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Equipment for crop protection — Knapsack sprayers —

Part 1: Requirements and test methods

Matériel de protection des cultures — Pulvérisateurs à dos —

Partie 1: Exigences et méthodes d'essai

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Foreword

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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.

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ISO 19932-1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

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

— *Part 1: Requirements and test methods*

— *Part 2: Performance limits*

Introduction

The application of crop protection chemicals with knapsack sprayers needs to take into consideration biological, economic, environmental and operator issues, as well as the suitability of the sprayer.

The aim of ISO 19932 is to specify requirements, test methods and performance limits for equipment in order to ensure safe use.

Implementation of ISO 19932 should achieve minimal exposure levels to the operator and avoid unnecessary waste of pesticides into the environment.

Equipment for crop protection — Knapsack sprayers —

Part 1:
Requirements and test methods

1 Scope

This part of ISO 19932 specifies the requirements and test methods for manually operated knapsack sprayers with a nominal tank volume of 5 l or more. It is applicable to lever-operated knapsack sprayers and knapsack compression sprayers for their intended use in, for example, agriculture and horticulture.

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 5681, *Equipment for crop protection — Vocabulary*

3 Terms and definitions

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

3.1
nominal volume
volume indicated by the maximum filling level marked on the sprayer tank without any operation of the sprayer

NOTE 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.

4 Test liquids and equipment

4.1 **Water**, clean and free from solids.

4.2 **Test liquid**, consisting of water with a known concentration of tracer.

Both colorimetric and fluorimetric tracers can be used to simulate pesticide solutions for the purpose of quantifying spray liquid leaks and deposits. The concentration of such solutions, instrumentation used and removal techniques shall be appropriate to the tracer selected for these measurements.

4.3 **Colorimeter or fluorimeter**, able to determine the concentration of the tracer.

4.4 **Preconditioning device**, permitting the sprayer to be fixed and the sprayer pump lever to operate continuously. The stroke and frequency shall be adjustable.

4.5 Shut-off valve test device, consisting of a frame for fixing the hand-held part of the valve and a unit for moving the valve lever in order to open it periodically with an induced flow at the prescribed rate and pressure. The stroke shall be adjustable.

4.6 Strap test device, capable of dropping the sprayer, vertically guided, onto each strap from a height of 200 mm using a horizontal restraining bar 75 mm in diameter. The device is to be capable of testing sprayers with one or two upper and/or lower fixing points.

An example is given in Annex A. Other devices with equivalent performance may be used.

4.7 Impact test device, used to drop the upright sprayer, vertically guided, onto a flat, level surface, 50 mm thick × 800 mm × 800 mm and made of high density polythene (PEHD), placed on a flat, level floor.

The device shall not affect the impact force of the dropped sprayer.

An example is given in Annex B. Other devices with equivalent performance may be used.

4.8 Filling device, by which the volume and flow of water or test liquid can be controlled and adjusted.

An example is given in Annex C. Other devices with equivalent performance may be used.

4.9 Weighing devices:

a) device with the ability to weigh up to 25 kg with a maximum error of ± 1 g;

b) device with the ability to weigh up to 2 kg with a maximum error of ± 0,1 g.

4.10 Measuring cylinders, permitting measurement of volumes of up to 1 l with a maximum error of ± 10 ml.

4.11 Timer (stop watch), with a maximum error of ± 0,5 s for measuring periods up to 5 min.

4.12 Pressure supply device, used to set the sprayer under pressure using air or water. The pressure shall be adjustable up to 1 MPa (10 bar) with a maximum error of ± 5 % of the measured value.

4.13 Pressure gauge, used to measure between 0 MPa and 2 MPa (20 bar) with a maximum error of ± 0,12 kPa (0,12 bar).

4.14 Polythene bags, of size 30 cm × 40 cm.

4.15 Polythene sheets, of size 2 m × 1 m.

5 Tests

5.1 General

The tests shall be performed on one new specimen of the sprayer type at an air temperature of 10 °C to 30 °C and relative air humidity of at least 50 %, with no influence of wind or sunlight and, for lever-operated sprayers, after preconditioning according to 5.2.

Assemble the knapsack sprayer in accordance with the instruction handbook. Inspect for tightness the filling cap, gland nut and other operator-controlled couplings. Weigh the complete empty sprayer using a device according to 4.9 a) and register the mass in grams (g).

5.2 Preconditioning of lever-operated sprayers

Attach the lever-operated sprayer by its straps to a device according to 4.4. Fill the spray tank with water to at least 75 % of its nominal volume.

Activate the lever with a frequency of maximum of 35 strokes/min such that a spray is provided that corresponds to the optimum spray pressure specified in the instruction handbook. If no such information is given in the instruction handbook, perform the preconditioning at (300 ± 20) kPa [(3 ± 0,2) bar]. Refill the spray tank when the water level has dropped to about 5 % of the nominal tank volume. Continue this procedure for 25 h.

5.3 Functional tests

5.3.1 Shut-off valve reliability

Detach the shut-off valve assembly with the spray lance from the sprayer and mount it on a device in accordance with 4.5. Connect the shut-off valve to a pressurised water supply of (300 ± 20) kPa [(3 ± 0,2) bar]. Fully activate the shut-off valve using a frequency of (15 ± 5) cycles/min for a total duration of 25 000 cycles. Inspect and record any leakage.

5.3.2 Sprayer output

The output rate of the sprayer for each type/number(s) of nozzles supplied shall be measured with a maximum error of 1 % at the optimum spray pressure or setting specified in the instruction handbook. If there is no such information in the instruction handbook then the test shall be done at (300 ± 20) kPa [(3 ± 0,2) bar]. Record the sprayer output rates and calculate the percentage deviation, expressed in percent, from the values specified in the instruction handbook as

$$\text{Deviation} = \frac{\text{measured output rate}}{\text{specified output rate}} \times 100$$

5.3.3 Straps and their fixation points

WARNING — This test has some element of risk. All personnel shall either be kept out of the test area or otherwise protected from hazards such as thrown objects.

Fill the spray tank with water so that the total mass of the sprayer is 7 kg ± 10 g. Attach the sprayer to a device conforming with 4.6, so that each load-carrying strap can be tested individually. From the position at which the sprayer is carried by a strap on the device, lift the sprayer vertically 200 mm and let it drop. Repeat this 10 times for each load-carrying strap.

Inspect for damage.

NOTE The test with a 7 kg sprayer mass represents a safety factor of 5 in respect of the maximum load expected to be applied on a strap by operator handling of the sprayer.

5.3.4 Volume of external surface deposit

5.3.4.1 General

This test shall be carried out on a complete, empty sprayer.

Wash all external surfaces of the sprayer with a non-ionic surfactant aqueous solution of 0,5 % and then dry the sprayer.

Put the lever and spray lance in the parked position. Remove the lid or the air pump. Place the filter basket in a polythene bag and fit it into the filling orifice so that the bag follows the shape of the basket.

For compression sprayers, fit a rubber bung into the filling orifice or, where an integral filling funnel is provided, seal this funnel's opening by stretching plastic film across it.

Set the sprayer over a container which can handle a volume at least equal to the nominal spray tank volume.

Position a filling device according to 4.8 with its outlet placed 100 mm above the filling opening such that it simulates overfilling. The sprayer shall be positioned with its straps opposite the filling device and with the line connecting the upper strap fixing points orientated perpendicularly to the axis of the filling device (see Annex C). The impact point of the test liquid shall be the middle of the filling opening.

Fill the filling device with a volume of test liquid or water to its maximum volume without overspill and continue according to 5.3.4.2 or 5.3.4.3.

5.3.4.2 Determination using test liquid

Pour a volume of test liquid that equates to the nominal spray tank volume from the filling device onto the closed filling opening of the sprayer such that it simulates overfilling. The flow rate shall be such that the nominal tank volume will be poured within 60 s with a maximum deviation of 10 %.

Remove the filling device and replace the container with collected test liquid with a dry container free from any tracer. This second container shall have the capacity which is at least equal to the volume of water selected to be used in the washing of the sprayer.

Wash the external surface of the sprayer with water until all deposits of tracer have been removed. Determine the amount of collected washing water using a device according to 4.9 a). Determine the tracer concentration in the washing water using a device according to 4.3.

Calculate the external surface deposit, V_D, using the following equation:

$$V_D = V_W \times \frac{C_W}{C_T}$$

where

V_W is the collected washing water in millilitres (ml);

C_T is the selected concentration of tracer in the test liquid;

C_W is the concentration of the tracer in the washing water.

The concentration of the tracer in the test liquid and the amount of washing water shall be chosen such that the external surface deposit can be determined with a maximum error of ± 1 ml.

5.3.4.3 Determination using water

Pour a volume of water that equates to the nominal spray tank volume from the filling device onto the closed filling opening of the sprayer such that it simulates overfilling. The flow rate shall be such that the nominal tank volume will be poured within 60 s with a maximum deviation of 10 %.

Remove the polythene bag and the rubber bung immediately after pouring the water and weigh the sprayer together with the lid or the air pump, using a device according to 4.9 a).

Determine the amount of external surface deposit as the difference in mass between the sprayer after water has been poured over it and the mass registered in 5.1.

5.3.5 Volume of total residual liquid

This test shall be carried out on a complete, empty sprayer.

Fill the spray tank with water to its nominal volume and fix it to a structure in operating position. For lever-operated sprayers, a device according to 4.4 may be used.

Sprayers carried with two straps shall normally be fixed vertically, while single-strap sprayers shall be inclined according to the strap–sprayer configuration.

The lance with hose shall be fixed in a horizontal position at the same level as the lowest part of the sprayer. Spray with the biggest nozzle supplied, at the optimum spray pressure specified in the instruction handbook. If no such information is provided in the instruction handbook, perform the test at (300 ± 20) kPa [(3 ± 0,2) bar].

For compression sprayers, close the shut-off valve when the spray fan collapses even if there is at least 100 kPa (1 bar) working pressure in the tank.

For lever operated sprayers, give five additional full pump lever strokes immediately after the spray fan collapses or the spray pressure drops below 100 kPa (1 bar) and then close the shut-off valve

Weigh the sprayer using a device according to 4.9 a).

Determine the amount of total residual liquid as the difference between the mass of the sprayer after test and the mass registered in 5.1.

5.3.6 Stability

Position the empty knapsack sprayer on a flat hard surface with an incline of 10° (= 5,7 %) so that the load-carrying straps are facing down the slope. Set the lever and lance in parked position. If there is no parked position, set the lever in its highest position and the lance down the slope.

Check the stability of the knapsack sprayer by rotating it by 90°.

Repeat the test with the spray tank filled to nominal volume.

Register any tendency to instability.

5.3.7 Contents gauge scale and total volume

Place the empty knapsack sprayer in upright position on a flat, horizontal surface with the lever in the parked position.

Measure and register the volume between the marks filling the spray tank using a measuring cylinder according to 4.10 or using a device according to 4.9 a). Continue until the spray tank is filled to its nominal volume.

Determine the scale error, E, as a percentage, using the following equation:

$$E = \frac{V_S - V_m}{V_S} \times 100$$

where

V_S is the volume according to spray tank scale, in millilitres (ml);

V_m is the measured volume of water filled into the tank, in millilitres (ml).