

INTERNATIONAL
STANDARD

ISO
10263-4

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**Earth-moving machinery — Operator
enclosure environment —**

Part 4:

Operator enclosure ventilation, heating and/or
air-conditioning test method

Engins de terrassement — Ambiance dans l'enceinte de l'opérateur —

*Partie 4: Méthode d'essai des systèmes de ventilation, de chauffage et/ou
de conditionnement d'air de l'enceinte de l'opérateur*



Reference number
ISO 10263-4:1994(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 10263-4 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

ISO 10263 consists of the following parts, under the general title *Earth-moving machinery — Operator enclosure environment*:

- Part 1: *General and definitions*
- Part 2: *Air filter test*
- Part 3: *Operator enclosure pressurization test method*
- Part 4: *Operator enclosure ventilation, heating and/or air-conditioning test method*
- Part 5: *Windscreen defrosting system test method*
- Part 6: *Determination of effect of solar heating on operator enclosure*

Annex A of this part of ISO 10263 is for information only.

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Earth-moving machinery — Operator enclosure environment —

Part 4:

Operator enclosure ventilation, heating and/or air-conditioning test method

1 Scope

This part of ISO 10263 specifies a test method which provides uniform measurement of the temperature and humidity inside an operator enclosure of an earth-moving machine equipped with devices for air-conditioning, heating and/or ventilation.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10263. 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 10263 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 9249:1989, *Earth-moving machinery — Engine test code — Net power.*

ISO 10263-2:1994, *Earth-moving machinery — Operator enclosure environment — Part 2: Air filter test.*

ISO 10263-3:1994, *Earth-moving machinery — Operator enclosure environment — Part 3: Operator enclosure pressurization test method.*

ISO 10263-6:1994, *Earth-moving machinery — Operator enclosure environment — Part 6: Determination of effect of solar heating on operator enclosure.*

3 Definitions

For the purposes of this part of ISO 10263, the following definitions apply.

3.1 comfort chart: Diagram to indicate the effective temperature range in which an operator environment is perceived to be comfortable. [ISO 10263-1:1994, definition 3.2]

3.2 operator environment: Space surrounding the operator defined by temperature measurement points. [10263-1:1994, definition 3.3]

3.3 air-conditioning system: Any system which lowers the effective air temperature within the operator environment by means of a refrigerant. [ISO 10263-1:1994, definition 3.13]

3.4 heating system: Any system which raises the effective air temperature within the operator environment. [ISO 10263-1:1994, definition 3.14]

3.5 air handling system: Any system which lowers or raises the effective air temperature within the operator enclosure by the use of full air-conditioning, air-conditioning, heating or ventilation. [ISO 10263-1:1994, definition 3.15]

3.6 ventilation system: Any system which provides fresh air to, and maintains air circulation within, the operator environment. [ISO 10263-1:1994, definition 3.16]

4 Test equipment and instrumentation

4.1 Test enclosure sufficiently large to contain the base machine with provision to circulate conditioned air and to load the machine engine and transmission.

4.2 Thermometers or **other temperature-measuring devices**, with a measuring accuracy of $\pm 0,5$ °C.

4.3 Manometers or **other pressure-measuring devices**, with a measuring accuracy of 2 % of the observed values.

4.4 Psychrometer with a measuring accuracy of $\pm 0,5$ °C, to obtain the wet bulb temperature.

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

4.6 Tachometer with a measuring accuracy of 2 % of the observed values.

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

5 General conditions

5.1 Field test conditions may be used.

5.2 If it is not practical to test the base machine due to physical size limitations, the operator's enclosure may be bench-tested with simulation of the loads imposed by the base machine on the enclosure. If this procedure is used, correlation with field data shall be established.

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

The dry bulb temperature shall be measured as close as practical to positions 1 to 6 as shown in figure 1.

If an alternative operator station position is available (for example, in a backhoe loader machine), the alternative positions should also be tested with a comparable array of temperature-measurement positions.

The wet bulb temperature shall be measured at position 6 as shown in figure 1.

5.4 The operator enclosure pressurization shall be measured in accordance with ISO 10263-3.

5.5 The refrigerant pressure may be measured at both the inlet and outlet connections of the compressor.

5.6 To determine machine temperature stabilization, the engine coolant, transmission oil and hydraulic oil temperatures may be recorded if applicable.

5.7 It is recommended that the air velocity should be measured at the operator eye point (position 7 in figure 1).

6 Air-conditioning, heating and/or ventilation systems

6.1 Common test conditions

6.1.1 The operator enclosure should be capable of being pressurized at a minimum pressure level of 50 Pa, but not exceeding 200 Pa, and be maintained at this level throughout the test.

6.1.2 Under all conditions of air-conditioning, heating or ventilation, a minimum of 43 m³/h of filtered fresh air per enclosure occupant should be provided.

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

6.1.4 Filtered fresh air should be passed through a filter that is a minimum of 96 % efficient, using fine test dust and the test method specified in ISO 10263-2.

6.1.5 It is recommended that a means should be provided to limit the maximum air velocity in front of the operator's eyes to 0,3 m/s. Adjustable diffusers may be used to redirect air.

6.1.6 Test conditions shall be maintained throughout the duration of the test.

Dimensions in millimetres

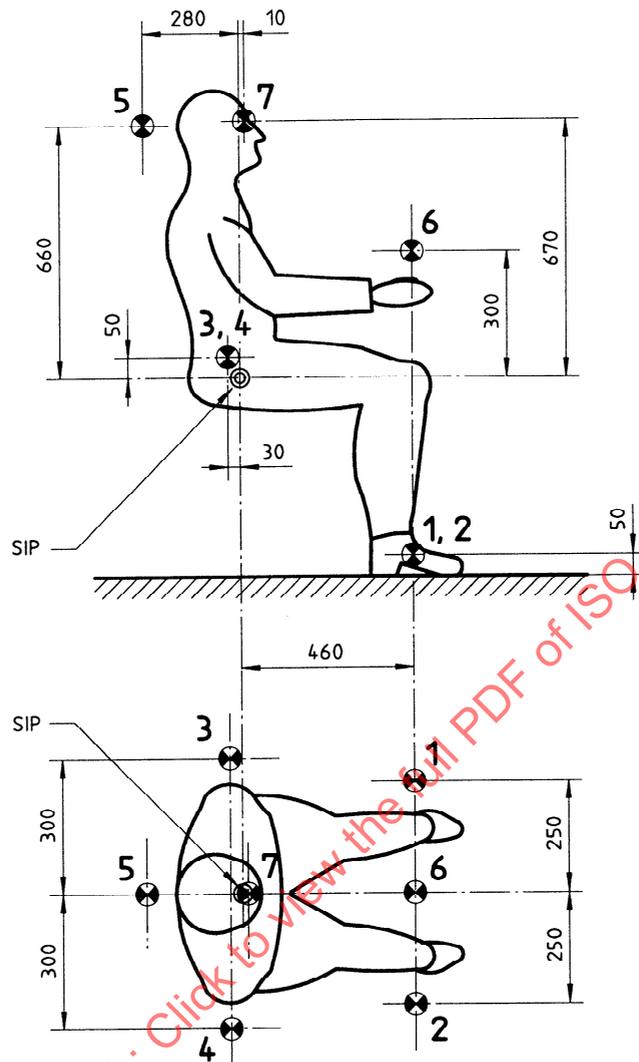


Figure 1 — Measurement point locations

6.2 Test procedure

6.2.1 Run the air-conditioning, heating and/or ventilation system, and record the operator enclosure temperatures as indicated in 5.3, at intervals not greater than 5 min.

Calculate the average dry bulb temperatures from all six points, to obtain the enclosure dry bulb temperature for each reading interval.

6.2.2 Consider the test terminated when either of the following conditions is fulfilled:

- the minimum temperature recorded in 6.2.1 does not vary by more than 0,5 °C in 15 min;

- the test has run for 1 h.

6.2.3 Compare the data obtained at the test termination with the operator comfort chart in figure 2.

7 Air-conditioning system

7.1 Test conditions

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

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

- 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.

7.1.3 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, determined in accordance with ISO 9249.

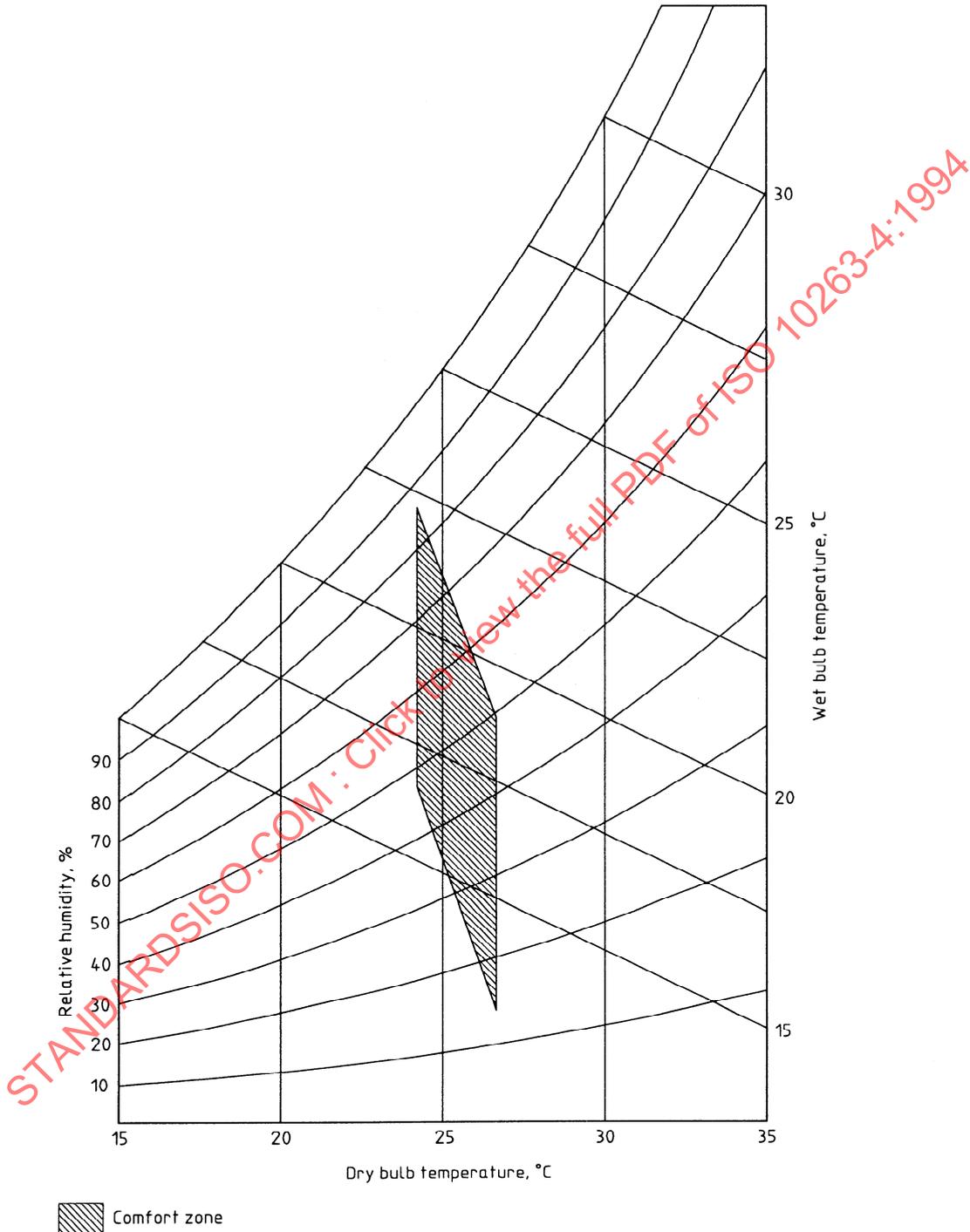


Figure 2 — Operator comfort chart

7.1.4 The air-conditioning system controls shall be set in accordance with the manufacturer's specifications or be adjusted to provide maximum operator enclosure pressure.

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

7.1.6 Prior to conducting tests on the air-conditioning system, the machine shall be operated for 1 h in accordance with 7.1.3, with the air-conditioning system not in use to provide a preliminary, stabilizing heat soak period. During this period, the ambient temperature shall be as specified in 7.1.2.

7.2 Minimum air-conditioning performance

The air-conditioning system shall be capable of reducing the operator environment temperature to the comfort zone of the operator comfort chart in figure 2, or a minimum of 11 °C below the ambient temperature for ambient temperatures of between 38 °C and the highest ambient temperature at which the machine is designed to operate.

8 Heating system

8.1 Test conditions

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

8.1.2 The ambient conditions for the heating system test shall be:

- a) maximum dry bulb temperature: – 7 °C;
- b) maximum air velocity passing the machine from front to rear: 5 m/s.

8.1.3 Before carrying out the tests, the machine shall be cold soaked for a minimum of 10 h at the temperature specified in 8.1.2.

8.1.4 The machine shall be operated in accordance with the manufacturer's recommended warm-up practice and then run at rated speed under a maximum load of no more than 20 % of the maximum rated net engine power, as determined in accordance with ISO 9249.

8.1.5 The heater system controls shall be set in accordance with the manufacturer's instructions or be adjusted to provide maximum operator enclosure pressurization.

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

8.2 Minimum heater performance

The heating system shall be capable of increasing the operator environment temperature to the comfort zone of the operator comfort chart specified in figure 2, or a minimum of 36 °C above the ambient temperature for ambient temperatures between – 12 °C and the lowest ambient temperature at which the machine is designed to operate.

9 Ventilation system

9.1 Test conditions

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

9.1.2 The ambient conditions for the ventilation system test shall be:

- a) maximum dry bulb temperature: + 27 °C;
- b) maximum air velocity passing the machine from front to rear: 5 m/s.

9.1.3 The machine shall be operated in accordance with the manufacturer's recommended warm-up procedure, and then run at the rated speed under a maximum load of no more than 20 % of the maximum rated net engine power, as determined in accordance with ISO 9249.

9.1.4 The ventilation system controls shall be adjusted to the maximum position with maximum operator enclosure pressurization.

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

9.2 Minimum ventilation performance

The minimum ventilation performance requirements shall be as indicated in 6.1.

10 Test report

The test report shall contain the following information. In addition, the optional test conditions shall be recorded when they are used.

- a) Air-conditioning and humidity control:

- 1) dry and wet bulb temperature reduction from the specific ambient values;
 - 2) solar radiant energy levels as measured in accordance with ISO 10263-6.
- b) Heating:
- 1) temperature rise above ambient at the specific ambient temperature;
 - 2) solar radiant energy levels as measured in accordance with ISO 10263-6.
- c) Ventilation:
- 1) enclosure temperature uniformity;
 - 2) ambient temperature;
 - 3) operator enclosure pressurization pressure;
 - 4) volume of fresh filtered air provided;
 - 5) solar radiant energy levels as measured in accordance with ISO 10263-6.

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Annex A
(informative)

Bibliography

- [1] ISO 6097:1989, *Tractors and self-propelled machines for agriculture — Performance of heating and ventilation systems in closed cabs — Test method.*

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