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Equipment for crop protection — Knapsack sprayers —

Part 2: Test methods

Matériel de protection des cultures — Pulvérisateurs à dos —

Partie 2: Méthodes d'essai

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Foreword

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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

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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 19932-2, together with ISO 19932-1, cancels and replaces ISO 19932-1:2006 and ISO 19932-2:2006, which have been technically revised.

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 test methods for the verification of requirements for equipment to ensure safe use and protect the environment.

Implementation of parts 1 and 2 of ISO 19932 should achieve an appropriate level of operator safety and avoid unnecessary dispersal of plant protection products into the environment.

Equipment for crop protection — Knapsack sprayers —

Part 2: Test methods

1 Scope

This part of ISO 19932 specifies test methods for the verification of requirements of ISO 19932-1 for knapsack sprayers carried on the back or shoulder of the operator for use with plant protection products.

It is applicable to lever-operated knapsack sprayers, knapsack compression sprayers and knapsack sprayers driven by an engine or electric motor using hydraulic pressure atomization 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 covered by ISO 28139.

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

ISO 19932-1:2013, *Equipment for crop protection — Knapsack sprayers — Part 1: Safety and environmental requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5681 and ISO 19932-1 apply.

4 Test liquids and equipment

4.1 Water, clean and free from solids.

4.2 Preconditioning device, allowing holding of the sprayer and the operation of the lever-operated knapsack sprayer pump lever continuously. The stroke and frequency shall be adjustable. An example is given in Annex A.

4.3 Shut-off device test equipment, consisting of a frame to fix the hand-held part of the shut-off device and a unit for moving the shut-off device control, e.g. valve lever, to open it periodically with an induced flow at the prescribed rate and pressure. The stroke shall be adjustable. An example is given in Annex B.

4.4 Strap test device, capable of dropping the sprayer, vertically guided, onto each strap from a height of 200 mm using a horizontal restraining bar that is 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 C. Other devices with equivalent performance can be used.

WARNING — This test device presents an element of risk when the test is underway. All personnel shall either be kept out of the test area or otherwise protected from hazards such as parts displaced from the sprayer on test.

4.5 Drop test device, to drop the upright sprayer, vertically guided, from a height of (600 ± 20) mm onto a flat level surface, 800 mm x 800 mm x 50 mm in height, made of high density polythene (HDPE) or hard wood placed on a flat level floor. The device shall not affect the impact force of the dropped sprayer. An example is given in Annex D. Other devices with equivalent performance can be used.

4.6 Filling device, by which the volume and flow of water or test liquid can be controlled and adjusted. An example is given in Annex E. Other devices with equivalent performance can be used.

4.7 Weighing devices, with the ability to weigh up to:

a) 25 kg with a maximum error of ± 1 g;

b) 2 kg with a maximum error of ± 0,1 g.

4.8 Measuring cylinder, for measuring volumes of up to 1 l with a maximum error of ± 10 ml.

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

4.10 Pressure supply device, to place the sprayer under pressure using air or water. The pressure shall be adjustable up to 10 bar with a maximum error of ± 5 % of the measured value.

4.11 Pressure gauges, to measure between 0 bar and 25 bar with a maximum error of ± 0,15 bar (equivalent to a class 0,6 pressure gauge according to EN 837-1).

4.12 Polythene bags, the size of which shall be at least 30 cm x 40 cm.

4.13 Polythene sheets, the size of which shall be at least 2 m x 1 m.

5 General

5.1 Test conditions

The tests shall be performed with one new specimen of the sprayer type at an air temperature of 10 °C to 30 °C and relative air humidity of at least 30 %, with no influence of wind or sunlight.

5.2 Sprayer

Assemble the knapsack sprayer in accordance with the instruction handbook. Inspect for tightness of the filling cap, gland nut and other operator controlled couplings. Weigh the complete empty sprayer using a weighing device [4.7 a)] and record the mass in kilograms.

5.3 Functional tests

5.3.1 Shut-off device reliability

Detach the shut-off device assembly with the spray lance from the sprayer and mount it on a frame (4.3). Connect the shut-off device to a pressurized water supply of (3 ± 0,2) bar. Fully activate the shut-off device using a frequency of (15 ± 5) cycles/min for a total duration of 25 000 cycles. Inspect functionality and record any leakage occurring within 1 min ± 5 s after completion of the last cycle.

5.3.2 Spray liquid output

The spray liquid output rate q_m of the sprayer for each combination of nozzle/pressure regulator supplied for use with the sprayer shall be measured with a maximum error of ±1 % at the optimum spray pressure specified in the instruction handbook or at the setting specified in the instruction handbook.

Record the spray liquid output and calculate the percentage deviation σ from the values q_s specified in the instruction handbook using the following equation:

$$\sigma = \frac{q_m}{q_s} \times 100\,\%$$

5.3.3 Load carrying straps and their fixation points

WARNING — This test has an element of risk. All personnel shall either be kept out of the test area or otherwise protected from hazards such as parts displaced from the sprayer on test.

Fill the spray tank with water so that the total mass of the sprayer is 7 kg ± 10 g. If the empty mass of the sprayer is over 7 kg the test shall be carried out with the sprayer empty and if the maximum mass of the sprayer filled to the nominal volume is below 7 kg record the mass and test at this mass. Attach the sprayer to a strap test device (4.4) so that each load carrying strap can be tested individually. From the position where the sprayer is carried by a strap in the device, lift the sprayer vertically (200 ± 20) mm and let the sprayer drop. Repeat this 10 times for each load carrying strap.

Inspect for damage.

5.3.4 Stability

Position the empty sprayer on a flat hard surface with an incline of 8,5° ± 0,2° so that the load carrying straps are facing down the slope. Set any lever and the lance in their park position. If there are no park positions, set the lever in its highest position with the lance down the slope.

Check the stability of the sprayer by rotating it at 90° intervals.

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

Record any position in which the sprayer is not stable.

5.3.5 Contents gauge scale and total volume

Place the empty sprayer in an upright position on a flat horizontal surface with any lever in the park position.

Measure and record the volume between the graduations on the spray tank contents gauge scale when filling the spray tank using a measuring cylinder (4.8) or using a device (4.7). Continue until the spray tank is filled to its nominal volume.

Determine the scale error E in percentage using the following equation:

$$E = \frac{V_s - V_m}{V_s} \times 100\,\%$$

where

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

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

As a second part of the test, fill the spray tank to the upper edge of the filling opening.

For lever-operated sprayer and engine- or motor-driven sprayers, insert the filling filter and close the tank lid.

For compression sprayers, insert and tighten the air pump and remove all liquid from an integrated filling funnel. If the filling opening is situated below any parts of the spray tank, so that air pockets are formed, remove the hose and fill the sprayer through the spray tank outlet opening with air pump mounted.

Weigh the sprayer using a device according [4.7 a)].

Determine the total volume V_t by the difference between the mass of the completely filled sprayer and the mass registered in 5.2.

Calculate the additional volume V_A of the spray tank in percentage using the following equation:

$$V_A = \frac{V_t - V_n}{V_n} \times 100\,\%$$

where V_n is the nominal volume.

5.3.6 Filling rate

This test shall be carried out on a complete sprayer, empty at the start of the test, as described in 5.2.

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

Put any lever and spray lance in the park position. Remove the spray-tank lid or the air pump, as appropriate, but keep the filling filter in position.

Position the sprayer in the centre of a polythene sheet (4.13).

Position a filling device (4.6)with its outlet placed 100 mm above the filling opening. The sprayer shall be positioned with its straps opposite to the filling device with the line connecting the upper strap fixing points orientated perpendicularly to the axis of the filling device (see Annex E). The impact point of the test liquid shall be the middle of the filling opening.

Fill the filling device with a volume of water to its maximum volume without overspill.

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

Wipe off any external residues on the sprayer with a tissue. Determine the amount of splashes as the mass of the collected splashes on the polythene sheet (4.13) and the tissue, considering their tare, using a weighing device [4.7 b)].

5.3.7 Emptying

This test shall be carried out on a complete sprayer, empty at the start of the test, as described in 5.2.

Fill the sprayer with water to its nominal volume. Drain the sprayer in accordance with the instruction handbook. Fill the sprayer again and drain according to the instruction handbook and then weigh it using a weighing device [4.7 a)].

Determine the amount of liquid remaining in the sprayer as the difference between the mass of the drained sprayer and the mass recorded before it was filled with water.

5.3.8 Absorbency of carrying straps

This tests shall be performed at an air temperature of 20 °C to 25 °C and relative air humidity of 50 % to 70 %.

Remove the carrying straps, and any padding and any metal or plastic parts attached to them before immersion (in order to minimize, as far as possible, the dry mass of the straps) and weigh them dry using a weighing device [4.7 b)]. Completely immerse the straps in water for 2 min. Remove the straps from the water, shake off surplus liquid and hang freely to drain for 10 min before re-weighing.

Calculate the mass increase Δm in percentage using the following equation:

$$\Delta m = \frac{m_a - m_b}{m_b} \times 100\,\%$$

where

m_b is the mass before the test;

m_a is the mass after the test.

NOTE The test method will be revised when sufficient data are available.

5.3.9 Test for compatibility of sprayer components

WARNING — Care should be taken when doing this test, as the test liquids are potentially toxic and inflammable.

This test shall be performed at an air temperature of 20 °C to 25 °C and relative air humidity of 50 % to 70 %.

The test is to determine any adverse effects on the material by checking whether it absorbs liquid or whether there is any visible effect (e.g. deformity), change in physical properties (e.g. flexibility) or mass change due to any action of the test liquids on the material.

This test applies to components that come into direct contact with the plant protection product. The samples to be tested shall be complete components (e.g. a whole 'O' ring, a washer, a gasket, a tube), or samples of material of larger components such as the spray tank.

The mass m_b of each sample of material shall be recorded before the test.

The samples shall be tested by immersion in:

a) a 10 % acetone (EC-No: 200-662-2) in distilled water for 72 h; and then

b) a mixture of 50 % regular unleaded gasoline and 50 % diesel for 72 h.

After the immersion period, any surplus liquid shall be wiped from the external surface and the samples dried in air for 24 h. Then, the mass m_a shall be recorded for each sample.

Calculate the mass change Δm in percentage using the following equation for each test liquid:

$$\Delta m = \frac{m_a - m_b}{m_b} \times 100\,\%$$

where

m_b is the mass before the test;

m_a is the mass after the test.

After these tests, any individual component removed from the equipment to conduct the test shall be re-assembled in the sprayer. Check whether the sprayer still functions correctly after reassembly.

5.4 Pressure test

WARNING — This test has an element of risk. All personnel shall either be kept out of the test area or otherwise protected from hazards such as parts displaced from the sprayer on test.

Lever-operated sprayers to be tested shall first have been subjected to the drop test (6.2).

Fill the spray tank with water to its nominal volume. Connect the outlet of the shut-off device to an external pressure supply device (4.10).

Lever-operated sprayers and engine or motor-driven sprayers are tested with the spray-tank lid removed from the filling opening. Compression sprayers are tested with the spray-tank closed with air pump and lid, if any.

Raise the pressure until the pressure relieve valve opens or the pressure level is two times the specified maximum pressure and maintain that pressure for 30 s.

Record the result of the test and the relief valve opening pressure, if applicable.

5.5 Leakage test

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2. The sprayer shall first have been subjected to the pressure test (5.3).

If a handle attached to the tank lid or the air pump is provided with the sprayer, a handle test shall be conducted before testing the leakage. To test the handle, fill the spray tank with water to its nominal volume and close the spray tank opening with the tank lid or the air pump and wipe off all residues of liquid on external surfaces. Attach an additional weight to the sprayer equivalent to its full gross mass. Attach the sprayer with the handle to a frame with the help of a strap of a minimum width of 50 mm and let it freely hang for 2 min. Remove the sprayer from the frame and detach the additional weight.

Pressurize the sprayer to the maximum pressure specified in the instruction handbook and spray for (10 ± 1) s ensuring that no spray liquid contaminates the external surface of the sprayer. Replace the spray nozzle with a blank to block output and wipe off all residues of liquid on external surfaces.

Place the sprayer in an upright position on a polythene sheet (4.13). Allow the sprayer lance with hose and closed shut-off device to hang freely.

Leave the sprayer for (300 ± 5) s and depressurise the tank immediately ensuring there is no leakage.

Repeat the test above twice, first with the sprayer inclined at 45° (strap side facing down) position for (60 ± 1) s and then with the sprayer in horizontal (strap side down) position for (60 ± 1) s.

Examine for leakage for each test separately.

Wipe off any residues on the external surfaces of the sprayer with a tissue.

Determine the amount of leakage as the mass of the collected water on the polythene sheet (4.13) and the tissue, considering their tare, using a weighing device [4.7 b)].

5.6 Centre of gravity

Fill the sprayer tank with water to its nominal volume. Put the sprayer frame with its back part on a weighing device [4.7 a)] and with the front part on fixed points using an angle iron or similar equipment with minimal contact area as shown in Figure 1. Level the sprayer so that the plane through the strap fixing points is vertical. Put the spray lance and pump lever, if any, in the operating position.

Measure the mass m_1 and the distance l and calculate the distance l_c of the centre of gravity using the following equation:

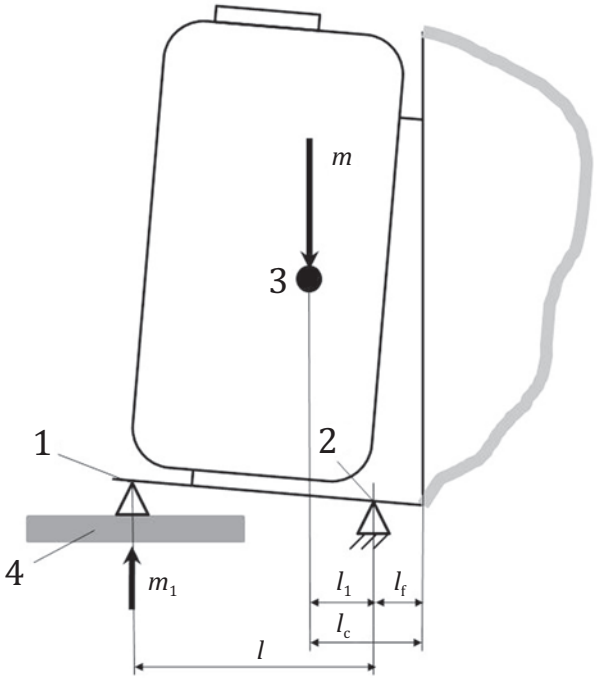
$$l_c = l_1 + l_f$$

$$l_1 = \frac{m_1 \times l}{m}$$

where

m is the full gross mass of the sprayer;

l_f is the distance from the vertical plane through the strap fixing points to the front part fix point.



Key

1 weighing point
2 fixed point
3 centre of gravity
4 weighing balance [4.7 a)]
l_1 distance from weighting point (1) to the front part fix point (2)
l_f distance from the vertical plane through the strap fixing points to the front part fix point

Figure 1 — Determination of the centre of gravity

6 Specific tests for lever-operated knapsack sprayers

6.1 Preconditioning

6.1.1 General

Attach the sprayer by its carrying straps on a preconditioning device (4.2). Fill the spray tank to at least 75 % of the nominal volume with water.

Mount a pressure gauge (4.11) prior to the pressure regulator. Activate the lever with a frequency providing a spray pressure prior to the pressure regulator of (10 to 30) % above the value specified in the instruction handbook. Refill the spray tank when the water level has dropped to about 5 % of the nominal tank volume. Continue this procedure for 25 h.

6.1.2 Volume of the external surface deposit

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2.

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

Weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Put any lever and spray lance in the park position. Remove the spray-tank lid. Put the filling filter into a polythene bag (4.12) and fit it into the filling orifice so that the bag follows the shape of the filter basket.

Set the sprayer over a container which can handle a volume at least equal to 20 % of the nominal spray-tank volume.

Position a filling device (4.6) with its outlet placed 100 mm above the spray-tank filling opening to simulate overfilling. The sprayer shall be positioned with its straps opposite to the filling device with the line connecting the upper strap fixing points orientated perpendicularly to the axis of the filling device (see Annex E). The impact point of the test liquid shall be the middle of the spray-tank filling opening.

Pour a volume of water that equates to 20 % of the nominal spray-tank volume from the filling device onto the closed spray-tank filling opening to simulate overfilling. The flow rate from the filling device shall be such that the nominal tank volume will be poured within 60 s with a maximum deviation of 10 %.

Remove the polythene bag (4.12) immediately after pouring the water and weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Determine the amount of external surface deposit as the mass difference between the sprayer after water has been poured over it and the mass measured previously with a completely empty sprayer.

6.1.3 Volume of total residual liquid

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2.

Weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Fill the spray tank with water to its nominal volume and fix it to a structure in operating position. A preconditioning device (4.2) can be used.

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.

For lever-operated sprayers, give 5 additional full pump lever strokes immediately after the spray fan collapses or the spray pressure drops below 1 bar and then close the shut-off device.

Weigh the sprayer using a weighing device [4.7 a)].

Determine the amount of total residual liquid as the difference between the mass of the sprayer after the test and the mass measured previously with a completely empty sprayer.

6.2 Drop test

WARNING — This test has an element of risk. All personnel shall either be kept out of the test area or otherwise protected from hazards such as parts displaced from the sprayer on test.

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2 as a preparation for the tests in 5.3 and 5.4.

Fill the spray tank to its nominal volume with water.

Attach the sprayer to the drop test device (4.5). Drop the sprayer once from a height of 600 mm.

7 Specific tests for engine- or motor-driven knapsack sprayers

7.1 Volume of external surface deposit

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2.

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

Weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Remove the spray-tank lid. Put the filling filter into a polythene bag and fit it into the filling orifice so that the bag follows the shape of the filter basket.

Set the sprayer over a container which can handle a volume at least equal to 20 % of the nominal spray-tank volume.

Position a filling device (4.6) with its outlet placed 100 mm above the spray-tank filling opening to simulate overfilling. The sprayer shall be positioned with its straps opposite to the filling device with the line connecting the upper strap fixing points orientated perpendicularly to the axis of the filling device (see Annex E). The impact point of the test liquid shall be the middle of the spray-tank filling opening.

Pour a volume of water that equates to 20 % of the nominal spray-tank volume from the filling device onto the closed spray-tank filling opening to simulate overfilling. The flow rate from the filling device shall be such that the nominal tank volume will be poured within 60 s with a maximum deviation of 10 %.

Remove the polythene bag (4.12) immediately after pouring the water and weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Determine the amount of external surface deposit as the mass difference between the sprayer after water has been poured over it and the mass measured previously with a completely empty sprayer.

7.2 Volume of total residual liquid

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2.

Weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Fill the spray tank with water to its nominal volume and fix it to a structure in operating position.

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.

After the spray fan collapses or the spray pressure drops below 25 % of the working pressure, operate the sprayer for an additional 5 s, then close the shut-off device.

Weigh the sprayer using a weighing device [4.7 a)].

Determine the amount of total residual liquid as the difference between the mass of the sprayer after the test and the mass measured previously with a completely empty sprayer.

8 Specific tests for compression sprayers

8.1 Volume test

8.1.1 Volume of external surface deposit

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2.

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

Weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Fit a rubber bung into the filling orifice or, where it is provided with an integral filling funnel, seal across the latter's opening with stretched plastic film.

Set the sprayer over a container which can handle a volume at least equal to 20 % of the nominal spray-tank volume.

Position a filling device (4.6) with its outlet placed 100 mm above the spray-tank filling opening to simulate overfilling. The sprayer shall be positioned with its straps opposite to the filling device with the line connecting the upper strap fixing points orientated perpendicularly to the axis of the filling device (see Annex E). The impact point of the test liquid shall be the middle of the spray-tank filling opening.

Pour a volume of water that equates to 20 % of the nominal spray-tank volume from the filling device onto the closed spray-tank filling opening to simulate overfilling. The flow rate from the filling device shall be such that the nominal tank volume will be poured within 60 s with a maximum deviation of 10 %.

Remove the plastic film or the rubber bung immediately after pouring the water and weigh the sprayer together with the air pump using a weighing device [4.7 a)].

Determine the amount of external surface deposit as the mass difference between the sprayer after water has been poured over it and the mass measured previously with a completely empty sprayer.

8.1.2 Volume of total residual liquid

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2.

Weigh the sprayer together with the spray-tank lid using a weighing device [4.7 a)].

Fill the spray tank with water to its nominal volume and fix it to a structure in operating position.

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.

Close the shut-off valve when the spray fan collapses even though there is at least (1 ± 0,2) bar above the pressure set on the pressure regulator in the tank.

Weigh the sprayer using a weighing device [4.7 a)].

Determine the amount of total residual liquid as the difference between the mass of the sprayer after the test and the mass measured previously with a completely empty sprayer.

8.2 Drop test

WARNING — This test has an element of risk. All personnel shall either be kept out of the test area or otherwise protected from hazards such as parts displaced from the sprayer on test.

This test shall be carried out on a complete sprayer, completely empty at the start of the test, as described in 5.2 as a preparation for the tests in 5.3 and 5.4.

Fill the spray tank to its nominal volume with water. Set the compression sprayer to the maximum nominal pressure specified in the instruction handbook.

Attach the sprayer to the drop test device (4.5). Drop the sprayer once from a height of 600 mm.

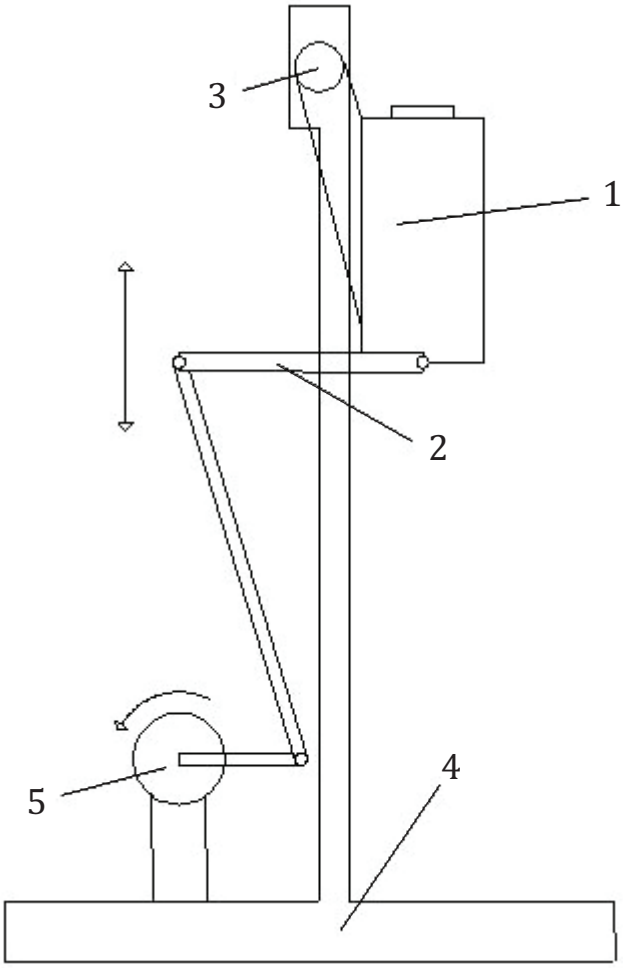
9 Test report

The results of the test shall be stated in a test report. The minimum content is given in Annex F.

Annex A
(informative)

Example of a preconditioning device

See Figure A.1.



Key

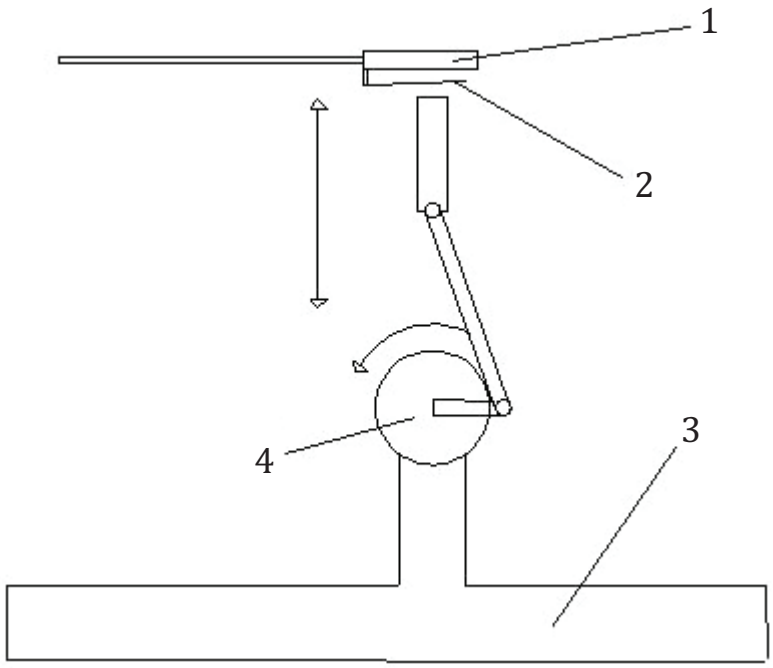
1 sprayer
2 lever of the sprayer
3 straps support
4 test bench frame
5 electric motor

Figure A.1 — Preconditioning device

Annex B
(informative)

Example of a shut-off test device

See Figure B.1.



Key

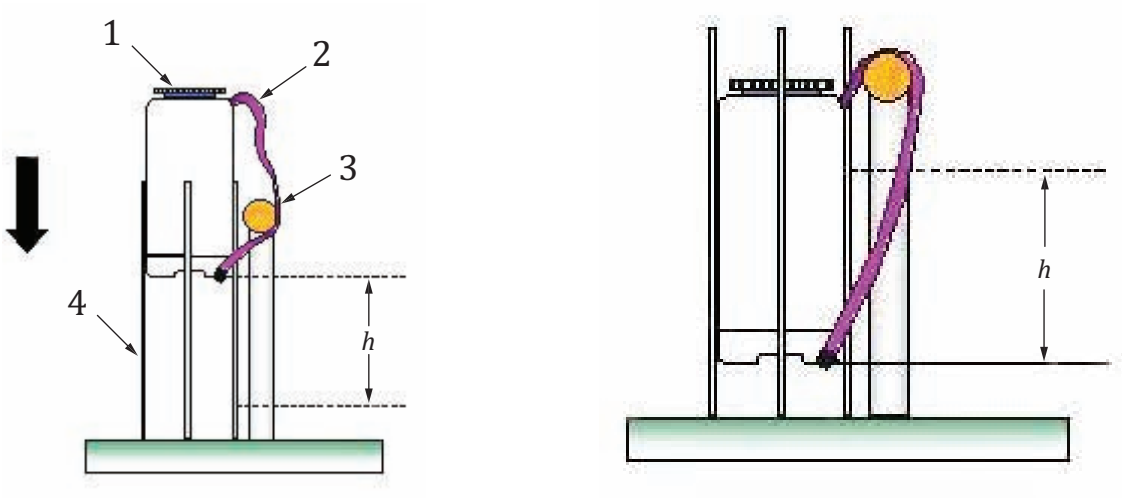
1 spray lance
2 lever of the lance
3 test bench frame
4 electric motor

Figure B.1 — Shut-off test device

Annex C
(informative)

Example of a strap test device

A strap test device is a device capable of applying a controlled and reproducible force to the load carrying straps as shown in Figure C.1.



a) Release position **b) Impact position**

Key

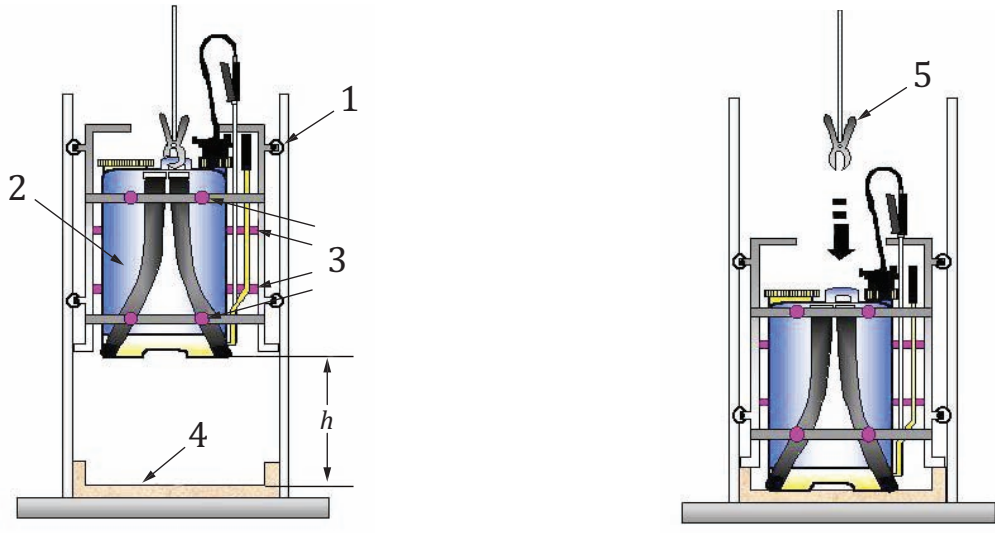
1 sprayer
2 straps
3 restraining bar
4 guides
h 200 mm

Figure C.1 — Force applied to the load carrying straps

Annex D
(informative)

Example of drop test device

An impact test device is a device capable of making a controlled and reproducible impact to the base of the sprayer as shown in Figure D.1. The guides shall be adjusted in a way to make sure a free downward movement of the sprayer after the guiding frame contacted the surface.



a) Release position **b) Impact position**

Key

1 roller
2 sprayer
3 adjustable guides
4 defined surface
5 pincers
h 600 mm

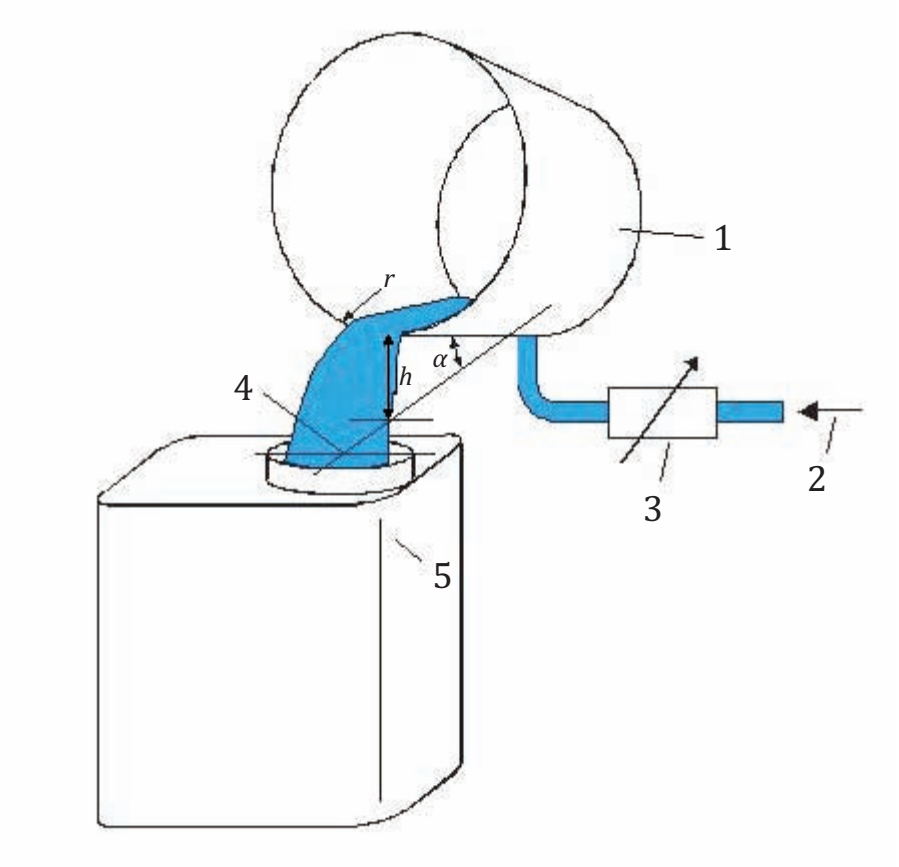
Figure D.1 — Impact to the base of the sprayer

Annex E
(informative)

Example of filling device

The filling device is a stationary device simulating the filling of a sprayer with an unprofiled bucket.

The device (see Figure E.1) consists of a liquid supply system capable of delivering a volume equal to the nominal volume of the sprayer under test within 1 min with a controlled and adjustable flow rate with a maximum deviation of 10 %.



Key

1 unprofiled bucket, fixed to the ground
2 from water tap
3 flow control valve
4 impact point of the test liquid
5 sprayer

The recommended dimensions are:

r 150 mm
h 100 mm
α 10°

Figure E.1 — Configuration of the filling device

Annex F
(normative)

Minimum content of test report

Report on knapsack sprayer tests according to ISO 19932-2						
Testing organization (name and address):						
Test location:	.....	Date:	.....			
Sprayer						
Type:	.....	Manufacturer:	.....			
Design:	.....					
Nominal tank volume/l:		.....				
Mass of the complete, empty sprayer/g:		.....				
Total mass of the filled sprayer/g:		.....				
Wearing parts easy to be changed?		...	yes		...	no
Carrying handle?		...	yes		...	no
Straps						
Number of straps:		.....				
Non-absorbent material?		...	yes		...	no
Length/mm	min:	.....				
	max:	.....				
One with quick coupling device?		...	yes		...	no
Unintentional loosening?		...	yes		...	no
Load-bearing width/mm:		.....				
Tank						
Pressure compensation?		...	yes		...	no
Filling limits visible?		...	yes		...	no
Filling opening diameter/mm:		.....				
Filling filter?	Mesh width/mm:	.....			...	none
Hose nipples protected?		...	yes		...	no
Volumetric contents gauge:			Range/l:	.....	...	
			Resolution/l:	.....	...	

Report on knapsack sprayer tests according to ISO 19932-2 (*continued*)					
Adjusting device					
Quick acting shut-off valve?		...	yes	...	no
Closed when released?		...	yes	...	no
Hoses					
With sharp bends?		...	yes	...	no
Filters					
Pressure filter?		...	nozzle	...	valve
		...	other	...	none
	Mesh width/mm:	.....			
Nozzles					
Adjustable?		...	yes	...	no
Lance parking device?		...	yes	...	no
Pressure gauge					
Pressure control?		...	gauge	...	control valve
		...	none		
Pressure gauge readable during operation?		...	yes	...	no
Stable indication?		...	yes	...	no
Pressure gauge scale resolution/kPa:		.....			
Remarks:					
Tests					
Test conditions					
	Temperature/°C:	.....			
	Relative humidity/%:	.....			
Preconditioning					
	Spray pressure/kPa:	.....			
	Pump frequency/min^{-1}:	.....			
	Duration/h:	.....			
Damages:		...	yes	...	no
Remarks:					

Report on knapsack sprayer tests according to ISO 19932-2 (*continued*)

5.3.1 Shut-off device reliability

	Nozzle type:	.....			
	Spray pressure/kPa:	.....			
	Operating frequency/min^{-1}:	.....			
	Total number of cycles:	.....			
Damages:		...	yes	...	no
Leakage:		...	yes	...	no
Remarks:					

5.3.2 Spray liquid output

Nozzle type	Adjustment	Spray pressure/ kPa	Stated spray liquid output/ l min^{-1}	Measured spray liquid output/ l min^{-1}	Deviation/%

5.3.3 Load-carrying straps and their fixation points

Damages that influences functionality:		...	yes	...	no
Remarks:					

5.3.4 Stability

Tank filling level	Sprayer position	Stability			
Empty	strap side down the slope	...	yes	...	no
	left side down the slope	...	yes	...	no
	strap side up the slope	...	yes	...	no
	right side down the slope	...	yes	...	no
Nominal volume	strap side down the slope	...	yes	...	no
	left side down the slope	...	yes	...	no
	strap side up the slope	...	yes	...	no
	right side down the slope	...	yes	...	no
Remarks:					

Report on knapsack sprayer tests according to ISO 19932-2 (*continued*)			
5.3.5 Contents gauge scale and total volume			
Level (V_S)/l	Net mass/g (V_m/ml)	Deviation (V_S–V_m)/l	Error (E)/%
1	.....		
2	.....		
3	.....		
4	.....		
5	.....		
6	.....		
7	.....		
8	.....		
9	.....		
10	.....		
11	.....		
12	.....		
13	.....		
14	.....		
15	.....		
16	.....		
17	.....		
18	.....		
19	.....		
20	.....		
21	.....		
22	.....		
Remarks:			
Total volume			
Mass of the completely filled sprayer/g:	.....		
Total volume/l:	.....		
Additional volume percentage (V_A)/%:	.....		
Remarks:			

Report on knapsack sprayer tests according to ISO 19932-2 (*continued*)				
5.3.6 Filling rate				
Pouring flow rate/l min^{-1}:		.....		
Mass of polythene sheet and/or tissue before test (tare)/g:		.....		
Mass of polythene sheet and/or tissue after test/g:		.....		
Volume of splashes (V_S)/ml:		.....		
Remarks:				
5.3.7 Emptying				
Mass of the sprayer after test/g:	.....			
Volume of remaining liquid/ml:	.....			
Remarks:				
5.3.8 Absorbency of carrying straps				
Mass of the straps before immersion/g:	.....			
Mass of the straps after immersion/g:	.....			
Mass increase/%	.....			
5.3.9 Test for compatibility of sprayer components				
Component	Mass before test/g	Mass after test/g		Change/%
1	.....	.....		
2	.....	.....		
3	.....	.....		
4	.....	.....		
5	.....	.....		
Functioning after reassembling:	...	yes	...	no
Remarks:				
5.4 Pressure test				
Final pressure/kPa	.....			
Pressure relieve valve opened?	...	yes	...	no
Damages:	...	yes	...	no
Remarks:				

Report on knapsack sprayer tests according to ISO 19932-2 (*continued*)				
5.5 Leakage test				
Spray pressure/kPa:		.....		
Duration/s:	Upright position 300	45° position 60	Horizontal position 60	
Mass of the polythene sheet and/or tissue before test (tare)/g:	.....	.....	.....	
Mass of the polythene sheet and/or tissue after test/g:	.....	.....	.....	
Mass of leakage/g:	.....	.....	.....	
Volume of leakage (V_L) [ml]:	.....	.....	.....	
Remarks:				
5.6 Centre of gravity				
Distance l /mm:		.....		
Distance l_f /mm:		.....		
Full gross mass m /g:		.....		
Mass m_1 /g:		.....		
Distance of centre of gravity l_c /mm:		.....		
Remarks:				
6.1.2; 7.1; 8.1.1 Volume of the external surface deposit				
Pouring flow rate/l min^{-1}:		.....		
Mass of the sprayer after test/g:		.....		
Volume of external deposit (V_D)/ml:		.....		
Remarks:				
6.1.3; 8.1.2 Volume of the total residual liquid				
Position:	...	upright	...	inclined by [°]
Spray pressure/kPa:		.....		
Mass of the sprayer after test/g:		.....		
Volume of total residual/ml:		.....		
Remarks:				
6.2; 8.2 Drop test				
Damages:		yes		no
Remarks:				

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Price based on 22 pages