
**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

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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.

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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*

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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

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

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3.1 knapsack sprayer

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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 $\pm 15\%$ 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 $8,5^\circ (\pm 0,2^\circ)$ 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.

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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 $\pm 10\%$ 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 <https://standards.iteh.ai/catalog/standards/sist/3ace8021-0610-4c84-810c-8f95948e3cf0/iso-19932-1-2013>

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.