BRITISH STANDARD

BS ISO
14269-2:1997

# Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment —

## Part 2: Heating, ventilating and air-conditioning test method and performance

ICS 65.060.01

# National foreword

This British Standard reproduces verbatim ISO 14269-2:1997 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee AGE/6, Agricultural tractors and forestry machinery, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

**Cross-references**

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, the ISO title page, page ii, pages 1 to 7 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

**Amendments issued since publication**

| Amd. No. | Date | Comments |
|---|---|---|
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# Contents

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# INTERNATIONAL STANDARD

# ISO 14269-2

First edition
1997-12-15

# Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment —

## Part 2:
## Heating, ventilation and air-conditioning test method and performance

*Tracteurs et machines automotrices pour l'agriculture et la sylviculture — Ambiance dans l'enceinte de l'opérateur —*

*Partie 2: Méthode d'essai et performances des systèmes de chauffage, de ventilation et de climatisation*


Reference number
ISO 14269-2:1997(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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 14269-2 was prepared by Technical Committee ISO/TC 23, *Tractors and machines for agriculture and forestry,* Subcommittee SC 2, *Common tests.*

This first edition, along with the other parts of ISO 14269, cancels and replaces ISO 3737:1976, ISO 6097:1989 and ISO/TR 8953:1987, which have been technically revised.

ISO 14269 consists of the following parts, under the general title *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment:*

— *Part 1: Vocabulary;*

— *Part 2: Heating, ventilation and air-conditioning test method and performance;*

— *Part 3: Determination of effect of solar heating;*

— *Part 4: Air filter element test method;*

— *Part 5: Pressurization system test method.*

Annex A of this part of ISO 14269 is for information only.

**Descriptors:** Agricultural machinery, forest equipment, self-propelled machines, agricultural tractors, operating stations, enclosures, environments, working conditions, heating, ventilation, air conditioning, tests, performance tests.

## 1 Scope

This part of ISO 14269 specifies a uniform test method for measuring the contribution to operator environmental temperature and humidity provided by an air-conditioning, heating and ventilation system operating in a specific ambient environment for tractors and self-propelled machines for agriculture and forestry. The method may not determine the complete climatic environment of the operator since this is also affected by heat load from sources other than those on the machine, for example solar heating. It is recommended that part 3 of ISO 14269 be used in conjunction with this part to determine more accurately the complete heat loading on the operator enclosure. Minimum performance levels for the machine's operator enclosure air conditioning, heating and ventilation systems are established in this part.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 14269. 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 14269 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 2288:1997, *Agricultural tractors and machines — Engine test code — Net power.*

ISO 5353:1995, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point.*

ISO 5721:1989, *Tractors for agriculture — Operator's field of vision.*

ISO 14269-1:1997, *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment — Part 1: Vocabulary.*

ISO 14269-4:1997, *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment — Part 4: Air filter element test method.*

ISO 14269-5:1997, *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment — Part 5: Pressurization system test method.*

## 3 Definitions

For the purposes of this part of ISO 14269, the definitions given in ISO 14269-1 apply, of which the following are particularly relevant.

**3.1**
**effective temperature**

combination of relative humidity and temperature which can indicate the level of comfort perceived by the human body [ISO 14269-1:1997, definition **2.1**]

**3.2**
**operator enclosure temperature chart**

diagram of the range of effective temperatures in which the operator environment within the operator enclosure is perceived as desirable
[ISO 14269-1:1997, definition **2.2**]

NOTE See Figure 1.

**3.3**
**operator environment**

space surrounding the operator as defined by temperature and velocity measurement points
[ISO 14269-1:1997, definition **2.3**]

NOTE See Figure 2.

**3.4**
**operator enclosure**

part of the machine which completely surrounds the operator, preventing the free passage of external air, dust or other substances into the area around the operator [ISO 14269-1:1997, definition **2.4**]

**3.5**
**air-conditioning system**

system which lowers the effective temperature of the air within the operator enclosure
[ISO 14269-1:1997, definition **2.5**]

**3.6**
**heating system**

system which raises the effective temperature of the air within the operator enclosure
[ISO 14269-1:1997, definition **2.8**]

**3.7**
**ventilation system**

system which provides fresh air to, and maintains air circulation within, the operator enclosure
[ISO 14269-1:1997, definition **2.11**]

## 4 Test equipment and instruments

**4.1 Test enclosure**, sufficiently large to contain the base machine with provisions to circulate conditioned air and to load the machine's engine and transmission.

**4.1.1** Field test conditions may be used.

**4.1.2** If it is not practical to test the base machine due to physical size limitations, the operator enclosure may be bench tested with the loads imposed by the base machine on the operator enclosure simulated. If this procedure is used, correlation with field data shall be established.

**4.2 Temperature measuring devices**, with a measuring accuracy of ± 0,5 °C.

**4.3 Pressure measuring devices**, with a measuring accuracy of 2 % of the observed values.

**4.4 Device to measure wet bulb temperature**, with a measuring accuracy of ± 0,5 °C of the observed values.

**4.5 Device to measure operator enclosure pressurization**, with a measuring accuracy of 10 % of the observed values.

**4.6 Device to measure rotational frequency (r.p.m.)**, with a measuring accuracy of 2 % of the observed values.

**4.7 Device to measure air velocity**, with a measuring accuracy of 10 % of the observed values.

**4.8 Device to measure blower voltage and clutch voltage**, with a measuring accuracy of 2 % of the observed values.

**4.9 Device to measure time**, with a measuring accuracy of ±0,5 s of the observed values.

## 5 Measurement locations

See Figure 2. The locations of the temperature and velocity measurement points are based on the seat index point described in ISO 5353.

**5.1** The ambient air temperatures shall be measured at a location where the ambient air is not affected by the machine and at a height equivalent to the air intake height on the operator enclosure.

**5.2** The operator enclosure pressurization shall be measured according to ISO 14269-5.

**5.3** Dry bulb temperatures shall be measured as close as is practical to positions 1 to 6 in Figure 2.

**5.4** Wet bulb temperature shall be measured at position 6 in Figure 2.

**5.5** It is recommended that the air velocity at the eyes (position 7 of Figure 2) be measured in accordance with ISO 5721.

NOTE If an alternative operator station position is available (for example, a reversible operator station), the alternate positions should also be tested with a comparable array of measurement locations.

## 6 Common minimum performance requirements

**6.1** The operator enclosure should be capable of maintaining a minimum pressurization of 50 Pa throughout the test, as outlined in ISO 14269-5. Maximum pressurization shall not exceed 200 Pa.

**6.2** Under all conditions of air-conditioning, heating or ventilation, a minimum of 43 $m^3$/h of filtered fresh air shall be provided.

**6.3** Under all conditions of air-conditioning, heating or ventilation, the temperatures measured in the operator's environment shall be uniform within 5 °C.

**6.4** Filtered fresh air shall be passed through a filter that is a minimum of 96 % efficient using fine test dust and test procedure defined in ISO 14269-4.

**6.5** It is recommended that a means be provided to limit the maximum air velocity at position 7 in Figure 2 to 0,3 m/s. Adjustable diffusers may be used to redirect air.

## 7 Common test procedures

**7.1** The test conditions specified in **8.1**, **9.1** and **10.1** shall be maintained throughout the duration of the respective test.

**7.2** Record the temperatures as specified in **5.3** and **5.4** at intervals not greater than 5 min.

**7.3** Dry bulb temperatures from all six locations shall be averaged for each reading interval.

**7.4** The test shall be considered terminated when either of the following conditions is fulfilled:

a) the minimum temperature recorded in clause **7.3** does not vary by more than 0,5 °C in 15 min; or

b) the test has run for 1 h.

**7.5** The data obtained at the termination of the heating or air conditioning test shall be compared with the operator enclosure temperature chart shown in Figure 1.

**7.6** An operator may be present in the operator enclosure throughout the duration of the test.

## 8 Air-conditioning system test

### 8.1 Test conditions

**8.1.1** The air-conditioning system shall be tested in the intended production configuration, adjusted within the manufacturer's specifications.

**8.1.2** The ambient conditions for moderate temperature and high humidity shall be:

a) minimum dry bulb temperature: 32 °C;

b) minimum wet bulb temperature: 25 °C;

c) maximum air velocity passing the machine from front to rear: 5 m/s.

**8.1.3** The machine shall be operated at rated engine speed in a mode which will provide at least one half of the maximum rated net engine power. Net engine power shall be determined in accordance with ISO 2288.

NOTE Loading of the engine through the transmission is recommended. Engine loading is recommended only when the engine or component temperatures (such as transmission) influence the environment within the operator enclosure.

**8.1.4** Prior to conducting tests on the air-conditioning system, the machine shall be operated as specified in **8.1.3** for one hour, to provide a preliminary, stabilizing heat soak period. Doors and windows shall be closed and other ventilation systems shall be turned off. During this period, ambient temperature shall be as specified in **8.1.2**.

**8.1.5** The air-conditioning system controls shall be set according to the manufacturer's specifications or to provide maximum cooling performance. The requirements specified in clause **6** shall be maintained throughout the test.

### 8.2 Minimum air-conditioning system performance

The air conditioning system shall be capable of reducing the operator environment temperature to the comfort zone shown in Figure 1, or a minimum of 11 °C below the ambient for ambient temperatures between 38 °C and the highest ambient temperature at which the machine is designed to operate.

## 9 Heating system test

### 9.1 Test conditions

**9.1.1** The heating system shall be tested in the intended production configuration, adjusted within the manufacturer's specifications.

**9.1.2** The ambient conditions for heating tests shall be:

a) maximum dry bulb temperature: – 7 °C;

b) maximum air velocity passing the machine from front to rear: 5 m/s.

**9.1.3** The test machine shall be cold soaked at the conditions outlined in **9.1.2** for a minimum of 10 h prior to start of the test.

**9.1.4** The machine shall be operated in accordance with the manufacturer's recommended warm-up procedure, then run at rated speed under a maximum load of no more than 20 % of the maximum rated net engine power. Net engine power shall be determined in accordance with ISO 2288.

**9.1.5** The heating system controls shall be set according to the manufacturer's specifications or for maximum heating capacity. The requirements specified in clause **6** shall be maintained throughout the test.

**9.1.6** If the machine is field tested, no solar heating is allowed on the operator station.

### 9.2 Minimum heating system performance

The heating system shall be capable of increasing the operator environment temperature to the comfort zone shown in Figure 1, or a minimum of 36 °C above ambient for ambient temperatures between – 12 °C and the lowest ambient temperature at which the machine is designed to operate.

## 10 Ventilation test

### 10.1 Test conditions

**10.1.1** The ventilation system shall be tested in the intended production configuration, adjusted within the manufacturer's specifications.

**10.1.2** The ambient conditions for the ventilation test shall be:

a) minimum dry bulb temperature: 27 °C;

b) maximum air velocity passing the machine from front to rear: 5 m/s.

**10.1.3** The machine shall be operated in accordance with the manufacturer's recommended warm-up procedure, then run at rated speed under a maximum load of no more than 20 % of the maximum rated net engine power. Net engine power shall be determined in accordance with ISO 2288.

NOTE Loading of the engine through the transmission is recommended. Engine loading is recommended only when the engine or component temperatures (such as transmission) influence the environment within the operator enclosure.

**10.1.4** The ventilation system controls shall be set according to the manufacturer's specifications for maximum ventilation.

**10.2** Minimum ventilation performance requirements are indicated in clause **6**.

## 11 Tests report

The test report shall include the following information:

a) model and serial number of tractor or self-propelled machine tested;

b) ambient conditions outside the operator enclosure (i.e. relative humidity, temperature, air velocity);

c) operator enclosure pressurization (Pa);

d) average dry bulb temperature in the operator enclosure at each reading (°C);

e) wet bulb temperature in the operator enclosure at each reading (°C);

f) test voltage of blower and compressor clutch.

An example of a suitable test report form is given in Annex A.

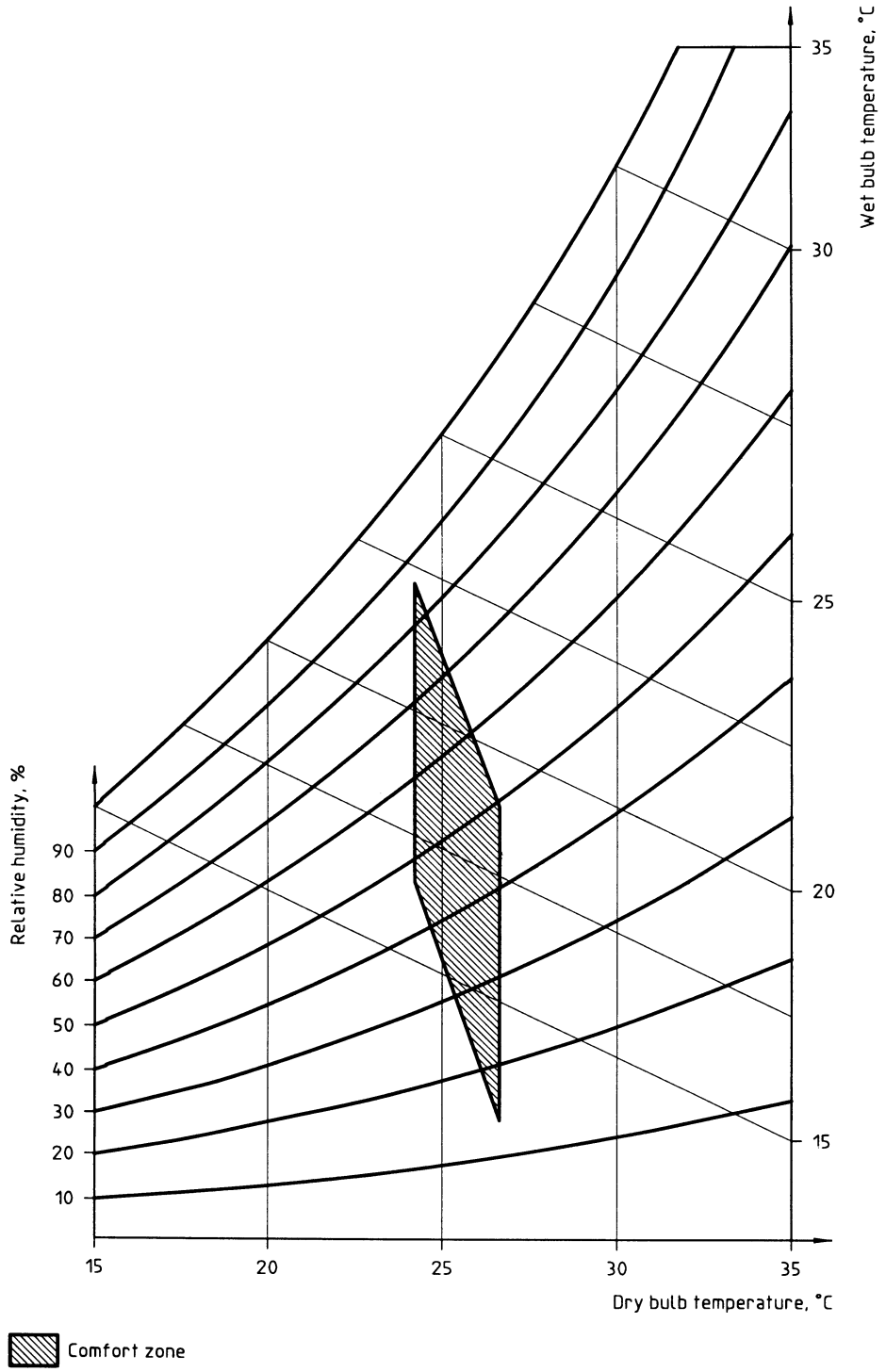


**Figure 1 — Operator enclosure temperature chart**

Dimensions in millimetres

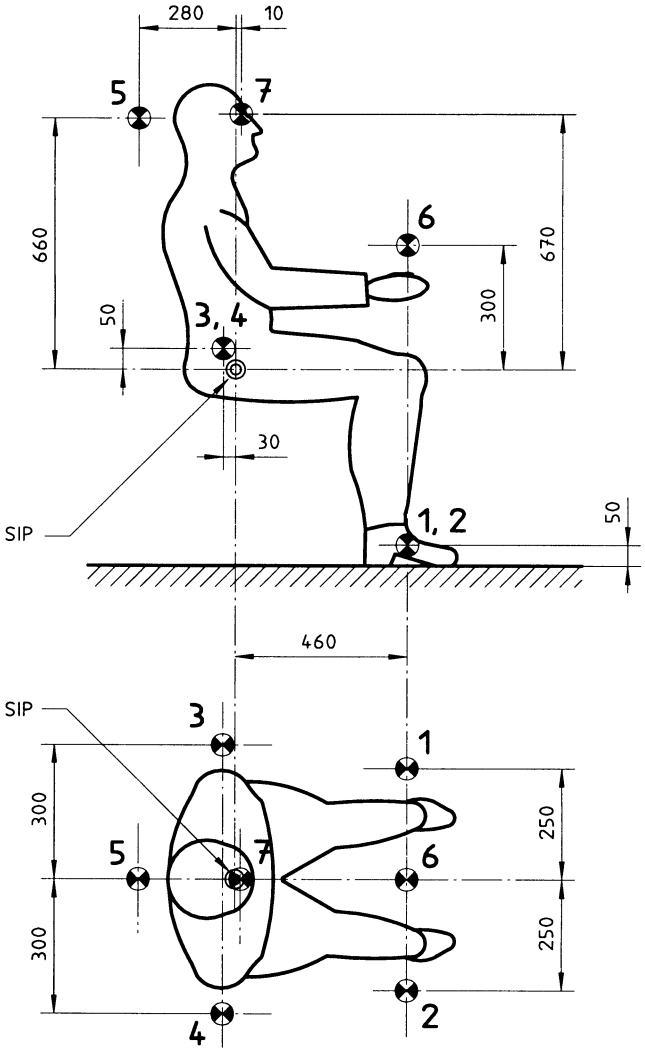


**Figure 2 — Temperature and velocity locations**

# Annex A (informative)
# Example of test report form for operator enclosure heating, ventilation and air-conditioning systems

**Tractor or self-propelled machine**

Type: ..... Model: ..... Serial No.: .....

**Air-conditioning system test** (ISO 14269-2, clause 8)

Ambient temperatures

dry bulb: ..... °C

wet bulb: ..... °C

Air velocity (8.1.2.3, 5 m/s max.): ..... m/s

Enclosure temperatures at end of test

dry bulb (average): ..... °C

wet bulb: ..... °C

Dry bulb temperature differences for enclosure measurement at end of test: ..... °C

Minimum performance achieved (8.2): ..... yes/no

Enclosure pressure: ..... Pa

Setting of adjustable controls: .....

Solar heating: natural ☐ simulated ☐ none ☐

solar radiant energy: ..... $W/m^2$

Method of engine loading (if applicable): .....

Duration of test: ..... min

**Heater system test** (ISO 14269-2, clause 9)

Ambient dry bulb temperature: ..... °C

Air velocity (9.1.2.2, 5 m/s max.): ..... m/s

Enclosure temperatures at end of test

dry bulb (average): ..... °C

wet bulb: ..... °C

Dry bulb temperature differences for enclosure measurements at end of test: ..... °C

Minimum performance achieved (9.2): ..... yes/no

Enclosure pressure: ..... Pa

Setting of adjustable controls: .....

Method of engine loading (if applicable): .....

Duration of test: ..... min

**Ventilation test** (ISO 14269-2, clause 10)

Ambient dry bulb temperature: ..... °C

Air velocity (9.1.2.2, 5 m/s max.): ..... m/s

Dry bulb temperature differences for enclosure measurements at end of test: ..... °C

Minimum performance achieved (6): ..... yes/no

Enclosure pressure: ..... Pa

Setting of adjustable controls: .....

Solar heating: natural ☐ simulated ☐ none ☐

solar radiant energy: ..... $W/m^2$

Method of engine loading (if applicable): .....

Duration of test: ..... min

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