TC 23

INTERNATIONAL STANDARD

ISO 6097

Second edition
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Tractors and self-propelled machines for agriculture — Performance of heating and ventilation systems in closed cabs — Test method

Tracteurs et machines automotrices agricoles — Performance des systèmes de chauffage et de ventilation dans le cabines fermées — Méthode d'essai

Reference number
ISO 6097 : 1989 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6097 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry.*

This second edition cancels and replaces the first edition (ISO 6097 : 1983), of which it constitutes a revision (see the Introduction).

Annex A of this International Standard is for information only.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
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Introduction

In the revision of this International Standard to adopt "Seat Index Point" (SIP) in place of "Seat Reference Point" (SRP), the mean seat position is used in accordance with ISO 5353. The seating position is therefore moved to the mean horizontal from the rearmost position used in previous editions. Half the minimum horizontal adjustment as stated in ISO 4253 is the adjustment figure used.

To adopt the seat index point (SIP) in place of seat reference point (SRP), the relationship of SIP 90 mm above and 140 mm in front of the SRP has been used. This relationship should be used when converting from SRP to SIP or vice versa.

The 1980 edition of ISO 3462, *Tractors and machinery for agriculture and forestry — Seat reference point — Method of determination* used a relationship of SIP 97 mm above and 130 mm in front of the seat reference point. In a practical comparison, however, it was found that the 90 mm vertical and the 140 mm horizontal relationship gave the most accurate conversion.

Variation from the 1980 edition of ISO 3462 is due to

a) seat cushions not being horizontal in practice;

b) seat cushion angle to backrest not being 90°;

c) curvature of the backrest placing the SIP device slightly forward of the SRP device.

Tractors and self-propelled machines for agriculture — Performance of heating and ventilation systems in closed cabs — Test method

1 Scope

This International Standard specifies a method of testing the performance of heating and ventilation systems in closed cabs of tractors and self-propelled machines for agriculture.

The method allows comparison of cab heating and ventilation systems and determination of the climate inside the cab with respect to specified requirements for temperature and air velocity. This can be achieved by two different, but equivalent, procedures :

a) testing in a cold-chamber;

b) testing without a cold-chamber.

In the latter case, it is essential that the requirements for air velocity (see clause 5) are observed (this may be achieved, for example, by the use of fans) and that the results of the test are not influenced by ambient radiant energy (for example direct sunlight).

The two basic principles of heating systems are also considered :

a) heating independent of the engine : in this case, the heating system is adjusted in accordance with the manufacturer's instructions;

b) heating dependent on the engine : in this case, the heating system is tested with the engine loaded under specified conditions (see 5.4.5), corresponding approximately to the engine load of a tractor with an empty trailer travelling on a road.

2 Normative references

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

ISO 2288 : 1989, *Agricultural tractors and machines — Engine test code (bench test) — Net power.*

ISO 3737 : 1976, *Agricultural tractors and self-propelled machines — Test method for enclosure pressurization systems.*

ISO 5353 : 1978, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point.*

3 Apparatus

3.1 Remote temperature-measuring devices, for example thermocouples, accurate to ± 0,5 °C.

3.2 Anemometer, with a reading accuracy of 10 %, to measure air velocities inside the cold-chamber and cab.

3.3 Sensitive manometer, with a reading accuracy of 10 %, to measure enclosure pressurization.

3.4 Water flow meter (optional), such that the pressure drop does not exceed 500 Pa, with a reading accuracy of 2 %.

3.5 Timer, accurate to 0,5 s.

3.6 Tachometer, with a reading accuracy of 2 %, to measure the engine speed.

3.7 Cold-chamber (optional), large enough to contain the entire tractor/machine, and equipped with a device to provide and maintain the temperature and air velocity around the cab at the values specified in 5.1.

3.8 Engine-loading device (only when a system using heating dependent on the engine is tested).

4 Measurement locations

4.1 Ambient temperature measurements

4.1.1 Engines with a suction fan

Measurements shall be made :

a) 1 m to 1,5 m in front of the tractor or machine and approximately 1,5 m above the floor;

b) in the air-intake to the heater. In the case of systems using more than one air-intake, the air temperature shall be measured in at least one air-intake, that chosen being the one least influenced by external heat sources.

4.1.2 Engines with a pressure fan

Measurements shall be made :

a) at a location giving a temperature equivalent to that in 4.1.1 a);

b) in the air-intake to the heater as described in 4.1.1 b).

4.2 Measurements of engine temperatures (optional)

The temperature of the coolant, if measured, shall be measured at the outlet of the cylinder block or at the cylinder top before the coolant reaches the thermostat.

In the case of air-cooled engines, the engine temperature shall be measured at a location specified by the manufacturer.

4.3 Measurements of heater temperatures and coolant flow (optional)

4.3.1 The temperature of the coolant entering the heater, if measured, shall be measured as close to the inlet pipe as possible. For systems using more than one heater, the temperature of the coolant shall be measured at the inlet pipe of the first heater unit receiving the coolant flow.

4.3.2 The temperature of the coolant leaving the heater, if measured, shall be measured as close to the outlet pipe as possible. For systems using more than one heater, the temperature of the coolant shall be measured at the outlet pipe of the last heater.

4.3.3 The coolant flow may be measured to allow calculation of the heat capacity. If measuring water flow, the flow shall be measured by means of the flow meter (3.4).

4.3.4 The temperature of the air from the heater, if measured, shall be measured in at least one outlet, 10 mm inside the outlet. Use of multiple temperature measurements is recommended as a means of obtaining an average temperature in large heater outlet units.

4.4 Measurements of air temperatures inside cab

Measurements shall be made (see figure 1 and 5.2.1) :

a) on the left side : 50 mm above the floor, 100 mm behind the clutch pedal centre and in line with the clutch pedal outer edge. (For left foot : see figure 1, position 1.);

b) on the right side : 50 mm above the floor, 100 mm behind the right brake pedal centre and in line with the right brake pedal outer edge. (For right foot : see figure 1, position 2.);

c) on the left side : 60 mm above and 115 mm (see 5.2.1) behind the SIP, 300 mm from the seat central longitudinal plane. (For left hip : see figure 1, position 3.);

d) on the right side : 60 mm above and 115 mm (see 5.2.1) behind the SIP, 300 mm from the seat central longitudinal plane. (For right hip : see figure 1, position 4.);

e) 670 mm above and 365 mm behind the SIP. (For the operator's head : see figure 1, position 5.);

f) at the steering-wheel centre. (See figure 1 : position 6.).

4.5 Measurements of air velocity inside cab

The air velocities shall be measured in the direction which gives the maximum air velocity (see figure 1 and 5.2.1) :

a) 670 mm above and 365 mm (see 5.2.1) behind the SIP. (For the operator's head : see figure 1, position 5.);

b) 670 mm above and 65 mm (see 5.2.1) behind the SIP. (For the operator's eye level : see figure 1, position 7.).

4.6 Measurements of air velocity outside cab

Measurements shall be made 1 m to 1,5 m in front of the tractor or machine and approximately 1,5 m above the floor.

5 Procedure

5.1 General

The heating capacity shall be tested at an ambient temperature of − 5 °C or − 15 °C. The ambient temperature shall be kept within ± 3 °C. The choice as to which of these ambient temperatures is to be used is left to the person carrying out the test. The air velocity in front of the cab shall be 5 m/s ± 1 m/s. The main direction of air velocity is specified as being towards the cab front windscreen.

5.2 Adjustment of seat and steering-wheel

5.2.1 Seat index point

The seat index point (SIP) shall be determined in accordance with ISO 5353.

If the horizontal seat adjustment provided exceeds ± 75 mm then any dimensions forward from the SIP shall be reduced, and dimensions to the rear from the SIP increased, on the basis :

[(Total adjustment to the rear of the seat mid-position) minus 75 mm]

5.2.2 Steering-wheel

Adjustable steering-wheels shall be in the normal position for a seated operator.

5.3 Soak period

The tractor/machine shall be maintained, with the engine off, at the specified test temperature for not less than 10 h. This period may be reduced if instruments are available to check that the engine coolant and lubricant have stabilized at the specified test temperature.

5.4 Starting and loading engine

5.4.1 After the specified soak period (see 5.3), the engine may be started by any external means.

5.4.2 Starting the engine shall be taken as the start of the test period.

5.4.3 For the first 5 min of the test, the engine speed may be in accordance with the manufacturer's recommendation for warming up when starting in cold weather.

5.4.4 The operator's engine speed control shall be set at the position for maximum engine speed.

5.4.5 Any suitable external load equal to (20 ± 5) % of the rated bare engine (net) power, measured in accordance with ISO 2288, may be used.

5.5 Adjustment of heating system

5.5.1 The heating system shall be adjusted for maximum heating capacity.

5.5.2 The heating fan may be switched on at any time during the test.

5.6 Recording of results

All temperatures shall be recorded continuously or at intervals of not more than 5 min. At the end of the test, measure the enclosure pressurization in accordance with ISO 3737.

The air velocity may be measured after the test, under the same conditions as were used during the test.

5.7 Test duration

The test shall be interrupted when at least one of the following conditions has been fulfilled :

a) the highest measured air temperature inside the cab increases by less than 1 °C in 5 min;

b) 60 min from the beginning of the test.

6 Test report

If the specimen test report in annex A is not used, the test report shall include the following information :

a) tractor/machine make and model (indicate if radiator shutters, viscous clutch fan or radiator blockage were used to increase the coolant temperature);

b) tractor/machine engine thermostat opening temperature (optional: see 4.2 and 4.3);

c) cab make and model;

d) heating and ventilation system make and model;

e) ambient air temperature;

f) a graph showing the mean temperature inside the cab as a function of time;

g) stabilized temperatures at all measuring locations inside the cab, and the time when the stabilized condition was reached;

h) stabilized temperature difference between right and left foot (positions 1 and 2) and maximum difference between foot and head level (position 1 or 2 and position 5);

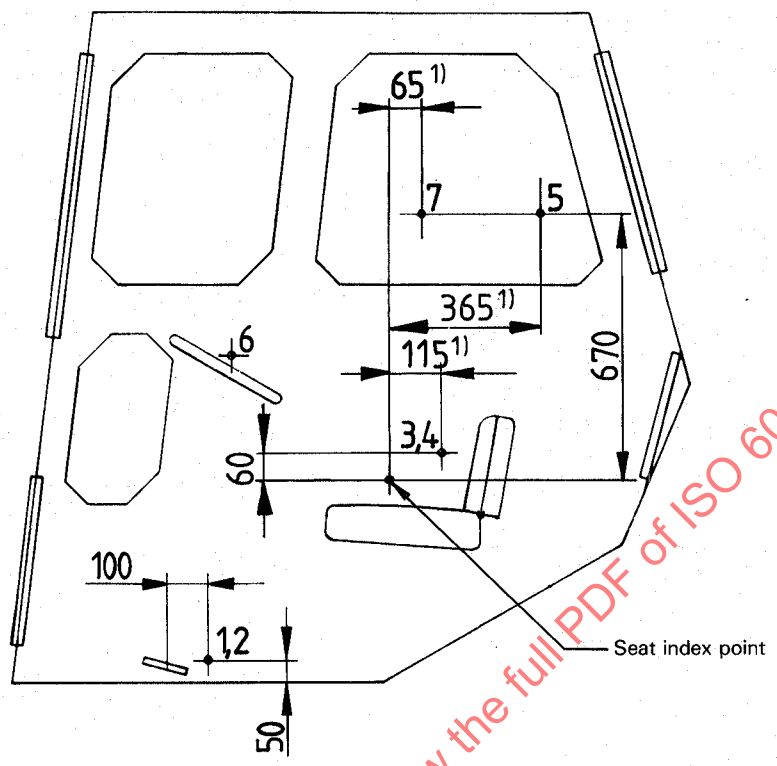
i) air velocities at the two measurement locations inside the cab;

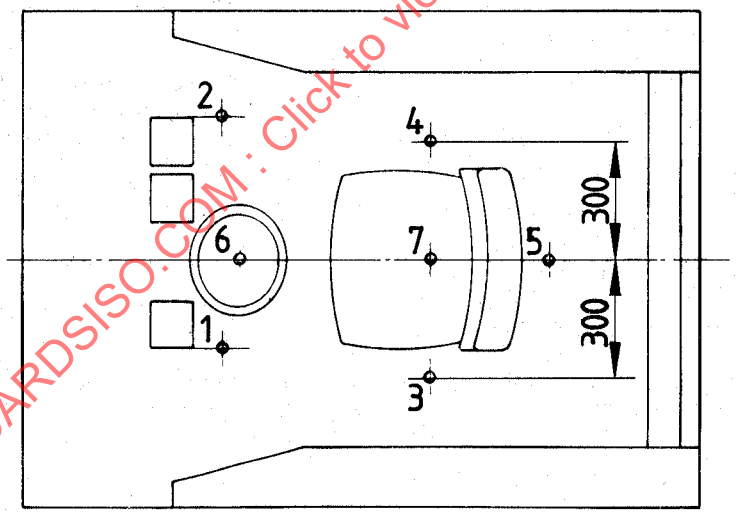
j) cab pressurization;

k) where applicable, engine coolant temperature at the end of the test;

l) where applicable, the flow (4.3.3) and the inlet and outlet temperatures of the heater (4.3.1 and 4.3.2).

Dimensions in millimetres





1) See 5.2.1.

Figure 1 — Measuring locations in the cab

Annex A
(informative)

Specimen test report form

1 Test No. : ..... Date : .....

2 Test requested by : .....

3 Machine/tractor[1] make and model : .....

Thermostat opening temperature : ..... °C

Special features : .....

Indicate if radiator shutters, viscous clutch fan or radiator blockage were used during the test. : .....

.....

4 Cab make and model : .....

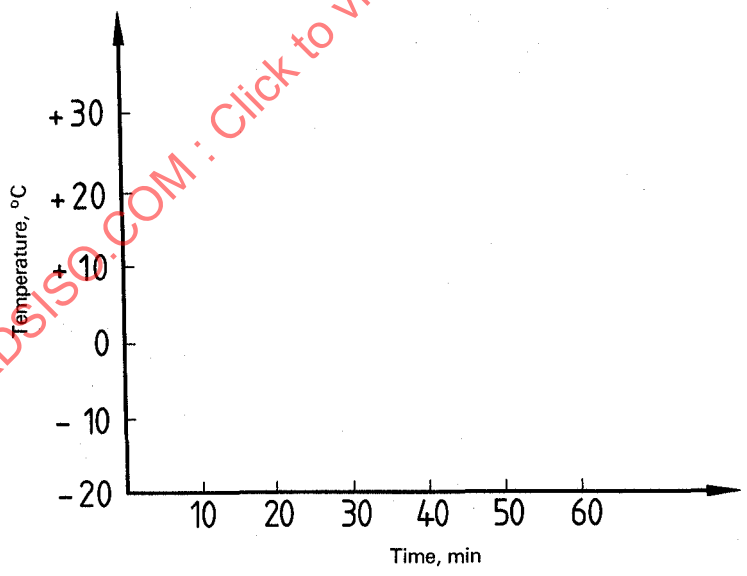
Description (cladding, etc.) : .....

5 Heating system make and model : .....

6 Ambient air temperature during the test : ..... °C

7 Cab mean temperature (graphical presentation as a function of time) :

NOTE — Mean temperature is the average of six locations listed under 8 below.



8 Stabilized temperatures inside cab

Left foot	:	°C was reached after	min
Right foot	:	°C was reached after	min
Left hip	:	°C was reached after	min
Right hip	:	°C was reached after	min
Head level	:	°C was reached after	min
Hand level	:	°C was reached after	min

1) Delete as appropriate.