.2.1, 6.3	5.11, 7.1
		Power transmission	6.4	—

[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 hazards relevant, but not significant, 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, the machine shall comply with the requirements of ISO 4254-1.

5.1.3 The machine shall allow for handling and operating, including filling and maintenance, by an operator wearing adequate personal protective equipment as recommended in 7.1 f).

5.2 Stability

5.2.1 General

The machine shall be designed to be stable as specified in ISO 4254-1:2008, 6.2.1. See also 7.1 k).

5.2.2 Mounted machines fitted with rollers for manual handling when dismounted

Machines equipped with transport rollers for manual handling shall be designed so that they cannot tip over.

5.3 Spray booms

5.3.1 Front-mounted booms

In order to protect the driver from spray, self-propelled machines with front-mounted spray booms shall be fitted with either

— a cab, or

— a driver's seat having a seat index point (SIP) in accordance with ISO 5353:1995, Clause 3, positioned at least 1 000 mm above the maximum working height of the boom, or

— a boom provided with a device that minimizes the contact of the operator with spray (e.g. shroud).

NOTE Further requirements will be included at the next revision of this part of ISO 4254 depending on progress of knowledge, particularly with regard to air purification devices.

See also 7.1 g).

5.3.2 Boom folding

5.3.2.1 To limit the risk associated with overhead power lines during work, the booms shall be capable of folding and unfolding without exceeding a height of 4 m. See also 7.1 d) and 7.1 j).

This requirement does not apply during release of the folded boom from the transport position, nor during positioning of the folded boom into the transport position.

5.3.2.2 Booms that can be manually folded/unfolded shall be fitted with two handles located at a distance of at least 300 mm from the nearest articulation. These handles may be integral parts of the boom, provided they are ergonomically designed and clearly identified.

In the case of powered folding/unfolding operation, the control shall be of the hold-to-run type and the manual control shall be located outside the swivelling zone.

A device shall be provided to prevent the boom from moving when it is in the transport position. 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 a pressure of at least four times the rated maximum hydraulic pressure. See also 7.1 d).

The unlocking and the unfolding of booms shall be controlled by means of separate actions by the operator.

5.3.3 Adjustment of height of boom

The manual force necessary to adjust the height of the boom shall not exceed 250 N.

Where height adjustment is by a mechanical device, this device shall be self-arresting and able to deal with a nominal load equal to at least 1,3 times the weight of the boom.

This mechanical device shall be operable from the ground or from a platform as specified in ISO 4254-1:2008, 4.5.2.

In the case of powered height adjustment systems that are manually actuated, it shall be possible to actuate the manual control from the driver's position and the control shall be of the hold-to-run type.

In the case of powered height adjustment systems that are automatically actuated, it shall be possible to override the system from the driver's position.

NOTE The automatically actuated height adjustment systems is to be dealt with at the next revision of this part of ISO 4254.

To ensure the protection of the operator against crushing and shearing hazards related to a failure of the control circuit of the height adjustment of the boom, the machine shall be fitted for those purposes with either

a) a device which limits the maximum downward speed of the boom to 10 $mm \cdot s^{-1}$ during a hydraulic failure, or

b) a device capable of stopping the boom lowering at a minimum height of 500 mm between the boom and the ground.

For b), in those cases where the height needs to be reduced to less than 500 mm, a safety device shall prevent any lowering beneath the chosen height, and it shall only be possible to reduce the height by means of an intentional and separate action.

If these safety devices are hydraulic valves not directly fitted to the cylinder, the lines connecting the valve to the cylinder shall be designed to withstand a pressure of at least four times the rated maximum hydraulic pressure.

5.4 Spray tank

5.4.1 Prevention of whole-body access to the tank

To limit the risk of access into the tank, any tank opening greater than 400 mm in diameter — or, if it is rectangular, of more than 400 mm × 300 mm — shall be provided with a grating which can only be removed by the use of tools. The openings in the grating shall not exceed the above-mentioned dimensions. See also 7.1 h) and 7.2.2.

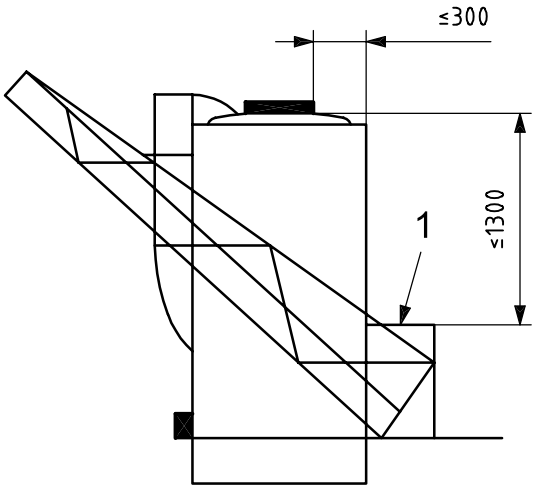
5.4.2 Limitation of contact with chemicals

To limit the risk of exposure to chemicals during filling/cleaning operations:

— a chemical induction bowl or equally effective device shall be provided with the sprayer;

— alternatively, the filling hole of the spray tank shall be so positioned that the height from the ground or platform is not more than 1 300 mm, with the horizontal reach between the rim of the hole and the outer edge of any part of the sprayer which could hinder the operator being not be more than 300 mm at the operator filling position (see Figure 1).

Dimensions in millimetres



Key

1 operator filling position

Figure 1 — Maximum reach for manually filling chemicals

The actual overall volume of the tank shall exceed the nominal volume by at least 5 %.

The lid shall be:

— attached to the machine, e.g. by means of a chain;

— fitted with a holding device ensuring a closed position either by means of a positive mechanical action or lids fixed by screwing;

— fitted so as to prevent leakage of the spray mixture, e.g. by means of a seal.

The level of liquid shall be indicated to the operator during filling and emptying. The nominal volume of the tank shall be marked.

A pressure-compensation device shall be fitted on tanks that are not designed to be put under pressure, in order to keep them at atmospheric pressure when emptying and filling. See also 7.1 b).

5.4.3 Protection from contact with spray mixture when draining

The operator shall be prevented from coming into contact with the spray mixture when emptying the tank. This requirement is met if

— the draining outlet can be opened without a tool (for example by means of a tap), and

— the flow is directed away from the operator.

An emptying device shall allow the complete emptying of the residual in the tank when the sprayer is in a horizontal position.

It shall be possible to collect the liquid at the outlet without contaminating the operator or equipment parts, e.g. using stays.

The tank outlet shall be guarded against accidental opening (see EN 12761-2:2001, 4.1.1.3).

See also 7.1 f) and 7.1 l).

5.5 Pressure indicator (manometer)

The sprayer shall have a pressure indicator.

The working pressure(s) shall be clearly readable from the driver's position. Turning of the head and the upper body is acceptable.

For analog pressure gauges, the minimum diameter of pressure gauge dial plate shall be:

— 63 mm where the gauge is connected to controls and positioned within the hand reach of the operator or between the plane formed by the hitch points of the three-point linkage and the tractor;

— 100 mm in all other cases.

The gauge case shall be isolated from the spray mixture.

Pressure exceeding the maximum working pressure shall be indicated — for example, on the analog pressure gauge by a red marking and on a digital instrument by an (audible or optical) indication initiated when the pressure reaches the maximum working pressure. See also 7.1 n).

5.6 Protection against overpressure

The sprayer shall be provided with a safety device that prevents the pressure from exceeding the maximum working pressure of the circuit by more than 20 %.

The adjustment of this safety device shall be protected against unauthorized or accidental modification. Its actuation shall not cause any spillage or leakage of liquid from the circuit.

5.7 Fan

If a sprayer is equipped with a fan, the following requirements apply:

— the fan shall be placed or protected so that when the sprayer is operating it shall not be able to draw in or discharge foreign matter which could injure the operator;

— access to the fan shall be prevented by fixed guards, which may be a combination of imperforate and mesh guards whose apertures conform to requirements of ISO 13857:2008, Tables 1, 3, 4 and 6;

— when the fan drive is not controlled independently from the pump drive, it shall be possible to disengage the fan drive from the pump drive from the ground or from a platform.

See also 7.1 i).

5.8 Spray liquid carrying hoses

For self-propelled sprayers equipped with a cab, hoses shall not be located in the sprayer cab. For self-propelled sprayers without a cab, hoses and their connecting devices shall be protected by imperforate screens, so that leakage cannot come into contact with the operator.

All pressurized hoses shall be directly and durably marked with the maximum working pressure.

The maximum working pressure of hoses and the maximum working pressure of connecting devices shall be at least equal to the maximum working pressure of the circuit [see also 7.1 n), 7.2.2 and 7.2.4].

5.9 Manual spraying stop control

Each machine shall be equipped at the driver's position with a manual spraying stop control device to safely stop the flow (e.g. by means of two valves placed in series). When the spraying stop control has been actuated, the volume dripping from each nozzle shall be minimized.

5.10 Clean water tank

Sprayers shall be equipped with a clean water tank for the operator's use (e.g. in case a person has been in contact with chemicals) having a minimum capacity of 15 l. This tank shall be totally isolated from the other parts of the machine and shall be fitted with a tap which can be easily opened without the use of a tool and without being continuously pressed.

See also 7.2.2.

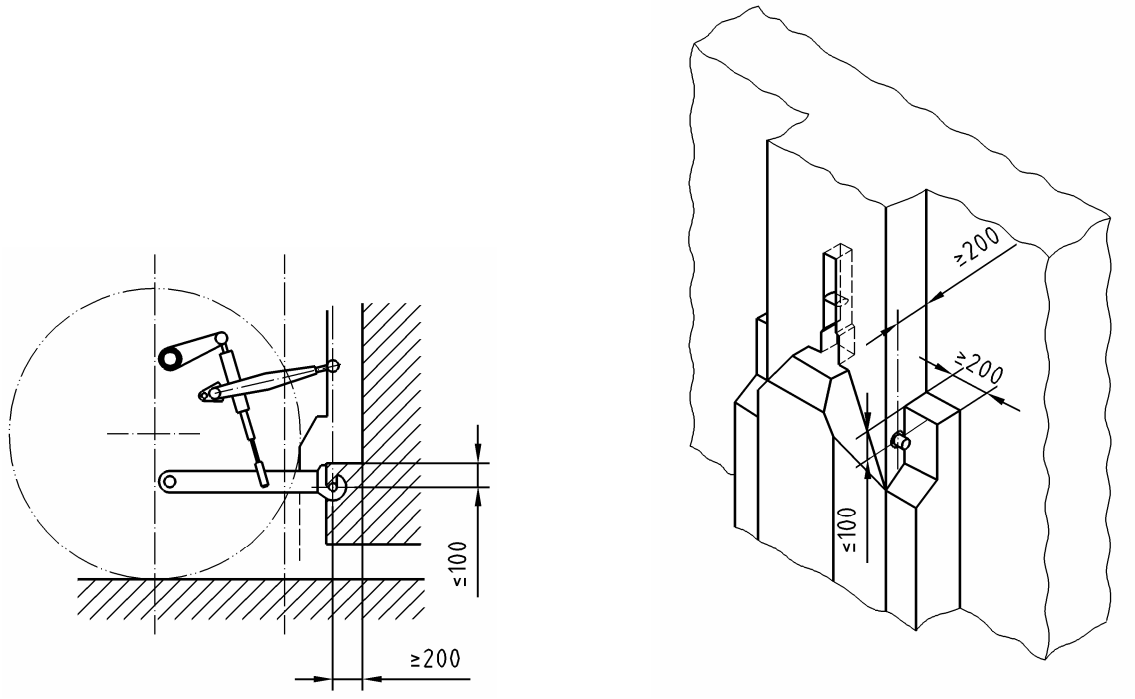
5.11 Hitching and clearance zone

For mounted machines, a sufficient clearance between the sprayer and the tractor shall be ensured for the connection of the driving elements (e.g. power transmission), if provided, and/or the control elements (e.g. electric/hydraulic remote control). This shall be achieved by either

— application of the dimensions of the clearance zone as shown in Figure 2 on at least one side, so that it is possible to connect the driving and/or steering elements after having coupled the sprayer, or

— the design of the driving and/or steering elements so that their connection is possible before coupling the sprayer in a clearance zone comparable to that shown in Figure 2.

Dimensions in millimetres



a) Side view

b) Global view

c) Top view

Figure 2 — Clearance zone

5.12 Servicing and maintenance

It shall be possible to carry out servicing and maintenance operations on pumps and filters without causing leakage from the tank when it is filled to its nominal volume. This can be achieved by, for example, appropriate positioning of components, isolation by means of a tap, or the use of valves.

See also 7.1 and 7.2.3.

5.13 Noise reduction at the design stage

The main sources of noise when operating spraying machines are the tractor and the fan (when fitted). Appropriately designed gearwheels, drives, blades and pumps may be seen as measures for noise reduction at the design stage.

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 — Additional means of verification of safety requirements and/or protective measures given in this part of ISO 4254

Subclause	Verification of	Visual inspection	Test performance checking	Measurement	Procedure/reference
5.2.1	Stability		×		Shall be verified in accordance with ISO 4254-1:2008, 6.2.1 with tanks full of water. The booms are folded. The machine passes the test if it remains stable in any direction.
5.2.2	Tipping-over of mounted machines fitted with rollers for manual handling when dismounted		×		Place the machine on a horizontal and even plane. Then push the machine in each direction so that it rolls, at a speed of 1 $m \cdot s^{-1}$, against a fixed rectangular obstacle 50 mm high and located at a right angle to the direction of the movement of the machine. The machine shall not tip over.
5.3.1	Protection of the operator of sprayers with front-mounted boom	×		×	
5.3.2.1 (first paragraph)	Boom folding during work			×	The height of 4 m shall be measured with the machine on horizontal and level ground.
5.3.2.2	Handles			×	
5.3.2.2	Restrain device	×			
5.3.3	Adjustment of the height of the boom		×	×	
5.4.1	Limitation of access into the tank and of contact with chemicals	×		×	
5.4.2	Prevention of spillage and overflow	×			
5.4.3	Protection from contact with the spray mixture when draining	×			

Table 2 (*continued*)

Subclause	Verification of	Visual inspection	Test performance checking	Measurement	Procedure/reference
5.4.3	Emptying device		×		Complete emptying of the residual has been achieved if there are no visible puddles at the bottom of the tank after 5 min drainage.
5.5	Pressure indicator (manometer)	×		×	
5.6	Safety pressure device	×			
5.7	Fan	×		×	ISO 13857:2008, Tables 1, 3, 4 and 6
5.8	Spray liquid carrying hoses	×			
5.9	Manual spraying stop control		×		When the spraying stop control has been actuated, the volume dripping from each nozzle shall not exceed 2 ml timed over a 5 min period. The measurement shall be started 8 s after the flow to the spray boom has been shut off.
5.10	Clean water tank	×	×		
5.11	Hitching and clearance zone	×		×	
5.12	Servicing and maintenance	×			

7 Information for use

7.1 Instruction handbook

An instruction handbook shall be provided by the manufacturer 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, as well as 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 in ISO 12100-2:2003, 6.5.

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

a) the restarting procedures for the machine after wintering;

b) methods for adjusting the pressure;

c) details of adjustments to be made to the sprayer when various nozzles are used;

d) the folding/unfolding and transport procedures for the boom;

e) the procedures to be followed for dealing with blocked nozzles and other breakdowns in the field;

f) a recommendation concerning precautions to be taken against contact with and/or inhalation of hazardous chemicals, i.e. the installation of the sprayer on a tractor with a cabin fitted with air filtration, the wearing of personal protective equipment, the use of equipment facilitating the direct introduction of chemical products and liquid fertilizers into the tank, etc., at each of the following stages of use:

   — filling of the tank and adding of chemicals;

— spraying;

— adjustments;

— draining and cleaning of the tank;

— changing of chemicals;

— servicing;

g) where applicable according to 5.3.1, information to the effect that mounted spray booms shall not be used in front of the tractor where there is no cab, and that the cab windows and doors are to be closed;

h) the hazards from entering the tank with the whole body;

i) the need to ensure that no other person is standing near the machine, including near the fan;

j) information to the effect that the risk of unintentional contact with overhead power lines possible during spraying operations (e.g. due to uneven ground or use of boom levelling devices), requires the operator to complete an analysis of the field in order to decide on the best working method — in particular for folding/unfolding operations during work process — before any spraying operation commences in the area to be sprayed by the machine;

k) the procedures to be followed for parking the machine;

l) the precautions (particularly for limiting the propagation of contamination) to be taken for the cleaning of the machine;

m) instructions for winter storage of the sprayer;

n) maximum working pressure of the circuit.

In addition, the following points shall be emphasized (additional information for the user):

o) the requirement that any maintenance intervention, shall only be undertaken after the parts of the sprayer involved have been cleaned of contamination;

p) the instructions and specifications of the pump needed for safe replacement.

7.2 Marking

7.2.1 General

The marking shall comply with ISO 12100-2:2003, 6.4.

All machines shall be marked legibly and indelibly with at least the information given in 7.2.2 to 7.2.4.

7.2.2 Sprayers

At least the following information shall be marked on sprayers:

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

— designation of the machinery;

— year of construction;

— designation of series or type;

— serial number, if any;

— maximum working pressure of circuit;

— mass when empty;

— laden mass;

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

— tank nominal volume;

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

In addition, sprayers shall carry:

— a warning placed near any spray tank opening of sufficient size to allow whole body access, after removal of any detachable grating shall indicate the hazards of entering the tank;

— a warning placed at the operator's position — at the driver's station for self-propelled machines, close to controls for other types of machines — shall draw attention to the risk of unintentional contact with overhead power lines;

— a warning placed on the clean water tank shall indicate that it is to be filled only with clean water.

7.2.3 Pumps

At least the following information shall be marked on pumps:

— name and address of manufacturer;

— serial number;

— maximum pump pressure;

— nominal frequency of rotation.

7.2.4 Hoses

The maximum working pressure shall be marked on hoses.

Bibliography

[1] ISO 3600:1996, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and presentation*

[2] ISO 14982:1998, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*

[3] EN 12761-2:2001, *Agricultural and forestry machinery — Sprayers and liquid fertilizer distributors — Environmental protection — Part 2: Field crop sprayers*

ICS 65.060.40

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