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Equipment for crop protection — Spraying equipment —

Part 3:

Test method for volume/hectare adjustment
systems of agricultural hydraulic pressure
sprayers

*Matériel de protection des cultures — Équipement de pulvérisation —
Partie 3: Méthode d'essai des systèmes de régulation du volume/hectare
des pulvérisateurs agricoles à jet projeté*



Reference number
ISO 5682-3:1996(E)

Foreword

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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.

International Standard ISO 5682-3 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

ISO 5682 consists of the following parts, under the general title *Equipment for crop protection — Spraying equipment*:

- *Part 1 : Test methods for sprayer nozzles*
- *Part 2 : Test methods for hydraulic sprayers*
- *Part 3 : Test method for volume/hectare adjustment systems of agricultural hydraulic pressure sprayers*

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Equipment for crop protection — Spraying equipment —

Part 3:

Test method for volume/hectare adjustment systems of agricultural hydraulic pressure sprayers

1 Scope

This part of ISO 5682, specifies the test method for volume/hectare adjustment systems of sprayers in order to assess precision of spraying and performance.

It applies to mounted, trailed or self-propelled agricultural hydraulic pressure sprayers used for protection and/or fertilization of crops.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 5682. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5682 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 5682-1:1996, *Equipment for crop protection — Spraying equipment — Part 1: Test methods of sprayer nozzles*.

ISO 5682-2:1986, *Equipment for crop protection — Spraying equipment — Part 2: Test methods for hydraulic sprayers*.

3 Definitions

For the purposes of this part of ISO 5682, the definitions given in ISO 5681 and the following definition apply.

3.1 volume/hectare adjustment system: Device which allows application, in liquid form, of a predetermined constant volume per hectare treated, of protection and/or fertilizing spray mixture independent of variation in the forward driving speed.

NOTE — The different systems are classified as follows:

- 1) system controlled by the rotation of a power take off (PTO);
- 2) system controlled by the rotation of a land wheel;
- 3) system controlled by any other means.

4 Test conditions and apparatus

4.1 General test conditions

The general test conditions shall be those specified in ISO 5682-2:1986, clause 6 and the specific conditions given in 4.2.

4.2 Specific test conditions

4.2.1 All measurements of the volume/hectare rate are carried out at the spray boom or nozzle carrier using water as the test liquid. Measuring and recording shall continue until the system returns to a steady state condition.

4.2.2 At the start of the measurements defined in 5.1 and 5.2, the following conditions shall be set on the sprayer:

- driving speed: 2 m/s;
- power take-off (PTO) rotational frequency: 400 min⁻¹;
- volume/hectare rate: 300 l/ha.

In case of other travelling speeds, nominal (PTO) rotational frequencies (for example 1 000 min⁻¹) or non PTO drives, rotational frequencies analogous to 540 min⁻¹ are valid.

4.2.3 If hydraulic driven pumps are tested when integrated in the sprayer, variation of the speed (5.2) is not necessary.

4.3 Test apparatus

The standard pressure gauges and the stop-watch used for the tests shall meet the specifications of ISO 5682-1:1996, clause 5.

5 Test procedure

The measurements shall be made under the conditions specified in 4.1 and 4.2 together with the conditions specified in 5.1, 5.2 and 5.3. Measure continuously the duration(s) for which the mean volume/hectare rate deviates by more than 10 % from the mean volume/hectare rate in the steady state.

The measurements in 5.1 and 5.2 shall be repeated twice.

5.1 Switching on and off the nozzle lines

5.1.1 Set the sprayer to the conditions specified in 4.2.2. Switch on the nozzle lines and make the measurements simultaneously.

5.1.2 Set the sprayer to the conditions specified in 4.2.2, then lower the driving speed to 1,5 m/s and reduce the PTO rotational frequency to 300 min⁻¹. Switch on the nozzle lines and make the measurements simultaneously.

5.1.3 Set the sprayer to the conditions specified in 4.2.2, then raise the driving speed to 2,5 m/s and raise the PTO rotational frequency to 500 min⁻¹. Switch on the nozzle lines and make the measurements simultaneously.

5.1.4 Successively switch off boom sections except one, then switch them on again. Make the measurements simultaneously.

5.2 Speed variations

5.2.1 Power take-off (PTO) rotational frequency

Change the PTO rotational frequency from at least 300 min⁻¹ to 400 min⁻¹ and then to 500 min⁻¹ and then from 500 min⁻¹ to 400 min⁻¹ and then 300 min⁻¹ in stages of five seconds each. Make the measurements simultaneously.

5.2.2 Driving speed

Set the driving speed to at least 1,5 m/s, 2 m/s, 2,5 m/s, 2 m/s, 1,5 m/s and make the measurements simultaneously.

5.3 Resetting the volume/hectare rate

Measure the volume/hectare rate as described below and calculate the coefficient of variation in accordance with clause 6.

The equipment is operated at PTO rotational frequency of 500 min⁻¹ and a driving speed of 2 m/s. Make the following two series of measurements seven times.

Set and operate the equipment at a volume/hectare rate of 100 l/ha, or the next highest value, then successively set it to 200 l/ha, 300 l/ha and 400 l/ha [1st series of measurements (ascending)]. Set to 500 l/ha, or the next lowest value, then successively set it to 400 l/ha, 300 l/ha and 200 l/ha [2nd series of measurements (descending)].

Make measurements at volume/hectare rates of 200 l/ha, 300 l/ha and 400 l/ha for the ascending series and at 400 l/ha, 300 l/ha and 200 l/ha for the descending series respectively.

When setting the volume/hectare rates, be careful not to exceed the required value to be set and to have to adjust the volume/hectare rate in the opposite direction.

NOTE — If tables, diagrams or the operator's manual, provide for a volume/hectare rate of less than 150 l/ha or greater than 450 l/ha, at a driving speed of 2 m/s, then both series of measurements should be reset to 150 l/ha or 450 l/ha.

6 Calculation

For each setting the coefficient of variation, CV, expressed as a percentage, is calculated as follows:

$$CV = \frac{s}{\bar{x}} \times 100$$

where

s is the standard deviation:

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

$\bar{x}$ is the mean volume/hectare rate:

$$\bar{x} = \frac{\sum x_i}{n}$$

x_i is the i th value of volume/hectare rate;

$i = 1, 2, \dots, n$ is the measurement index ($n = 7$).

The largest and smallest deviations, $\delta_{\max}$ and $\delta_{\min}$ respectively, expressed as percentages, are calculated as follows:

$$\delta_{\max} = \frac{x_{\max} - \bar{x}}{\bar{x}} \times 100$$

$$\delta_{\min} = \frac{x_{\min} - \bar{x}}{\bar{x}} \times 100$$

The mean deviation, Δ , expressed as a percentage, between mean volume/hectare rate, $\bar{x}$, and nominal volume/hectare rate, x_{nom} , is calculated as follows:

$$\Delta = \frac{\bar{x} - x_{\text{nom}}}{x_{\text{nom}}} \times 100$$

7 Test report

The results shall be presented in a test report, of which an example is given in annex A.

Annex A

(informative)

Model test for volume/hectare adjustment systems of agricultural hydraulic pressure sprayers in accordance with ISO 5682-3:1996

A.1 Duration(s) for which the mean volume/hectare rate deviates by more than 10 % from the mean volume/hectare rate in the steady state

A.1.1 Switching on and off the nozzle lines

Values in seconds

ISO 5682-3:1996, subclause	1st measurement	2nd measurement
5.1.1		
5.1.2		
5.1.3		
5.1.4		

A.1.2 Speed variations

Values in seconds

ISO 5682-3:1996, subclause	1st measurement	2nd measurement
5.2.1		
5.2.2		

A.2 Volume/hectare rate (ISO 5682-3:1996, subclause 5.3)

Values in litres per hectare

Parameter	Ascending series			Descending series		
	Setting			Setting		
	200 l/ha	300 l/ha	400 l/ha	400 l/ha	300 l/ha	200 l/ha
Measurement 1						
Measurement 2						
Measurement 3						
Measurement 4						
Measurement 5						
Measurement 6						
Measurement 7						
Mean, $\bar{x}$						
Standard, s						
Coefficient of variation, CV						
Largest deviation, $\delta_{\max}$						
Smallest deviation, $\delta_{\min}$						
Mean deviation, Δ						

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