INTERNATIONAL STANDARD

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Crop protection equipment — Test methods for the evaluation of cleaning systems —

Part 1: Internal cleaning of complete sprayers

Matériel de protection des cultures — Méthodes d'essai pour l'évaluation des systèmes de nettoyage —

Partie 1: Nettoyage interne de la totalité du pulvérisateur

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22368-1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

ISO 22368 consists of the following parts, under the general title *Crop protection equipment — Test methods for the evaluation of cleaning systems*:

— *Part 1: Internal cleaning of complete sprayers*

— *Part 2: External cleaning of sprayers*

— *Part 3: Internal cleaning of tank*

Introduction

The cleaning of sprayers used in crop protection is becoming increasingly important, especially for the following reasons:

— to avoid contamination of the environment and the operator;

— because of the possibility of accidental release of agrochemicals that could cause crop damage, raise residue fears or lead to the mixing of incompatible crop protection products.

Moreover, it is likely that the relevant sections of the industry are in need of guidance in developing cleaning systems, so that the state of the art and a basis for future specifications can be evaluated.

ISO 22368-1 and ISO 22368-2 specify test methods related to the internal and external cleaning of sprayers, offering the user the means to evaluate the general performance of both inside and outside cleaning systems and a possible basis for defining performance specifications in the future. The standard also offers individual sections for key sprayer components (see ISO 22368-3).

This part of ISO 22368 enables the cleaning system to be evaluated for specific components and provides the means for obtaining detailed results that can be used for its improvement.

Crop protection equipment — Test methods for the evaluation of cleaning systems —

Part 1: Internal cleaning of complete sprayers

WARNING — Users of this part of ISO 22368 should be familiar with normal laboratory practice. This part of ISO 22368 does not address all possible safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and ensure compliance with any national regulatory conditions related to safety and environmental issues.

1 Scope

This part of ISO 22368 specifies tests for determining the performance of the rinsing systems fitted onto sprayers used in crop protection for the internal cleaning of the complete sprayer, including the tank. It is applicable to mounted, trailed and self-propelled agricultural sprayers used for crop protection and liquid fertilizer applications. It is not applicable to sprayers with direct injection systems.

2 Test conditions

Testing shall be performed under the following conditions.

Temperature of test liquid: 5 °C to 25 °C.

Air temperature: 5 °C to 25 °C.

Relative humidity of air: > 30 %.

Where testing is done outdoors, the influence of climatic/weather conditions should be considered.

3 Tests

3.1 General

SAFETY PRECAUTIONS — Because of possible environmental hazards inherent in this method, recognized precautions shall be observed to eliminate accidental release of test liquids outside the test site. All operations should preferably be carried out such that the test liquids and the water used to clean the sprayer can be collected. If this is not the case, care shall be taken that the spread liquids do not cause any environmental damage.

Testing shall be performed using a 1 % suspension of copper oxychloride test liquid according to Annex A and the present clause. Other traced liquids may be used if the same level of measuring performance can be demonstrated. For this purpose, accuracy of measurements — for example — should be at least 0,01 % of the original tank concentration.

The test liquid may be used on several occasions providing checks show that there are few, if any, changes to its original specification.

3.2 Principal test procedure

3.2.1 Clean the internal surfaces of the complete sprayer at the start of the test. Fill up the tank completely with test liquid while the agitator or agitators are running. Ensure that all internal surfaces — especially the upper ones and the lid — are wetted with the test liquid and use all functions, including pressure agitation, induction bowl and the pressure relief valve. Wait for 10 min while the agitator(s) is running. Take three representative samples from the sprayer tank to check the concentration of the reference test liquid. Each of these samples shall have a volume of at least 50 ml and shall not deviate by more than 5 % from the concentration of the reference liquid. Empty the tank as in normal spraying practice (e.g. normal PTO speed, pressure, nozzle size, nozzle number, flow rate) by using the whole spray boom. Wait until there is not any liquid coming out of the nozzles.

3.2.2 Operate the rinsing system of the sprayer according to the manufacturer's instructions. Empty the tank as in normal spraying practice by using the whole spray boom. Wait until there is not any liquid coming out of the nozzles.

3.2.3 Fill the sprayer completely with clean water. Ensure all internal surfaces, especially the upper ones and the lid, are cleaned with the water. Use all functions (pressure agitation, induction bowl, pressure relief valve, etc.).

3.2.4 Start spraying and collect the liquid in a separate tank (A).

3.2.5 Take three representative samples out of Tank A. Each of these samples shall have a volume of at least 50 ml and shall not deviate by more than 5 % from the mean concentration of the Tank A liquid.

3.2.6 Determine the concentration of the copper of the samples taken according to 3.2.1 and 3.2.5 by using appropriate methods such as atomic-absorption-spectrometry. Calculate the mean values of the samples.

3.2.7 Calculate the fraction, F, of the mean concentration of the samples taken according to 3.2.1 and 3.2.5 as a percentage using the following equation:

$$F = \frac{C_{\text{AM}}}{C_{\text{RM}}} \times 100\ \%$$

3.2.8 Record the data in the test report (for an example test report, see Annex B).

3.3 Optional test (to show the cleaning process of the rinsing system) procedure

Operate the rinsing system of the sprayer according to the manufacturer's instructions, but divide the rinsing water in two or more parts. Take samples at the end of each cycle under the nozzle with the longest supply hose at the end of each rinsing process (just before the spray jet is collapsing). Calculate the concentration of the samples according to the concentration of the reference test liquid.

Annex A
(normative)

Composition of test powder

A.1 Composition

Copper shall be used in the form of copper oxychloride trihydrate [the test powder is also known under the name Cupravit[1)]], as follows:

Compound	Content
($3CuO \cdot CuCl_2 \cdot 3H_2O$)	45 %
Lignosulfonate	5 %
Calcium carbonate ($CaCO_3$)	8 %
Sodium sulfate decahydrate ($Na_2SO_4 \cdot 10H_2O$)	11 %

A.2 Size and distribution of particles

The size and volume distribution of the particles used shall be as follows:

Size	Volume distribution
$<$ 20 µm	98 % min.
$<$ 10 µm	90 % min.
$<$ 5 µm	70 % min.

A.3 Impurities in the technically active material

Impurities shall be limited to the following.

Total impurities: 3,5 % max.

Water: 2 % max.

Ash: 1,5 % max. (in addition to copper).

A.4 Solubility

The test powder shall be slowly soluble in water and organic solvents, soluble in strong mineral acids, and soluble in solutions of ammonia and amines through the formation of complexes.

1) Cupravit is an example of a suitable product available commercially. This information is given for the convenience of users of this part of ISO 22368 and does not constitute an endorsement by ISO of this product.

Annex B
(informative)

Example test report

Sprayer data

Type of sprayer: ....

Nominal spray tank capacity: l

Type and size of spraying nozzles: ....

Type of rinsing system: ....

Liquid output of rinsing nozzle: .... l/min

Nominal capacity of rinsing water tank: l

Dead volume: l

Measurement data

Concentration of reference test liquid (see 3.2.1)	mg/l
Sample 1 (C_{R1})	
Sample 2 (C_{R2})	
Sample 3 (C_{R3})	
Mean concentration (C_{RM})	

Concentration of liquid after rinsing (see 3.2.5)	mg/l
Sample 1 (C_{A1})	
Sample 2 (C_{A2})	
Sample 3 (C_{A3})	
Mean concentration (C_{AM})	

Fraction of mean concentration after rinsing F (see 3.2.7)	%
$F = \frac{C_{AM}}{C_{RM}} \times 100\ \%$	

Optional test results (see 3.3)	mg/l
Sample 1 (C_{O1})	
Sample 2 (C_{O2})	
Sample 3 (C_{O3})	

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