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Earth-moving machinery — Operator enclosure environment —

Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance

Engins de terrassement — Environnement de l'enceinte de l'opérateur —

Partie 4: Performances et méthode d'essai des systèmes de chauffage, de ventilation et de climatisation (CVCA)

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Contents

Page

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.

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 10263-4 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

This second edition cancels and replaces the first edition (ISO 10263-4:1994), which has been technically revised.

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

— *Part 1: Terms and definitions*

— *Part 2: Air filter element test method*

— *Part 3: Pressurization test method*

— *Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance*

— *Part 5: Windscreen defrosting system test method*

— *Part 6: Determination of effect of solar heating*

Earth-moving machinery — Operator enclosure environment —

Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance

1 Scope

This part of ISO 10263 specifies a uniform test method for measuring the contribution to operator environmental temperature provided by a heating, ventilating and air conditioning system operating in a specific ambient environment. The method might 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. ISO 10263-6 is to be used in conjunction with this part of ISO 10263 to determine more accurately the complete heat loading on the operator enclosure. Minimum performance levels for the machine's operator enclosure heating, ventilating and air conditioning systems are established in this part of ISO 10263.

NOTE The HVAC is also referred to as the climate control system.

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

ISO 9249:2007, *Earth-moving machinery — Engine test code — Net power*

ISO 10263-1, *Earth-moving machinery — Operator enclosure environment — Part 1: Terms and definitions*

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

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10263-1 and the following apply.

3.1
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

3.2
operator environment
space surrounding the operator defined by temperature and wind speed measurement points

3.3
air conditioning system
system which lowers the effective temperature of the air within the operator enclosure

3.4
heating system
system which raises the effective temperature of the air within the operator enclosure

3.5
ventilating system
system which provides fresh air to, and maintains air circulation within, the operator enclosure

4 Test equipment and instruments

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 if required.

Field test conditions may be used.

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 Thermometers or **other temperature measuring devices**, with a measuring accuracy of ± 0,5 °C

4.3 Device to measure wet bulb or dew point temperature, with a measuring accuracy of ± 0,5 °C.

4.4 Device to measure operator enclosure pressure (Pa), with a measuring accuracy of 5 % of the observed values.

4.5 Device to measure rotational frequency (rpm), with a measuring accuracy of 2 % of the observed values.

4.6 Anemometer to measure wind speed, with a measuring accuracy of within 0,5 m/s.

4.7 Stopwatch or **other timing device**.

5 Measurement locations

5.1 General

The locations of the temperature and wind speed measurement points shall be based on the seat index point, described in ISO 5353. See Figure 1.

5.2 Measurement specifications

5.2.1 The ambient outside 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.

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

5.2.3 The inside dry bulb temperature shall be measured as close as practical to point 1 to point 6 as shown in Figure 1.

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

5.2.4 It is recommended that the wind speed be measured at the operator eye point (point 7 in Figure 1).

If an alternative operator station position is available (for example, in a backhoe loader machine), the alternative position should also be tested at a comparable operator eye point.

6 Heating, ventilating and air conditioning system

6.1 Common test conditions

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

6.1.2 Under all conditions of heating, ventilating or air conditioning, a minimum of 43 m^3/h of filtered fresh air shall be provided.

6.1.3 At the conclusion of heating, ventilating or air conditioning tests, the temperatures measured (point 1 to point 6, see Figure 1) in the operator's environment shall not vary by more than 5 °C.

6.1.4 Filtered fresh air shall 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 be provided to limit the maximum wind speed at point 7 in Figure 1 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.

6.1.7 The maximum wind speed passing the machine from front to rear is 5 m/s.

6.2 Common test procedure

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

6.2.2 Record enclosure pressure, in Pascals (Pa). The pressure measuring device shall be positioned to avoid velocity head by keeping its reference and measuring points away from air streams.

6.2.3 Record the temperatures as specified in 5.2.3 at intervals not greater than 5 min.

6.2.4 The average dry bulb temperatures from point 1 to point 6 shall be determined for each reading interval.

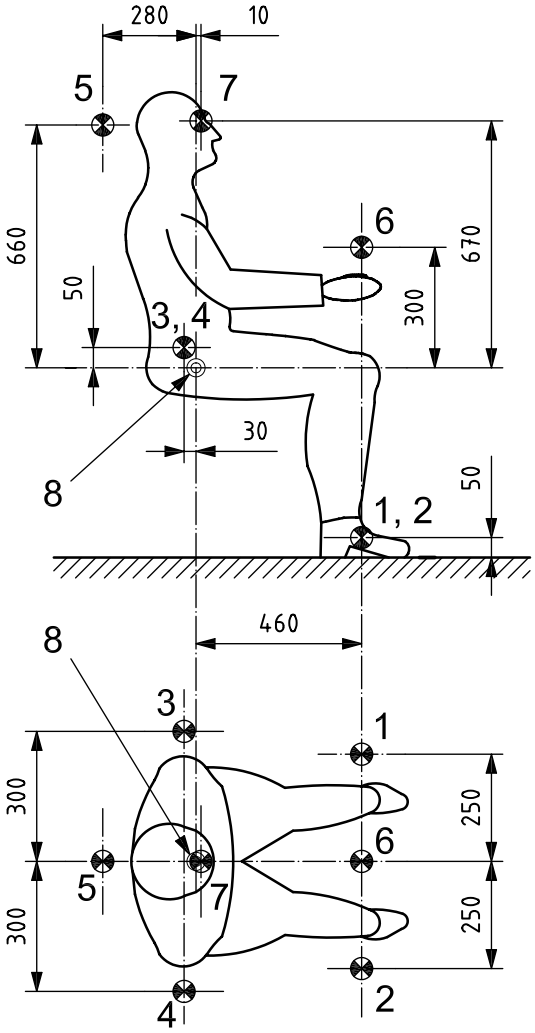
6.2.5 The test shall be considered terminated when either of the following conditions has been fulfilled:

a) the average dry bulb temperature recorded in 6.2.3 does not vary by more than 0,5 °C in 15 min;

b) the test has run for 1 h.

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

Dimensions in millimetres



Key

1–6 temperature and wind speed measurement points

7 operator eye point

8 SIP

Figure 1 — Measurement point locations

7 Air conditioning systems

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 shall be:

a) minimum dry bulb temperature: + 38 °C;

b) minimum moisture content of 0,018 kg H_2O per kg dry air at or above 38 °C.

7.1.3 When the environment within the operator enclosure is influenced by engine or component temperatures (such as transmission) the machine shall be operated at rated engine speed in a mode which will provide at least 50 % of the maximum rated net engine power, determined in accordance with ISO 9249 or these conditions shall be simulated as referenced in 4.1. Loading of the engine through the transmission is recommended.

7.1.4 The air conditioning system controls shall be set according to the manufacturer's specifications or to provide maximum cooling performance. The requirements specified in 6.1 shall be maintained throughout the test.

7.1.5 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.

7.1.6 It is recommended that solar loading be applied in accordance with ISO 10263-6. The loading shall be applied in one of the following time periods.

— If the machine or operator enclosure is heat soaked using the engine as defined in 7.1.5, the solar loading is to start at the beginning of the air conditioning tests. Solar loading before the air conditioning tests is allowable.

— If the machine or operator enclosure is not heat soaked as defined in 7.1.5, the solar loading is to begin a minimum of 1 h prior to conducting the air conditioning tests. Doors and windows shall be closed. During this period, ambient temperature shall be as specified in 7.1.2.

7.2 Minimal air conditioning performance

The air conditioning system shall be capable of reducing the operator environment dry bulb temperature to 25 °C or lower.

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 maximum ambient temperature for the heating system test shall be –15 °C or colder.

8.1.3 Before carrying out the tests, the machine shall be cold soaked at the temperature specified in 8.1.2 for 10 h or until the heat transfer medium, the windshield, the HVAC system, the duct work and the enclosure are at the temperature specified in 8.1.2. No external oil or coolant heating source shall be used during the cold soak.

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, or these conditions shall be simulated as referenced in 4.1.

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

8.2 Minimum heating performance

The heating system shall be capable of increasing the operator environment temperature to 25 °C or greater.

9 Ventilating system

9.1 Test conditions

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

9.1.2 The ambient conditions for the ventilating system test shall be a minimum outside dry bulb temperature of 27 °C.

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 or these conditions shall be simulated as referenced in 4.1.

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

9.2 Minimum ventilating performance

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

10 Test report

The test report shall include the following information:

a) model and serial number of machine tested;

b) ambient conditions outside the operator enclosure [i.e. dry bulb temperature, moisture content (kg H_2O per kg dry air), wind speed];

c) operator enclosure pressurization (Pa);

d) average dry bulb temperature in the operator enclosure at the end of the test (°C);

e) operator environment temperature uniformity;

f) volume of fresh filtered air provided;

g) solar radiant energy levels as measured in accordance with ISO 10263-6.

In addition, the optional test conditions shall be recorded when they are used.

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

Annex A
(informative)

Example of test report form for operator enclosure air conditioning, heating and ventilating systems

Test machine

Type: ..... Model: ..... PIN (or serial number): .....

Air conditioning system test (Clause 7)

Ambient conditions

Dry bulb temperature: ..... °C

Moisture content: ..... kg H_2O per kg dry air

Wind speed passing machine (6.1.7): .....m/s

Operator environment temperature at end of test

Dry bulb temperature (average): ..... °C

Operator environment temperature uniformity (6.1.3): ..... Δ °C

Minimum performance achieved (7.2): ..... 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

Heating system test (Clause 8)

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

Wind speed passing machine (6.1.7): .....m/s

Operator environment dry bulb temperature at end of test (average): ..... °C

Operator environment temperature uniformity (6.1.3): ..... Δ °C

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

Enclosure pressure: .....Pa

Setting of adjustable controls: .....

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

Duration of test: ..... min

Ventilating test (Clause 9)

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

Wind speed passing machine (6.1.7): ..... m/s

Operator environment temperature uniformity (6.1.3): ..... Δ °C

Minimum performance achieved (9.2): .....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

Bibliography

[1] ISO 5006, *Earth-moving machinery — Operator's field of view — Test method and performance criteria*

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