INTERNATIONAL STANDARD

ISO 19932-1

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Equipment for crop protection — Knapsack sprayers —

Part 1: Safety and environmental requirements

Matériel de protection des cultures — Pulvérisateurs à dos —

Partie 1: Exigences environnementales et de sécurité

Reference number
ISO 19932-1:2013(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.

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. 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. 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.

The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

This second edition of ISO 19932-1, together with ISO 19932-2, cancels and replaces ISO 19932-1:2006 and ISO 19932-2:2006.

ISO 19932 consists of the following parts, under the general title *Equipment for crop protection — Knapsack sprayers*:

— *Part 1: Safety and environmental requirements*

— *Part 2: Test methods*

Introduction

The application of plant protection products with knapsack sprayers should take into consideration biological, economic, environmental and operator issues.

The aim of this part of ISO 19932 is to specify safety and environmental requirements for equipment.

Implementation of this part of ISO 19932 should achieve an appropriate level of operator safety and avoid unnecessary dispersal of plant protection products into the environment.

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

— 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.

Equipment for crop protection — Knapsack sprayers —

Part 1: Safety and environmental requirements

1 Scope

This part of ISO 19932 specifies the safety and environmental requirements and their means of verification for the design and construction of knapsack sprayers carried on the back or shoulder of the operator for use with plant protection products. In addition, it specifies the type of information on safe working practices (including residual risks) to be provided by the manufacturer.

It is applicable to lever-operated knapsack sprayers, knapsack compression sprayers and knapsack sprayers driven by an engine or electric motor using hydraulic pressure atomisation of the spray liquid, with a nominal volume of more than 3 l, for their intended use primarily in agriculture and horticulture.

It does not apply to knapsack mistblowers according to ISO 28139.

This part of ISO 19932 deals with all significant hazards, hazardous situations and hazardous events relevant to knapsack sprayers when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex A), excepting the hazards arising from:

— static electricity;

— explosion or fire from chemicals for spraying; and

— insufficient structural integrity.

This document is not applicable to knapsack sprayers which are manufactured before the date of publication of this document.

2 Normative references

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

ISO 1401:1999, *Rubber hoses for agricultural spraying*

ISO 3767-5:1992, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 5: Symbols for manual portable forestry machinery*

ISO 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

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

ISO 5682-1:1996, *Equipment for crop protection — Spraying equipment — Part 1: Test methods for sprayer nozzles*

ISO 6385:2004, *Ergonomic principles in the design of work systems*

ISO 8169:1984, *Equipment for crop protection — Sprayers — Connecting dimensions for nozzles and manometers*

ISO 8893:1997, *Forestry machinery — Portable brush-cutters and grass-trimmers — Engine performance and fuel consumption*

ISO 10626:1991, *Equipment for crop protection — Sprayers — Connecting dimensions for nozzles with bayonet fixing*

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 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

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

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

ISO 19732:2007, *Equipment for crop protection — Sprayer filters — Colour coding for identification*

ISO 19932-2:2013, *Equipment for crop protection — Knapsack sprayers — Part 2: Test methods*

ISO 22868:2011, *Forestry and gardening machinery — Noise test code for portable hand-held machines with internal combustion engine — Engineering method (Grade 2 accuracy)*

ISO 29664:2010, *Plastics — Artificial weathering including acidic deposition*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5681 and ISO 12100 and the following apply.

3.1
knapsack sprayer
self-contained sprayer carried on the operator's back or shoulder by means of straps or a strap

3.2
nominal volume
volume indicated by the maximum filling level marked on the spray tank

Note 1 to entry: The maximum filling level can be marked by the upper value of the contents gauge scale or at a lower level by a dedicated mark.

3.3
maximum working pressure
maximum pressure allowed at any part of the sprayer

4 General requirements

4.1 General

4.1.1 The sprayer shall comply with the safety and environmental requirements and/or protective measures of this Clause, as well as the additional requirements for particular types of knapsack specified in Clauses 5, 6, and 7.

In addition, the sprayer shall be designed according to the principles of ISO 6385 and ISO 12100 for relevant but not significant hazards which are not dealt with by this part of ISO 19932.

All spray functions including spraying, filling, emptying and cleaning (including cleaning nozzles and filters) shall be possible for an operator wearing appropriate protective gloves.

Compliance shall be checked by inspection and function test.

4.1.2 The mass of the equipment with the fuel tank and spray tank filled to the nominal volume shall not be more than 25 kg. The centre of gravity of the upright sprayer shall not be located at a horizontal distance greater than 150 mm from the vertical plane passing through the fixation points of the harness with fuel and spray tanks filled to their nominal value and with the equipment ready for use.

Compliance shall be checked by measurement.

4.1.3 The sprayer shall have an adjustable spray liquid output which does not deviate by more than ± 15 % of the values specified in the instruction handbook for each setting.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.2.

4.1.4 Wearing parts (such as nozzles, filters, anti-drip valves, valves, diaphragms) specified in the instruction handbook shall be changeable without special tools, unless provided with the sprayer, by an operator wearing appropriate protective gloves and without contamination of the operator and the environment.

Compliance shall be checked by inspection and function test.

4.1.5 All parts in contact with the spray liquid during operation shall be resistant to spray liquids. After defined immersion in test liquids, the change in mass of small components or samples of material of larger components shall not be more than 10 % of the mass before immersion in the test liquid. Components shall not be deformed and when reassembled into the sprayer, the sprayer shall not leak and shall function as intended.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.9.

4.1.6 The sprayer shall be equipped with a means for lifting and carrying the filled sprayer (e. g. a handle) in an upright position.

Compliance shall be checked by inspection and function test.

4.1.7 In order to guarantee the stability of the sprayer during filling operations, the sprayer shall remain stable on an incline of 8,5° (±0,2°) in any direction, irrespective of the amount of liquid in the spray tank.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.4.

4.1.8 The sprayer shall be designed so that the loss of liquid during stoppage of spraying is minimised. The volume emitted within 5 s after spray shut-off shall not be more than 5 ml.

Compliance shall be checked by measurement.

4.1.9 For sprayers with a nominal volume of up to 17 l, the residual volume of liquid shall not exceed 250 ml. For those that exceed 17 l, this volume shall not exceed 1,5 % of the nominal spray-tank volume.

Compliance shall be tested according to ISO 19932-2:2013, 6.1.3 for lever-operated sprayers, according to ISO 19932-2:2013, 7.2 for engine- or motor-driven sprayers or according to ISO 19932-2:2013, 8.1.2 for compression sprayers.

4.1.10 The sprayer shall be designed to avoid accumulation of liquid in case of accidental overfilling. External deposit shall not exceed 70 ml.

Compliance shall be tested according to ISO 19932-2:2013, 6.1.2 for lever-operated sprayers, according to ISO 19932-2:2013, 7.1 for engine- or motor-driven sprayers or according to ISO 19932-2:2013, 8.1.1 for compression sprayers.

4.1.11 Pressurized parts of the sprayer shall withstand twice the maximum working pressure specified by the manufacturer after undertaking the drop test specified in ISO 19932-2.

Compliance shall be tested according to ISO 19932-2:2013, 5.4.

4.1.12 Hose connections shall be protected from being damaged in order to prevent leakage.

Compliance shall be checked by inspection.

4.2 Harness

4.2.1 A harness shall be provided to carry the sprayer. It shall be adjustable to the size of the operator so that one person shall be able to pick up, to carry and to put down the sprayer.

A double shoulder harness shall be designed so that pressure is evenly distributed on both shoulders of the operator. The design of the double shoulder harness shall prevent slipping in any direction.

All double shoulder harnesses shall be equipped with a quick-release mechanism positioned either at the connection between the sprayer and harness or between the harness and operator. Either the design of the harness or the use of the quick-release mechanism shall ensure that the sprayer can be released quickly from the operator in the event of emergency.

If a quick-release mechanism is provided, it shall be possible to open it under load and release the machine using only one hand.

Compliance shall be checked by inspection and function test.

4.2.2 Straps shall be made of non-absorbent material. The increase in mass of straps after defined immersion in water shall not exceed 30 % of the dry mass.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.8.

4.2.3 Each shoulder strap shall have a load-bearing part of a length of at least 100 mm ± 10 mm and of a minimum comfort width of:

a) 25 mm in case of (filled) sprayer masses up to 10 kg;

b) 50 mm in case of (filled) sprayer masses higher than 10 kg.

The load shall be distributed over the whole width.

Compliance shall be checked by measurement.

4.2.4 If the load-bearing area is formed by a pad, this shall not slip from its position unintentionally.

Compliance shall be checked by inspection and function test.

4.2.5 There shall be no damage on load-bearing straps and their fixation points that reduces their functionality as a consequence of the specified strap drop test.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.3.

4.3 Spray tank

4.3.1 The nominal volume shall be specified in whole litres (l). It shall be possible to determine the spray tank filling level of the sprayer with a minimum resolution of 1 l.

Compliance shall be checked by inspection.

4.3.2 The volumetric contents gauge scale shall have a maximum error of ± 10 % of the reading.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.5.

4.3.3 The spray tank material shall be resistant to UV light. When tested in accordance with ISO 29664:2010, Method B, the spray tank material shall show no cracks and the change in tensile strength shall not be more than 20 % from the initial value after the 6 week exposure.

Compliance shall be certified by the manufacturer of the tank material.

4.3.4 It shall be possible to fill the spray tank to its nominal volume within 60 s. The total volume of all liquid spillage during filling shall not exceed 5 ml.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.6.

4.3.5 It shall be possible to fully empty the spray tank. The amount of liquid remaining in the spray tank shall not exceed 50 ml.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.7.

NOTE This requirement is still under development for sprayers with diaphragm pump.

4.3.6 The operator shall be protected from coming into contact with the plant protection product when emptying the spray tank. This requirement is met if the draining outlet can be opened without the use of a tool, wearing appropriate protective gloves, and the flow is directed away from the operator such that it can be collected in a suitable container.

Compliance shall be checked by inspection and function test.

4.4 Controls

4.4.1 It shall be possible to operate all controls by an operator wearing appropriate protective gloves.

Compliance shall be checked by inspection and function test.

4.4.2 The pressure line shall be equipped with a quick-acting shut-off device positioned so that it can be easily reached by the operator in normal operating position. Unintentional opening of the shut-off device shall be minimised by the application of a force, for example by means of a spring or a locking device. If the device is lockable in the open position, it shall be locked by two independent and dissimilar actions and shall be unlocked easily by one action. After unlocking, the device shall shut-off automatically when released.

Compliance shall be checked by inspection and function test.

4.4.3 Any mechanical shut-off device shall be designed to work reliably. It shall properly open and close, it shall not leak after 25 000 duty cycles.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.1.

4.4.4 Sprayers shall have a device for pressure control (pressure regulator) at a pre-determined value. The device for pressure control shall be changeable or adjustable without contamination of the operator or environment.

Compliance shall be checked by inspection and function test.

4.5 Hoses

4.5.1 To allow free handling of the spray lance, the length of the hose from the hose nipple of the spray tank to that of the spray lance hand grip shall be at least 1 200 mm.

Compliance shall be checked by measurement.

4.5.2 Flexible hoses shall be attached so there are no sharp bends in all normal working positions.

Compliance shall be checked by inspection and function test.

4.5.3 Hoses fitted or supplied with the sprayer shall comply with Type A of ISO 1401:1999.

Compliance shall be certified by the hose manufacturer.

NOTE Reference in ISO 1401 to ISO 7326:1999, Method 1 is the same as ISO 7326:2006, Method 1.

4.6 Filters

4.6.1 Spray liquid going to the nozzles shall be filtered on the pressure side. The mesh width of these filters shall correspond with the size of nozzle to be used according to the recommendation of the nozzle manufacturer.

Filters shall be marked in such a way that they can be identified. Identification can be achieved directly or from information given in the instruction handbook, e.g. by marking of filters with:

— the mesh width; or

— colour coding according to ISO 19732.

Compliance shall be checked by inspection.

4.6.2 Filters shall be installed at a freely accessible place. The operator shall be capable of removing and cleaning the filter, while wearing appropriate protective gloves, and without being contaminated by spray liquid or causing environmental contamination.

Compliance shall be checked by inspection and function test.

4.7 Spray lance and nozzles

4.7.1 It shall be possible to adjust the spray characteristics to the different application conditions to minimize the use and/or environmental impact of plant protection products by mounting nozzles of dimensions complying with ISO 8169. Horizontal booms with flat fan nozzles shall have nozzle mountings complying with ISO 10626.

Compliance shall be checked by inspection.

4.7.2 The spray lance shall provide a sufficient distance from the operator to the spray. The distance from the front of the hand grip to the nozzle shall be at least 500 mm.

Compliance shall be checked by measurement.

4.7.3 The nozzle shall be protected from external clogging during storage and filling of the sprayer, for instance by a spray lance parking device.

Compliance shall be checked by inspection and function test.

4.7.4 Nozzles fitted to or supplied with the sprayer shall give a flow rate of ± 10 % of the nominal value given by the nozzle manufacturer.

Compliance shall be tested according to ISO 5682-1.

4.7.5 If the spray lance is equipped with a horizontal boom fitted with flat fan nozzles, the deviation of flow rate shall not exceed 10 % between nozzles when mounted on the boom.

Compliance shall be tested according to ISO 5682-1.

4.7.6 Nozzles shall be marked in such a way that they can be identified directly or from information given in the instruction handbook. At least type and size shall be indicated where appropriate.

Compliance shall be checked by inspection.

5 Specific requirements for lever-operated knapsack sprayers

5.1 General

5.1.1 The sprayer shall remain functional after a defined drop.

Compliance shall be tested according to ISO 19932-2:2013, 6.2.

5.1.2 After the drop test and the pressure test defined by ISO 19932-2, the total volume of leakage shall not exceed:

— 0 ml in upright position;

— 0,5 ml in 45° position;

— 5 ml in horizontal position.

Compliance shall be tested according to ISO 19932-2:2013, 5.5.

5.2 Spray tank

5.2.1 Spray tanks shall have a pressure compensation means.

Compliance shall be checked by inspection.

5.2.2 The total volume of the spray tank shall exceed the nominal volume by at least 5 % of the nominal volume.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.5.

5.2.3 To avoid spillage during filling, the diameter of the filling opening shall be at least 100 mm. The filling opening shall have a filling filter with a mesh width between 0,5 mm and 2 mm.

Compliance shall be checked by measurement.

5.2.4 The spray tank filling opening shall be fitted with a lid which shall be able to be opened and closed without the use of a tool and be fitted with a holding device ensuring a closed position by means of a positive action (for example fixed by screwing) to avoid unintended loosening. The lid shall be fixed to the sprayer with a holding device.

Compliance shall be checked by inspection.

5.2.5 The space between the spray tank filling opening and the filling filter, as well as openings within the filling filter, shall not exceed 2 mm in diameter.

Compliance shall be checked by measurement.

6 Specific requirements for engine- or motor-driven knapsack sprayers

6.1 General

6.1.1 After the pressure test defined by ISO 19932-2, the total volume of leakage shall not exceed:

— 0 ml in upright position;

— 0,5 ml in 45° position;

— 5 ml in horizontal position.

Compliance shall be tested according to ISO 19932-2:2013, 5.5.

6.2 Spray tank

6.2.1 Spray tanks shall have a pressure compensation means.

Compliance shall be checked by inspection.

6.2.2 The total volume of the spray tank shall exceed the nominal volume by at least 5 % of the nominal volume.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.5.

6.2.3 To avoid spillage during filling, the diameter of the filling opening shall be at least 100 mm. The filling opening shall have a filling filter with a mesh width between 0,5 mm and 2 mm.

Compliance shall be checked by measurement.

6.2.4 The spray tank filling opening shall be fitted with a lid which shall be able to be opened and closed without the use of a tool and be fitted with a holding device ensuring a closed position by means of a positive action (for example fixed by screwing).

Compliance shall be checked by inspection.

6.2.5 It shall be possible to fully empty the sprayer tank of engine-driven sprayers without inverting. The amount of liquid remaining in the tank shall not exceed 50 ml.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.7.

6.2.6 The space between the spray-tank-filling opening and the filling filter, as well as openings within the filling filter, shall not exceed 2 mm in diameter.

Compliance shall be checked by measurement.

6.3 Controls

6.3.1 For engine-driven sprayers, an engine starting device shall be provided to allow starting of the engine without the need for separate, independent auxiliary assistance (for example belts or cables). If the engine is fitted with an electric starting device, two or more independent and dissimilar motions shall

be required to engage the device. The sprayer shall be fitted with an engine-stopping device by which the engine can be brought to a full stop and that does not depend on sustained manual effort for its operation.

Compliance shall be checked by inspection and function test.

6.3.2 The sprayer shall be equipped with a pressure-relief device that prevents pressurization of the sprayer beyond the maximum working pressure prescribed by the manufacturer plus 20 %. If the device operates, it shall reseal to allow normal operation of the sprayer without leakages.

Compliance shall be checked by inspection and function test.

6.4 Power-driven components

Engine or motor-driven sprayers shall be constructed to ensure that access to power-driven components such as pulleys, shafts, gears and flywheels, and to drive belts and chains is prevented. For openings, e.g. in covers and in guards preventing access to dangerous parts, the safety distances shall be in accordance with ISO 13857:2008, Table 4.

Compliance shall be checked by inspection and measurement.

6.5 Fuel tank

6.5.1 Fuel caps shall have a retainer. Fuel tanks shall have a ventilation system.

Compliance shall be checked by inspection.

6.5.2 Fuel-tank openings shall be at least 20 mm in diameter, and the oil-tank opening (if any) shall be at least 15 mm in diameter.

Compliance shall be checked by measurement.

6.5.3 The design of the fuel-tank assembly shall be such that no leakage occurs in any operating and transport position at normal operating temperature.

Compliance shall be checked by inspection and function test.

6.6 Hot parts

The engine and silencer or parts in direct contact with them shall be guarded so that they are not accessible to unintentional contact during normal operation of the sprayer. If hot parts are accessible, they shall not have a contact area greater than 10 cm^2. They shall be considered as accessible if they can be reached by the test cone shown in Figure 1.

NOTE 1 EN 14930 specifies requirements on determination of inadvertent accessibility of hot surfaces of machinery.

The temperature of accessible parts shall not cause a hazard to the operator. There shall be no hot surfaces greater than 10 cm^2 with a temperature greater than the threshold values given for 0,5 s contact period in ISO 13732-1.

NOTE 2 Examples of protective measures against burns are specified in ISO 13732-1:2006, Annex E.

Compliance shall be checked by measurement.

Dimensions in millimetres

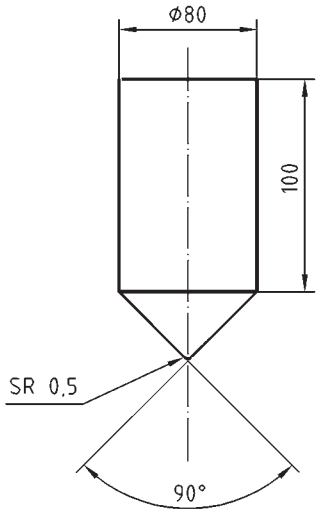

Figure 1 — Test cone

6.7 Exhaust system

Exhaust outlets shall be located so as to direct exhaust emissions away from the operator in the normal operating position.

Compliance shall be checked by inspection.

6.8 Parts under high voltage

All parts of the engine or motor which are under high voltage shall be insulated so that the material under high voltage cannot be touched.

Compliance shall be checked by inspection.

6.9 Electromagnetic immunity

All electronic components used in the systems to control the machine shall meet the acceptance criteria in ISO 14982:1998, 6.3 and 6.6 concerning electromagnetic immunity of the machine.

Compliance shall be tested according to ISO 14982:1998.

6.10 Noise

Noise reduction shall be an integral part of the design process thus specifically taking into account measures at source.

The success of the applied noise reduction measures are assessed on the basis of the actual noise emission values. The main sources causing and influencing noise are generally the engine cooling system, engine exhaust system, pumps and vibrating surfaces.

The A-weighted emission sound pressure level at the operator's position and the A-weighted sound power level shall be measured and calculated at full load speed in accordance with ISO 22868:2011, Annex E.

6.11 Vibration

Vibration reduction shall be an integral part of the design process thus specifically taking into account measures at source.

The success of the applied vibration reduction measures are assessed on the basis of the actual vibration total values for each handle. The main sources causing and influencing vibration are generally the dynamic forces from engine, unbalanced moving parts, clutch, bearings, pumps and other mechanisms and the interaction between operator and the sprayer.

Besides measures to reduce vibration at source, technical measures such as isolators and resonating masses shall be used to isolate, when appropriate, the vibration source from the handle.

7 Specific requirements for compression sprayers

7.1 General

7.1.1 The sprayer shall remain functional after the specified drop test.

Compliance shall be tested according to ISO 19932-2:2013, 8.2.

7.1.2 The sprayer shall not leak in any position.

Compliance shall be tested according to ISO 19932-2:2013, 5.5.

7.2 Harness

A double shoulder harness shall be provided for all sprayers exceeding a mass of 15 kg.

Sprayers having a mass of 15 kg or less shall at least be provided with a single shoulder harness.

Compliance shall be checked by inspection.

7.3 Spray tank

7.3.1 Sprayers shall be equipped with an integrated filling funnel with an upper diameter of at least 100 mm or it shall be possible to affix such a funnel. If an integrated funnel is not provided, a separate funnel shall be supplied with the sprayer and this information shall be given in the instruction handbook. Filling filters, integrated in the funnel or provided separately, shall have a mesh width of 0,5 mm to 2 mm.

Compliance shall be checked by measurement.

7.3.2 The total volume of the spray tank shall exceed the nominal volume by at least 25 % of the nominal volume.

Compliance shall be tested according to ISO 19932-2:2013, 5.3.5.

7.3.3 The spray tank shall be equipped with a pressure-relief device that prevents pressurization of the spray tank beyond the maximum working pressure prescribed by the manufacturer plus 20 %. The device shall reseal to allow normal operation of the sprayer without leakage.

Compliance shall be checked by inspection and function test.

8 Information for use

8.1 Instruction handbook

8.1.1 General

The sprayer shall be supplied with information about the use for which it is designed or has been tested and about conditions necessary to ensure that it will minimize any risks to the operator and the environment when it is being filled, adjusted, used, cleaned or maintained.

For the information to be provided to the user the content of this clause together with ISO 12100:2010, 6.4, apply.

It shall be stated that the sprayers shall be used only with plant protection products approved by local/national regulatory authorities for plant protection products for use with knapsack sprayers.

Comprehensive instruction and information on all aspects of operator/user maintenance and the safe use for the sprayer, including safety clothing and personal protective equipment (PPE) requirements and the need for training in all operations shall be provided in the instruction handbook. In particular, the following information shall be included:

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

b) transport, handling and storage of the sprayer, such as securing the sprayer during transport to prevent loss of fuel, damage or injury;

c) commissioning of the sprayer, such as:

   1) assembling instructions, initial adjustments and checks;

   2) consequences of improper maintenance, use of non-conforming components and removal of safety devices;

   3) explanation of symbols and safety signs;

   4) filling of fuel and oil (if any), especially concerning fire precautions;

   5) charging the battery (if any);

d) the use of the sprayer, such as:

   1) application of the sprayer and how it is intended to be used, including prohibited uses;

   2) a description, identification and nomenclature of principal parts, including the safety devices, environmental control devices and harness, together with an explanation of their functions;

   3) operating instructions, including the use of personal protection equipment (PPE), which shall include the type of PPE to be used with the sprayer;

   4) the need for adequate training on safe use;

   5) a warning against the use of the sprayer while tired, ill or under influence of alcohol or other drugs or medicaments;

   6) hazards which may be encountered while using the sprayer and how to avoid them while doing typical tasks including the advice to direct the spray lance downwind from the operator;

   7) starting and stopping, with particular reference to safety and environmental control;

   8) warning about the emission exhaust gases and the danger of starting and running the engine in a closed room;

9) an explanation of symbols and safety signs;

10) the operating methods to be followed in the event of accidents or blockages that are likely to occur to enable the equipment to be safely unblocked;

11) ways which experience has shown that the sprayer ought not to be used.

e) the restarting of the sprayer after wintering;

f) methods for adjusting the pressure including details of adjustments to be made to the sprayer when various nozzles or pressure regulators are used;

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

h) recommendations concerning precautions to be taken against contact with and/or inhalation of hazardous chemicals, e.g. the wearing of personal protective equipment, handling of spray lance or boom at each of the following stages of use:

1) filling of the spray tank with chemicals;

2) spraying;

3) adjustments, including precautions to avoid contamination of environment, operator or bystanders, for instance in case of shortening telescopic spray lances;

4) draining of the spray tank and cleaning;

5) changing of chemicals;

6) servicing;

i) maintenance instructions, such as:

1) specifications of the spare parts to be used, when these affect the health and safety of operators and/or the environment, e.g. nozzles, filters, gaskets, handle, hose, couplings and anti-drip device;

2) servicing and replacement tasks for the user;

3) drawings or diagrams to allow user maintenance and for fault finding tasks;

j) additional equipment or attachments for the sprayer according to the intended use;

k) mixing and filling and precautions to be taken to avoid contamination of the environment;

l) conditions of use and the corresponding adjustment of the machine. The nominal flow rate, maximum working pressure and optimum working pressure shall be specified for all nozzles supplied with the sprayer;

m) avoiding drift taking into account different parameters such as nozzles, pressure, boom height, wind speed, etc.;

n) the volume of total residual;

o) emptying and cleaning;

p) checking the volume application rate;

q) the range of types and sizes of nozzles and filters that can be used;

r) intervals for checking the machine;

s) restriction on use of plant protection products;

t) necessary preparations for different conditions of use;

u) possibilities of connecting to other equipment and the necessary precautions;

v) checking the sprayer;

w) sprayer flow rate for each nozzle/pressure regulator combination. In case of adjustable nozzles, spray liquid output shall be specified for at least two settings.

When nozzles can be replaced, advise the user of the correct filters recommended by the nozzle manufacturer.

The importance of reading the instruction handbook thoroughly before using the sprayer shall be stressed on the front page of the instruction handbook. The instructions shall take into account that the sprayer could be used by a first time inexperienced operator.

8.1.2 Technical data

8.1.2.1 The following technical information shall be made available for each model and/or mark where significant differences occur:

a) Gross mass:

   1) empty; kg;

   2) full; kg;

b) Nominal spray-tank capacity: l.

8.1.2.2 If there is an engine, the following technical information shall also be included:

a) Nominal fuel-tank capacity: l;

b) Nominal oil-tank capacity: l;

c) Engine displacement: cm^3;

d) Maximum engine performance (in accordance with ISO 8893): kW;

e) Engine speed (rotational frequency) at racing: min^{-1};

f) Noise levels (in accordance with ISO 22868).

8.2 Marking

All sprayers shall be marked legibly and indelibly with the following minimum information:

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

   — The address can be simplified as long as the manufacturer (and where applicable, his authorized representative) can be identified.

   — In any event, the address shall be sufficient for mail to reach the company;

— year of construction, i.e. the year in which the manufacturing process was completed;

— designation of series or type;

— designation of machinery;

— serial number, if any;

— empty mass in kilograms;

— nominal volume of the spray tank, in litres.

8.3 Warnings

All controls shall be marked with a symbol in accordance with ISO 3767-5, if applicable. Symbols relating to safety shall be in accordance with the requirements of ISO 11684 and with the shape and colours requirements of ISO 3864-1.

The sprayer shall be marked with the following warnings by text or pictorials, indicating:

— “Wear eye protection (goggles or face shield)”;

— “Wear respiratory protection and appropriate protective clothing”;

— “Read the instruction handbook”;

— “Keep bystanders away when spraying”;

— “Wear ear protection” if the sprayer is engine-driven.

Marking shall be located in a readily visible position on the sprayer and shall resist the anticipated service conditions, such as the effects of spray liquids, temperature, moisture, petrol, oil abrasion and weathering exposure.

Annex A
(informative)

List of significant hazards

Table A.1 specifies the significant hazards, significant hazardous situations and significant hazardous events that have been identified as being significant to the types of machines covered by this standard and which require specific action by the designer or manufacturer to eliminate or reduce the risk.

Table A.1 — List of significant hazards, hazardous situations and events associated with knapsack sprayers

Ref. N°	Hazard	Subclause of this part of ISO 19932
1	ergonomic (unhealthy postures, excessive efforts, excessive loads)	4.1, 4.2, 4.4, 7.2
2	operator contact with chemicals	4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 5.1, 6.1, 6.2, 6.5, 7.1, 7.3
3	related to power driven components (trapping or drawing-in)	6.3, 6.4
4	related to high pressure	4.1, 6.3
5	thermal (contact with hot surfaces)	6.6
6	electrical (contact with parts under high voltage)	6.8
7	fire and explosion (fuel)	6.5
8	operator contact with exhaust gases	6.7
9	leakage	4.1, 4.3, 5.2, 6.1, 7.1
10	control and monitoring of application	4.3, 4.4, 4.7, 5.2, 6.3
11	filling and emptying of the sprayer	4.1, 4.3, 5.2, 6.2, 7.3
12	application rate	4.1, 4.4, 4.7, 5.2
13	distribution, deposition and drift of chemicals	4.7, 5.2
14	noise	6.10
15	vibration	6.11
16	loss of chemicals during stoppage	4.1
17	cleaning of sprayer	4.1, 4.3, 4.6, 5.2
18	servicing of sprayer	4.4, 4.6

Bibliography

[1] ISO 7326, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

[2] ISO 22867:2011, *Forestry and gardening machinery — Vibration test code for portable hand-held machines with internal combustion engine — Vibration at the handles*

[3] ISO 28139:2009, *Agricultural and forestry machinery — Knapsack combustion-engine-driven mistblowers — Safety requirements*

[4] EN 837-1:1996, *Pressure gauges — Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

[5] EN 14930, *Agricultural and forestry machinery and gardening equipment — Pedestrian controlled and hand-held machines — Determination of accessibility of hot surfaces*

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