INTERNATIONAL STANDARD 3148

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Radiators, convectors and similar appliances — Determination of thermal output — Test method using air-cooled closed booth

Radiateurs, convecteurs et appareils similaires — Détermination de la puissance thermique — Méthode d'essai en chambre fermée à refroidissement par air

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

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.

International Standard ISO 3148 was drawn up by Technical Committee ISO/TC 116, *Space-heating appliances,* and circulated to the Member Bodies in September 1973.

It has been approved by the Member Bodies of the following countries:

Australia	France	South Africa, Rep. of
Belgium	Germany	Thailand
Bulgaria	Ireland	Turkey
Canada	Italy	United Kingdom
Czechoslovakia	Netherlands	Yugoslavia
Denmark	Norway	
Egypt, Arab Rep. of	Romania	

No Member Body expressed disapproval of the document.

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Radiators, convectors and similar appliances — Determination of thermal output — Test method using air-cooled closed booth

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the determination of the thermal output of radiators, convectors and similar appliances, using an air-cooled closed booth.

Radiators are heating bodies which emit heat partly by radiation; convectors, on the contrary, emit heat almost wholly by natural convection.

2 REFERENCES

ISO 3147, *Heat exchangers — Verification of thermal balance of water-fed or steam-fed primary circuits — Principles and test requirements.*

ISO 3150, *Radiators, convectors and similar appliances — Calculation of thermal output and presentation of results.*

3 TEST INSTALLATION

The tests shall be carried out in an installation containing the following equipment :

a) a test booth consisting of :

— an internal enclosure comprising the test area in which the appliance to be tested is placed;

— a compensation enclosure permitting the creation and maintenance around the internal enclosure of a specific environment independent of external atmospheric conditions;

b) apparatus for cooling the air circulating in the compensation enclosure;

c) a primary heating fluid circuit feeding the appliance under test (see ISO 3147);

d) measuring and checking instruments.

3.1 Test booth

3.1.1 *Internal enclosure*

3.1.1.1 Dimensions

The internal enclosure shall have the following dimensions :

floor : 4 ± 0,2 m × 4 ± 0,2 m

height : 2,8 ± 0,2 m

However, the following dimensions are permitted for existing booths:

floor : 3,5 to 4,2 m × 3,9 to 5 m

height : 2,6 to 3 m

3.1.1.2 Construction

The nature and thickness of the material of which the closed booth is constructed shall be such that the four walls, the ceiling and the floor have the same thermal resistance (within 20 %). This applies equally to doors and, where provided, to windows.

Doors, windows (if provided), framing and joints shall be airtight under all circumstances.

3.1.2 *Compensation enclosure*

The compensation enclosure shall be provided with an access door preferably directly facing the door to the internal enclosure. The access door must be airtight and have the same thermal resistance as the walls.

The overall coefficient of thermal conductivity of the walls, ceiling and floor of the compensation enclosure shall be less than or equal to 0,58 W/(m²·K).

The circulation of air in the space between the inner and outer enclosures shall be uniform and controlled by a suitable inlet and extraction system.

NOTE — In order to achieve sensibly uniform cooling of the surfaces of the inner enclosure and to minimize the temperature difference between individual inner surfaces, it is recommended that:

a) the width of the space between the inner and outer enclosures be of the order of 0,50 m (not less than 0,30 m);

b) the average velocity of the cooling air circulating around the inner enclosure be between 0,1 and 0,5 m/s.

3.2 Measurements in the booth

3.2.1 *Measurement of air temperature within the inner enclosure*

Temperatures shall be measured by means of shielded sensors as indicated below, at the reference position within ± 0,1 °C and at all other positions within ± 0,2 °C.

3.2.1.1 On the vertical axis of the inner enclosure

a) at the reference point 0,75 m from the floor;

b) at four points;

- 0,05 m from the floor;
- 0,50 m from the floor;
- 1,50 m from the floor;
- 0,05 m from the ceiling.

3.2.1.2 On four verticals at 1 m from each of two adjoining walls

At eight points (two on each vertical):

- 0,75m from the floor;
- 1,50 m from the floor.

3.2.2 *Temperature measurements of the internal faces of the inner enclosure*

The temperature shall be measured to within ± 0,2 °C:

a) at six points, at the centres of the six inner faces of the enclosure;

b) at a point on the vertical centre line of the inner face of the wall against which the appliance under test is placed : 0,30 m from the floor.

3.2.3 *Other measurements*

a) Relative humidity of the air within the inner enclosure.

b) Air temperature in the space between the two enclosures, to within ± 0,5 °C.

c) Barometric pressure, to within ± 0,1 kPa (± 1 mbar).

4 PROCEDURE

The tests shall be carried out in the closed booth with six cooled surfaces, steady-state conditions being recorded by the logging of temperatures as indicated below.

4.1 Preparation and installation of appliances

Tests may be carried out only on appliances with characteristics lying within the following ranges:

a) an output per unit volume of the inner enclosure of less than 87 W/m^3;

b) a total output of not less than 700 W;

c) a length of not less than 0,5 m;

d) in the case of a sectional appliance, the number of sections in the unit tested is if possible, not less than 10.

Unless other conditions are specified by the manufacturer, the appliance shall be installed in the following reference conditions:

e) the appliance shall be placed parallel to, and symmetrically about the centre line of, one of the walls of the inner enclosure;

f) the gap between the rear of the nearest heat-emitting surface of the appliance and the wall against which it is placed shall be 0,05 ± 0,005 m;

g) the gap between the floor and the bottom of the appliance shall be between 0,10 and 0,12 m;

h) the appliance under test shall be connected with the flow connection at the top of one end and the return connection at the bottom of the opposite end, except when otherwise specified by the manufacturer;

j) a uniform coating of paint shall be applied to all external surfaces; paints with metallic pigments are not to be used.

NOTE — Requirement j) does not apply to convectors.

The appliance shall be supported and fixed in the normal way with the components normally provided by the manufacturer, unless this would prevent compliance with the above requirements. Alternatively, fixings are to be such that they will not affect the output of the appliance.

Connecting pipes shall be fixed with a slope of 0,5 % and suitable air vents shall be provided in the primary fluid circuit to ensure a normal circulation without air locks.

4.2 Control of ambient conditions in the inner enclosure and in the space between the inner and outer enclosures

The temperature of the air circulating between the two enclosures shall be so set that the air temperature measured at the reference point in the inner enclosure is held to within ± 0,1 °C at a value between 19 and 21 °C.

The difference in air pressure between the two enclosures shall be sufficiently small to prevent any appreciable air transfer through joints of doors or windows between the two.

Temperatures of the inner faces of the inner enclosure shall at all times be above the dew point of the air within the inner enclosure.

4.3 Steady-state conditions

Steady-state conditions shall be maintained throughout the duration of the test and shall have been established before the start of the test, so far as both the primary fluid circuit and the ambient conditions in the test booth are concerned.

Steady-state conditions are deemed to have been established and maintained throughout the duration of the test (as defined in 4.5.1 and 4.5.2) when the values of the parameters measured at not less than six equal intervals during the test do not exceed the limits specified in 4.3.1 and 4.3.2.

4.3.1 *Primary circuit*

See ISO 3147

4.3.2 *Inner enclosure*

Parameters measured	Maximum deviation from mean value °C
Temperatures at the centres of the inner faces	± 0,3
Temperatures on the inner face of the wall against which the appliance is placed	± 0,5
Air temperature at the reference point	± 0,1

4.4 Preparation for tests

The appliance having been placed in position (see 4.1), the test rig shall be preheated and adjusted to give the test conditions required.

During this preparatory period, temperatures shall be recorded and the setting of the heating and cooling rates shall be adjusted until steady-state conditions have been established in both the primary heating circuit and the test booth, as defined in 4.3.

4.5 Performance of tests

See ISO 3147.

For each test, temperatures shall be recorded, to confirm that stable conditions exist.

4.5.1 *Tests with low pressure hot water or superheated water*

Carry out at least three tests with any three successive values of the following mean temperatures of the primary fluid in the appliance:

50 ± 5 °C

65 ± 5 °C

80 ± 3 °C

100 ± 10 °C

140 ± 15 °C

The tests shall be carried out with the same flow of water, to within ± 2 %, such that the temperature drop lies in the range 20 ± 2 °C for radiators and 10 ± 2 °C for convectors and skirting heating units, when the mean water temperature is approximately 80 °C.

When so requested by the manufacturer, convectors and skirting heating units can be tested at the same mean temperatures but a higher primary fluid flows, such as

250 to 300 kg/h, or

500 to 600 kg/h

Each test, lasting not less than 1 h, shall consist of the recording, at equal intervals not exceeding 10 min, of all the required measurements for the primary and secondary circuits; temperatures, pressures and flow or energy input.

After confirmation of the validity of the tests (maintenance of steady-state conditions), the mean values shall be used for calculation of the thermal balance and the presentation of the test results, as laid down in ISO 3147 and ISO 3150.

4.5.2 *Tests with steam*

Carry out one or three tests for one or three successive pressures from the range:

5 kPa (0,05 bar)

20 kPa (0,2 bar)

100 kPa (1 bar)

400 kPa (4 bar)

800 kPa (8 bar)

within limits of ± 10 % of the absolute pressure used.

Each test, lasting not less than 1 h, shall consist of the recording, at equal intervals not exceeding 10 min, of all the required measurements of the primary and secondary circuits: temperatures, pressures and flow or energy input.

After confirmation of the validity of the tests (maintenance of steady-state conditions), the mean values shall be used for calculation of the thermal balance and the presentation of the test results as laid down in ISO 3147 and ISO 3150.

5 PRESENTATION OF TEST RESULTS

See ISO 3150.

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