
**Crop protection equipment —
Reciprocating positive displacement
pumps and centrifugal pumps — Test
methods**

*Matériel de protection des cultures — Pompes volumétriques
alternatives et pompes centrifuges — Méthodes d'essai*

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Published in Switzerland

Foreword

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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 12809 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

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Crop protection equipment — Reciprocating positive displacement pumps and centrifugal pumps — Test methods

1 Scope

This International Standard specifies test methods and the environmental conditions for evaluating the performance of positive displacement pumps and centrifugal pumps designed for crop protection equipment.

It is not applicable to pesticide metering pumps for injection systems.

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

suction pressure

pressure at the suction fitting of the pump [ISO 12809:2011](https://standards.iteh.ai/catalog/standards/sist/0277d46a-2087-4e99-ab89-4b77c0716621/iso-12809-2011)

3.2

reference suction pressure

pressure at the suction fitting of the pump, taking into account the pressure drop that is present when the pump is installed on the sprayer

3.3

delivery pressure

pressure at the delivery fitting of the pump

3.4

rated pressure

maximum pressure at which the pump can be used continuously when installed on the sprayer, as declared by the manufacturer

3.5

rotating speed

number of revolutions of the pump shaft in the considered time interval

3.6

volumetric flow rate

volume of the testing liquid that flows through the pump

3.7

power consumption

power given to the pump by the power source, measured at the inlet shaft of the pump

3.8

adjustment valve

valve for adjusting the liquid flow

**3.9
delivery fitting**

body of pipelines collecting the liquid coming from the pump and routing it to the delivery pipeline

4 Accuracy of measurements

Temperatures shall be measured with an accuracy of ± 1 °C.

Length shall be measured with an accuracy of ± 1 mm.

Suction pressure shall be measured with an accuracy of ± 1 kPa.

Delivery pressure shall be measured with an accuracy of ± 1 % of the full scale. The full-scale value shall not exceed twice the maximum value that has to be measured during the test.

Rotating speed shall be measured with an accuracy of ± 1 %.

Flow rate shall be measured with an accuracy of $\pm 1,5$ %.

Load torque shall be measured with an accuracy of ± 5 %, at least for values greater than the 25 % of the maximum torque.

5 Test liquid

Clean water without solids in suspension.

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6 General test conditions

6.1 Test bench

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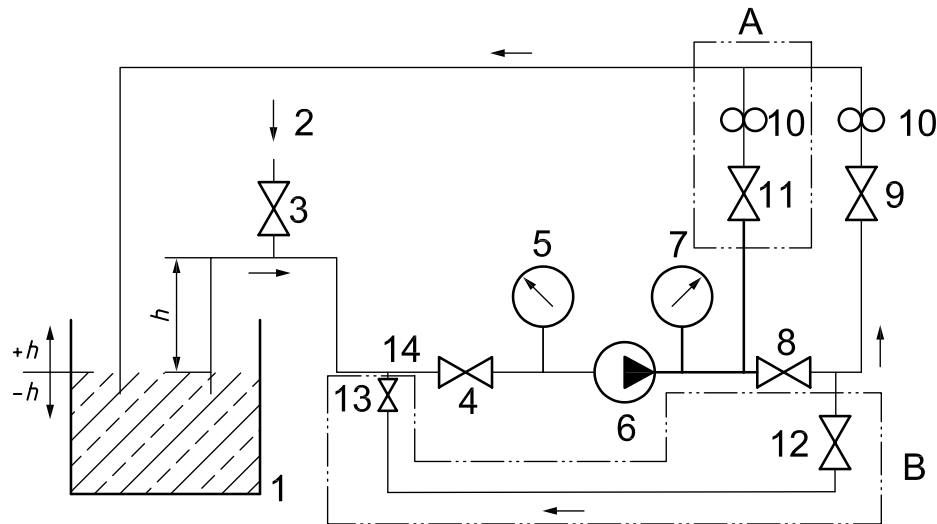
6.1.1 The test bench shall have a main circuit containing the devices for flow control and pressure adjustment. To simulate the installation of the pump on the sprayer, the test bench shall have a “nozzle line” (section A in Figure 1) and an extra circuit (section B in Figure 1) able to simulate the cleaning conditions, with part of the flow coming back directly to the suction line of the pump.

6.1.2 The suction line connects the pump with the tank. It shall be fitted with an air inlet valve, a suction pressure adjustment valve and a suction pressure gauge. For self-priming pumps, the h value shall be (400 ± 100) mm. For non-self-priming pumps, the h value shall be (-100 ± 20) mm. The start of the suction line shall be free, without non-return valves. See Figure 1.

6.1.3 The delivery line shall be fitted with a pressure gauge, a pressure adjustment valve and the device for flow rate measurement (see Figure 1). The output of the delivery line shall be connected to the tank in order to guarantee the re-circulation of the test liquid. Ensure that the back flow does not create turbulence in the suction line.

6.1.4 The extra circuit shall be fitted with a by-pass flow-rate adjustment valve and a shut-off valve able to isolate this part of the circuit.

6.1.5 The level of the liquid in the tank shall be equal (± 10 mm) to the top of the pump housing. Set the level when all the lines are filled with the test liquid.

**Key**

- | | |
|---|--------------------------------------|
| 1 tank | 8 delivery pressure adjustment valve |
| 2 air inlet | 9 shut-off valve |
| 3 air inlet valve | 10 flow rate measurement |
| 4 suction pressure adjustment valve | 11 nozzle flow-rate adjustment valve |
| 5 suction pressure measurement | 12 shut-off valve |
| 6 pump to be tested | 13 shut-off valve |
| 7 delivery pressure measurement | 14 by-pass input |
| A nozzle line | |
| B extra circuit to simulate the cleaning conditions | |

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Figure 1 — Hydraulic circuit

6.2 Installation of pump

The pump shall be fixed on the test bench following the indications given by the manufacturer, and especially those concerning the positioning of the pump and the dimension of the fixing device.

The pump shall be connected to the test bench by non-collapsible pipelines, both at the suction and delivery side.

The internal diameter of the suction line shall be as follows:

- for hoses, equal to or greater than (max. + 5 %) the internal diameter indicated by the manufacturer;
- for fittings, equal to or greater than (max. + 20 %) the internal diameter indicated by the manufacturer.

The internal diameter of the delivery line shall be equal to or greater than (max. + 50 %) that indicated by the manufacturer.

6.3 Environmental conditions

The air and testing liquid temperatures shall be not less than 10 °C and not more than 35 °C, except for centrifugal pumps, for which the testing liquid temperature shall be not less than 20 °C and not more than 30 °C.

6.4 Pressures**6.4.1 Suction pressure**

The suction pressure, expressed in kilopascals (kPa), shall be measured at the suction fitting indicated in 6.1.

6.4.2 Reference suction pressure

The reference suction pressure value shall be (-25 ± 2) kPa.

That reference value shall be set once at the beginning of the test (by means of valve 4, shown in Figure 1) at the maximum rotating speed indicated by the manufacturer and with the delivery pressure set to (5 ± 1) % of the rated pressure. It will rise during the test, reducing the rotating speed, because of the reduction of the pressure drop.

6.4.3 Delivery pressure

The delivery pressure, expressed in kilopascals (kPa), shall be measured at the delivery fitting, before the adjustment valve.

6.5 Rotating speed

The rotating speed shall be expressed in revolutions per minute (r/min).

6.6 Flow rate

The flow rate shall be expressed in cubic decimetres per minute ($\text{dm}^3 \cdot \text{min}^{-1}$).

The flow rate can be determined using a flow meter or by collecting the liquid in a separate tank for a measuring time and weighing.

During the measurement, the level of the liquid in the suction tank shall not change by more than ± 50 mm from the level specified in 6.1.5.

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6.7 Load torque

The load torque, expressed in newton metres (N·m), shall be determined by measurements on the inlet shaft of the pump.

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6.8 Power consumption

The power consumption, indicated in kilowatts (kW), shall be calculated as the rotating speed multiplied by the load torque, using the following equation:

$$P = \frac{\pi \times n \times C}{30\,000}$$

where

- P is the power, in kilowatts (kW);
- n is the rotating speed, in revolutions per minute (r/min);
- C is the load torque, in newton metres (N·m).

7 Test methods

7.1 General

After installation of the pump on the test bench and before starting the tests, ensure visually that all connections work properly without leakage at the maximum pressure and without air inlet at the maximum depression in the suction line.

If present, set the pressure of the pressure damper as indicated by the manufacturer.

Use the test liquid specified in Clause 5.

7.2 Flow rate at the reference suction pressure

7.2.1 Test conditions

Ensure that valves 11, 12 and 13, as indicated in Figure 1, are closed.

Set the reference suction pressure as defined in 6.4.2 by means of valve 4, as indicated in Figure 1.

Use valve 8, as indicated in Figure 1, for the adjustment of the delivery pressure.

Before each setting, ensure that the pump is correctly primed.

The tests shall be performed setting the delivery pressure so as to have the maximum and minimum pressures indicated by the manufacturer and at least two other values equally spaced in the range. In every case, the test shall be performed at the maximum and minimum rotating speeds of the pump, as indicated by the manufacturer, and at least at two other values equally spaced in the range.

If the pump has variable volume, perform the test at the maximum and minimum volumes, as indicated by the manufacturer, and at least at two other values equally spaced in the range.

For each combination of the above parameters, measure the flow rate.

7.2.2 Results

Report the results of these tests in a chart or graph (for an example, see A.1).

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7.3 Flow rate at variable suction pressure

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7.3.1 Test conditions

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Ensure that valves 11, 12 and 13, as indicated in Figure 1, are closed.

The tests shall be performed with the delivery pressure set to (10 ± 1) % of the rated pressure, which shall be at least (100 ± 10) kPa, and at the maximum rotating speed, as indicated by the manufacturer.

Start with the suction pressure set to (-60 ± 2) kPa and repeat the test at increasing suction pressures in steps of (10 ± 2) kPa up to (-10 ± 2) kPa.

Measure the flow rate for each suction pressure.

7.3.2 Results

Report the results of these tests in a chart or graph (for an example, see A.2).

7.4 Power consumption

7.4.1 Test conditions

The test conditions shall be as specified in 7.2.1.

7.4.2 Results

Report the results of these tests in a chart or graph (for an example, see A.3).