BS ISO 16236:2013

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Crop protection equipment — Test method for the determination of drainable volume and its concentration

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The UK participation in its preparation was entrusted to Technical Committee AGE/15, Equipment for crop protection and application of liquid fertilizer.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Crop protection equipment — Test method for the determination of drainable volume and its concentration

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Foreword

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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*.

Introduction

The cleaning of sprayers becomes more and more important especially for the following reasons:

— to avoid the contamination of the environment and the operator;

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

In addition, it is likely that the relevant bodies of the industry will need guidance in developing systems for cleaning the sprayer for emptying the sprayer as far as possible,, to enable the evaluation of the state of the art and to establish a basis for future specifications.

The main purpose of ISO 16236 is to define the standardized procedure to determine the drainable volume which can be emptied in the field after carrying out the cleaning procedure as recommended by the sprayer manufacturer. This drainable volume can be relevant when letting out the rinsing liquid (drainable volume) of the tank by using its outlet. Furthermore, other outlets should be included (e.g. suction filter, pressure filter, filling connection). In this sense, this International Standard completes ISO 13440 and ISO 22368-1 to -3.

INTERNATIONAL STANDARD ISO 16236:2013(E)

Crop protection equipment — Test method for the determination of drainable volume and its concentration

1 Scope

This International Standard specifies the test method for the determination of the volume and the concentration of the drainable volume of sprayers, in connection to the emptying of the diluted residue of the spray tank by using its outlet and other outlets allowing draining (e.g. suction filter, filling connection) at the end of the cleaning procedure.

It applies to agricultural sprayers used for crop protection and liquid fertiliser applications for both brand new sprayers and sprayers already in use.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
drainable volume
amount of liquid collectable from the spray tank outlet and/or other outlets, intended for emptying the sprayer at the end of the cleaning procedure

2.2
rinsing system
system that is fitted onto sprayers and used for the internal cleaning of the complete sprayer including the tank

3 Test conditions

Temperature of the test liquid: 5 °C to 30 °C.

Air temperature: 5 °C to 30 °C.

Relative humidity of air: > 30 %.

4 Test

4.1 Test liquid

The preferred test liquid is water with an approximate concentration of 0,000 1 % of fluorescein sodium (extra pure).

Other traced liquids may be used, if the same level of measuring performance can be demonstrated.

4.2 Test procedure

4.2.1 The test shall be carried out with the sprayer kept in a stationary and horizontal position. The internal surfaces of the complete sprayer shall be carefully cleaned at the start of the test.

4.2.2 Fill up the tank with water to at least 10 % of the nominal tank volume and introduce approximately 1 mg of the tracer per litre of water into the tank through the tank opening with the agitator(s) running. If the sprayer is equipped with an induction hopper, it should not be used in order to avoid its contamination.

To ensure the same contamination as in normal practice, use and operate all functions needed during the spraying process as specified in the operator's manual. Run the agitator(s) for at least 1 min. Open the outlet valve, collect test liquid enough to ensure the contamination of the outlet device and refill it again to the main tank. To contaminate the complete sprayer (hydraulic circuit and internal parts of the main tank), operate all valves as specified by the operator's manual and spray an appropriate amount of test liquid. For sprayers without agitation, contaminate the internal part of the tank by shaking or turn off the equipment several times.

4.2.3 Take one representative sample of at least 50 ml, from the sprayer tank to check the concentration of the test liquid. Enter the concentration in Table A.1.

4.2.4 Empty the tank as in normal spraying practice (e.g. normal PTO speed, pressure, nozzle size, nozzle number, flow rate) by using all nozzles (e.g. the whole spray boom). Allow the pump to run for 1 min ± 5 s after the liquid fan from the nozzles has collapsed to ensure that all relevant liquid has been emptied. For shutting off the pump when completely emptying the tank the specification in the instruction handbook apply, if available.

4.2.5 Operate the rinsing system of the sprayer according to the operator's manual. If no special rinsing instructions from operator's manual are available carry out a rinsing procedure where the rinsing water is used in three portions. Each portion equals to one third of the volume of the clear water tank or 10 % of the nominal volume of the spray tank divided by three. Measure the volume of each portion of rinsing water with a maximum error of ± 2 % of its nominal volume. After each step of this procedure, spray the rinsing liquid as in normal spraying practice.

If no rinsing system is available, carry out a rinsing procedure where the rinsing water is used in three portions with a clean water volume corresponding to at least 10 % of the nominal tank volume of the sprayer. For this purpose, the rinsing water is to be filled in by the filling opening.

When each rinsing process is coming to the end, ensure that the agitators are switched off before the pump sucks air in and wait till there is not any liquid coming out of the nozzles, so that the drainable volume is minimized.

4.2.6 After the rinsing process, stop the pump drive, operate all relevant valves allowing to discharge the liquid still present in the hydraulic circuit and let the drainable volume out of the tank by using its outlet. Open other outlets allowing draining tool-free (e.g. suction filter, pressure filter, further discharge valves positioned along the hydraulic circuit, filling connection) and make sure to collect all the liquids running out in separate clean containers. Measure the collected volumes individually and record them in Table A.2.

4.2.7 Take one representative sample, of at least 50 ml, out of each container.

4.2.8 Conduct the test procedure from 4.2.1 to 4.2.7 at least three times.

4.2.9 Determine the concentration of the tracer in the samples taken in 4.2.3 and 4.2.7 by using appropriate methods with a maximum error of ± 0,01 % of the original tank concentration. Record these concentrations in Table A.3.

4.2.10 Calculate the total amount of tracer of the collected drainable volumes (using Table A.4) by multiplying the volumes measured in 4.2.6 (Table A.2) and the concentrations determined in 4.2.9 (Table A.3). Calculate also the total amount of tracer from these measurements.

4.2.11 Calculate the mean values and the coefficients of variation C_v of measured volumes and concentrations (using Tables A.2 to A.4). Each C_v should not exceed 15 %. If one or more C_v values are higher than 15 %, repeat the test.

4.2.12 Calculate the fraction F of the mean concentration of the samples taken according to 4.2.3 and 4.2.6 as percentage using the following equation (using Table A.5):

$$F = \frac{C}{C_R} 100\,\%$$

4.2.13 Report the data in the test report (see Annex A).

Annex A
(normative)

Minimum content of test report

A.1 Sprayer data

— Type of sprayer:

— Nominal spray tank capacity (l):

— Type and size of spraying nozzles:

— Spray pressure and flow rate of spraying nozzle:

— Type and size of rinsing nozzle(s):

— Type of rinsing system:

— Manually: ☐ — Automatically: ☐

— Continuous: ☐ — Non-continuous: ☐

— Number of rinses:

— Clear water volume used per rinse (l):

— Liquid output of rinsing nozzle (l/min):

— Nominal capacity of rinsing water tank (l):

— Amount of rinse water used (l):

— Working width of spray boom (m):

— Tests were made according to instruction handbook: yes ☐ no ☐

A.2 Measurement data

A.2.1 Concentration of test liquid (4.2.3)

Table A.1 — Concentration of test liquid (4.2.3)

Measurement data	**Test 1** mg/l	**Test 2** mg/l	**Test 3** mg/l	**Mean** mg/l
Sample R (C_R)				

A.2.2 Volumes of liquid after rinsing (4.2.6)

Table A.2 — Volumes of liquid after rinsing (4.2.6)

Measurement data	Test 1 l	Test 2 l	Test 3 l	Mean l	C_v value %
V_1 (tank sump)					
V_2 (suction filter)					
V_3 (filling connection)					
V_4 (...)					
Total volume (V_t)					

A.2.3 Concentration of liquids after rinsing (4.2.9)

Table A.3 — Concentration of liquids after rinsing (4.2.9)

Measurement data	Test 1 mg/l	Test 2 mg/l	Test 3 mg/l	Mean mg/l	C_v value %
C_1 (tank sump)					
C_2 (suction filter)					
C_3 (filling connection)					
C_4 (...)					

A.2.4 Amount of tracer in drainable volumes (4.2.10)

Table A.4 — Amount of tracer in drainable volumes (4.2.10)

Measurement data	Test 1 mg	Test 2 mg	Test 3 mg	Mean mg	C_v value %
m_1 (tank sump)					
m_2 (suction filter)					
m_3 (filling connection)					
m_4 (...)					
Total amount of tracer (m_t)					

A.2.5 Fraction of mean concentration of liquids after rinsing in drainable volume (4.2.12)

Table A.5 — Fraction of mean concentration of samples as percentage of test liquid

Measurement data	Mean %
F_1 (tank sump)	
F_2 (suction filter)	
F_3 (filling connection)	
F_4 (...)	

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