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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Household and similar use electrical hair care appliances – Methods for measuring the performance

Appareils électriques destinés aux soins des cheveux pour usages domestiques et analogues – Méthodes de mesure de l'aptitude à la fonction

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR USE ELECTRICAL HAIR CARE APPLIANCES – METHODS FOR MEASURING THE PERFORMANCE

FOREWORD

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IEC 61855 has been prepared by subcommittee 59L: Small household appliances, of IEC technical committee 59: Performance of household and similar electrical appliances. It is an International Standard.

This second edition cancels and replaces the first edition published in 2003. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the definitions of hair dryers, hair curlers and hair straighteners are updated;
b) the measurement of temperature profile of the outlet air of hair dryers is added;
c) the measurement of temperature profile of the whole work area of hair curlers is added;
d) the measurement of temperature profile of the heating plate of hair straighteners is added;
e) the measurement method for air flow of hair dryers is introduced;
f) the measurement method for anion emission concentration of anion hair dryers is introduced;

g) the measurement method for tension of hair straighteners is introduced;

h) the service life test for hair dryers, hair curlers and hair straighteners is introduced.

The text of this International Standard is based on the following documents:

Draft	Report on voting
59L/215/FDIS	59L/218/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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HOUSEHOLD AND SIMILAR USE ELECTRICAL HAIR CARE APPLIANCES – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This document applies to electrical appliances for household and similar use for drying and styling hair (including their accessories).

This document defines the main performance characteristics that are of interest to the user and specifies methods of measuring these characteristics.

NOTE 1 Appliances to which this document applies include:

– **Hair dryers**;

– **Hair curlers**;

– **Hair straighteners**.

This document does not specify the requirements for performance.

This document does not deal with safety requirements (IEC 60335-2-23).

This document does not apply to electric hair clippers or trimmers.

NOTE 2 See IEC 62863 for the method of measuring the performance of electric hair clippers or trimmers for household use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60704-2-9, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 2-9: Particular requirements for electrical hair care appliances*

ISO 2267:1986, *Surface active agents – Evaluation of certain effects of laundering – Methods of preparation and use of unsoiled cotton control cloth*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
hair dryer
appliance that applies electric energy to dry the hair by cool or warm air flow

3.1.1
portable hair dryer
hair dryer intended to be moved during normal use

3.1.2
anion hair dryer
hair dryer capable of releasing anion particles in normal use

3.2
hairstyling appliance
electric appliance in which heat is produced for styling the hair

3.2.1
hair curler
hairstyling appliance which is able to curl the hair

3.2.2
hair straightener
hairstyling appliance which is able to straighten the hair

3.3
concentrator
accessory used to concentrate the air flow in one direction

3.4
diffuser
volumiser
accessory for providing a wide distribution of the air flow

3.5
rated voltage
voltage assigned to the appliance by the manufacturer

3.6
rated voltage range
voltage range assigned to the appliance by the manufacturer

3.7
rated frequency
frequency assigned to the appliance by the manufacturer

3.8
rated frequency range
frequency range assigned to the appliance by the manufacturer

4 List of measurements and tests

4.1 General

Depending on the appliance, the following measurements or tests are relevant when assessing the performance:

– mass, in accordance with 5.1;
– length of the flexible cord, in accordance with 5.2;
– heating-up time, in accordance with 5.3;
– temperatures, in accordance with 5.4;

– air flow, in accordance with 5.5;
– drying rate, in accordance with 5.6;
– anion concentration of **anion hair dryer**, in accordance with 5.7;
– tension of **hair straightener**, in accordance with 5.8;
– drop endurance test, in accordance with 5.9;
– service life test, in accordance with 5.10;
– attachment of accessories, in accordance with 5.11;
– airborne acoustical noise, in accordance with Clause 6;
– features, in accordance with Clause 7;
– instructions for use, in accordance with Clause 8.

NOTE For other items, see Annex A for additional information.

4.2 General conditions for measurements

Unless otherwise specified, the measurements are carried out under the conditions of 4.2 to 4.9.

The measurements are made with controls adjusted to their highest setting and when steady conditions in accordance with 4.8 are established.

NOTE 1 Due to the influence of environmental conditions, variations in time, origin of test materials and proficiency of the operator, most of the described test methods will give more reliable results when applied for comparative testing of a number of appliances at the same time, in the same laboratory, and by the same operator.

4.3 Test environment

The tests are carried out in a substantially draught-free room. The ambient temperature is maintained at (23 ± 2) °C. The relative humidity is maintained at 50 % ± 5 %.

4.4 Limits of voltage variation

During the test, the variation in the voltage shall not exceed ±1 % of the test voltage.

4.5 Test voltage

Unless otherwise specified, the tests are carried out at a specific voltage within a **rated voltage range** (e.g.100 V to 240 V) or at the **rated voltage** or voltages (e.g. 120 V, or 120 V and 240 V).

4.6 Test frequency

The appliances are tested at the **rated frequency** or within a **rated frequency range** (e.g. rated as 50 Hz and 60 Hz, or 50 Hz to 60 Hz).

4.7 Test electrical supply system

Total harmonic distortion of the test electrical supply system shall be less than 5 %.

4.8 Steady conditions

For **hair dryers**, steady conditions are considered to be established 10 min after switching on the appliance.

For other appliances, steady conditions are considered to be established 20 min after switching on the appliance or when the thermostat has operated four times, if this occurs first.

4.9 Requirements for measurement instruments

The requirements for measurement instruments shall be in accordance with Table 1.

Table 1 – Requirements for measurement instruments

Parameter	Unit	Minimum resolution	Instrument accuracy
Temperature	°C	0,1 °C	±0,5 K
Mass	g	0,1 g	±2 %
Time	s	1 s	±1 %
Air flow	m/s	0 to 9.99: 0.01 m/s 10 to 30:0.1 m/s	± 2% on indicated or 0.015 m/s, whichever is bigger
Electrical energy	W·h		±1 %
Anion concentration	ion/cm^3	10 ion/cm^3	±10 %
Tension	N	0,01 N	±0,5 %

The thermocouples shall be type K, Ni-CrSi.

5 Measurements

5.1 Mass of the appliance

The mass of the appliance is determined including the flexible cord, but excluding any accessory.

The mass of each accessory is measured separately.

The results are expressed in kg to the nearest 0,01 kg.

5.2 Length of the flexible cord

The length of the flexible cord is measured between the point where the cord or cord guard enters the appliance and the cord entry point of the plug. Coiled cords are stretched with a pull of 10 N before measurement.

The length is expressed in m rounded down to the nearest 0,05 m.

5.3 Heating-up time

5.3.1 Hair dryer

Not applicable.

5.3.2 Hair curler

The heating-up time of the **hair curler** is the time taken for the temperature rise of the barrel to reach 100 K, measured in accordance with 5.4.4.1. The time is expressed in s.

NOTE This temperature rise implies a temperature of approximately 120 °C, which is considered to be the minimum temperature necessary for curling dry hair.

5.3.3 Hair straightener

The heating-up time of the **hair straightener** is the time taken for the temperature rise of the heating plate to reach 100 K, measured in accordance with 5.4.5.1. The time is expressed in s.

NOTE This temperature rise implies a temperature of approximately 120 °C, which is considered to be the minimum temperature necessary for straightening dry hair.

5.4 Temperatures

5.4.1 General

The test methods, which are considered to be reproducible, are only applicable for comparative testing.

5.4.2 Hair dryer

5.4.2.1 Outlet air temperature of hair dryers

The measuring device is shown in Figure 1.

The thermocouple grid assembly shall consist of two pieces of 1,6 mm thick glass epoxy board with the configuration and dimensions shown in Figure 1. The two boards are to be separated by 3,2 mm by one 134 mm × 6,4 mm × 3,2 mm wood spacer at the top and bottom edges. Each spacer is to be secured by four M3 × 12mm countersunk flat head machine screws, so that each screw's head is the same level with the front plate. Each end screw is to be threaded from the face of the assembly into a nut against the rear epoxy board. Each of the middle screws is to be located approximately 38 mm from the nearest longer edge of the board and threaded from the face into a standoff leg of a sheet aluminium back plate. The 140 mm by 83 mm stand-off back plate is to consist of sheet aluminium that is 1,3 mm thick, having a minimum 11 mm wide integral standoff leg formed at each corner by means of an extension of the metal being bent in two successive 90° angles to cause the back plate to stand away from the rear epoxy board at 6,5 mm. The back plate is to be secured to the centre of the 140 mm × 83 mm section of the board. The board assembly is to be provided with 53 thermocouples. The thermocouples are to be located on the grid spaced as shown in Figure 1. The thermocouples are to be passed through the two thicknesses of glass epoxy board, and the thermocouple junction is to be cemented to the face of the board using epoxy cement, as shown in Figure 2.

Controls are adjusted to obtain the highest outlet air temperature.

The temperature is measured within 30 s after steady conditions have been reached, in accordance with 4.8.

The measured outlet air temperature T_i of each measurement is the mean value of the five measuring points with the highest values and is expressed in °C, rounded off to one decimal place. The accuracy of measurement is to be within ±3 K.

In order to compensate the variation of the ambient temperature, the measured outlet air temperature T_i has to be corrected in accordance with Formula (1):

$$T_{i,\mathrm{comp}} = T_i - T_{\mathrm{actamb}} + 23\,[°\mathrm{C}] \tag{1}$$

where

$T_{i,\mathrm{comp}}$ is the compensated outlet air temperature, expressed in °C;

T_i is the measured outlet air temperature, expressed in °C;

T_{actamb} is the actual ambient temperature measured 100 mm from the air inlet side of the appliance immediately before switching it on, expressed in °C;

23 is the nominal ambient temperature in °C.

The distance between the measuring device and the air outlet is:

- Without attachments: 25 mm and 100 mm, as shown in Figure 3a);
- With a **concentrator**: 100 mm, as shown in Figure 3b);
- With a **diffuser**: 50 mm, as shown in Figure 3c).

The measurement without attachments shall be carried out three times. The mean value of these three measurements is the final outlet air temperature and is calculated from Formula (2):

$$T_{fin} = \frac{T_{1,comp} + T_{2,comp} + T_{3,comp}}{3} [°C] \quad (2)$$

The measurement may be repeated with the control adjusted to lower settings, if any, except for supplying cold air.

5.4.2.2 Outlet air temperature uniformity of hair dryers

During the measurement described in 5.4.2.1, all readings of 53 temperature measuring points are recorded and a temperature distribution graph is plotted as shown in Figure 4 to indicate the uniformity of outlet air temperatures of the **hair dryer**.

5.4.3 Hairstyling appliances with warm air

5.4.3.1 Outlet air temperature of hairstyling appliances with warm air

The appliance is placed in a horizontal position over the thermocouple grid, specified in Figure 1 and Figure 2. The appliance is centred with its axis parallel to the line of measuring points 2 and 52, the distance between the grid and the surface of the barrel holding the brush being 15 mm. The appliance is rotated about its horizontal axis to find out the position giving rise to the highest temperatures.

NOTE A brush is used for disentangling and shaping the hair.

Controls are adjusted to obtain the highest outlet air temperature, and the measurement is taken when the steady condition is reached.

The steady condition can be considered to be reached when the variation range of the mean value of the five measuring points with the highest values is not over 2 K.

The outlet air temperature is the mean value of the five measuring points with the highest temperature, expressed in °C. The temperature shall be corrected in accordance with Formula (1).

The accuracy of the measurement is to be within ±3 K.

5.4.3.2 Outlet air temperature uniformity of hairstyling appliances with warm air

During the measurement described in 5.4.3.1, all readings of 53 temperature measuring points are recorded and a temperature distribution graph is plotted as shown in Figure 4 to indicate the uniformity of outlet air temperatures of the **hairstyling appliance** with warm air.

5.4.4 Hair curler

5.4.4.1 Temperature measurement of the barrel of hair curler

The appliance is positioned horizontally and at a distance of at least 100 mm from the test table. Appliances with a stand shall be placed directly on the test table.

Five thermocouples are evenly distributed along the longitudinal edge at the top of the curling barrel (see Figure 5) on the side away from the test table. The thermocouples are not placed under the curling tong.

The appliance is switched on, and the temperatures of 5 measuring points are measured after it has reached steady condition.

The temperature of the barrel is the mean value of the 5 measuring points and is expressed in °C. This temperature shall be corrected in accordance with Formula (1). The ambient temperature shall be measured within 100 mm of the handle immediately before switching on the appliance.

5.4.4.2 Temperature uniformity of the barrel of hair curler

In accordance with the setup of 5.4.4.1, except that the five thermocouples are not applied, the thermal imaging viewer is used to scan the whole barrel area, and temperature uniformity is expressed as the temperature profile, as shown in Figure 6.

5.4.5 Hair straightener

5.4.5.1 Temperature measurement of the heating plate of hair straightener

The appliance is positioned horizontally, and the plane of the straightening plates shall be kept vertical. The bottom plane of the **hair straightener** shall be at least 100 mm away from the test table. Appliances with a stand are placed directly on the test table.

The two straightening plates of the **hair straightener** shall be opened with an angle of 180° during measurement. Five thermocouples are evenly distributed on the heating plate surface along the longitudinal edge (see Figure 7). The two straightening plates shall be measured if both of them are heating plates.

If the two plates are hinged together so that they cannot be opened with an angle of 180°, before the test, the hinge may be made inoperative so that the plates can be opened, but the thermal performance of the plates should not be affected by this action.

The appliance is switched on, and the temperatures of 5 measuring points are taken after it has reached steady condition.

The temperature of the plate is the mean value of the 5 measuring points and is expressed in °C. This temperature shall be corrected in accordance with Formula (1). The ambient temperature is to be measured within 100 mm of the handle immediately before switching on the appliance.

5.4.5.2 Temperature uniformity of the heating plate of the hair straightener

In accordance with the setup of 5.4.5.1, except that the five thermocouples are not applied, the thermal imaging viewer is used to scan the heating plate area and temperature uniformity is expressed as the temperature profile, as shown in Figure 8.

5.5 Air flow of the hair dryer

The measurement setup is shown in Figure 9.

The distance between the air outlet of **hair dryer** and the anemometers shall be D_d = 200 mm. See Figure 9a).

The measurement shall be carried out with the maximum air flow setting of the **hair dryer** and all attachments removed. The heating function shall be inoperable. The **hair dryer** is switched on and the measurement is started after the steady condition has been reached.

Eight (or 10, or 12) hot wire anemometers shall be arranged along the horizontal test arm. The distance between each anemometer shall be 5 mm. Initially, the arm of anemometer is placed at the mid-height of the air outlet of the **hair dryer**, and is then moved up vertically with an increment of 5 mm until the measurements of all anemometers fall below 24 m/min. The test arm is returned to its starting point and is then moved down vertically with an increment of 5 mm until the measurements of all anemometers fall below 24 m/min. The measurement is completed, and the data shall be recorded.

The total flow rate shall be calculated by assuming that each measurement point (e.g. point A) is indicative of the air velocity through a square of 5 mm × 5 mm centred about that point. See Figure 9b). Therefore, the flow rate shall be calculated by multiplying the measured air velocity by the area of each square.

The area of each square = 5 mm × 5 mm = 25 mm^2 = 0,000 025 m^2

If each of the air velocity measurements is U_i (m/min), and the number of the squares with an air velocity measurement not less than 24 m/min is N, then the total air flow rate of the **hair dryer** will equal the sum of all individual air flow rates through each square as given by:

Total flow rate of **hair dryer** in m^3/min = $\sum_{i=1}^{N}(0.000025U_i)$

5.6 Drying rate of the hair dryer

5.6.1 General

The purpose of this test is to assess the drying ability of a **hair dryer** under standardized test conditions.

The test is carried out at test conditions in accordance with 4.8. The relative humidity in the test room shall be (50 ± 5) %.

Temperature and humidity conditions within the specified ranges are required for good repeatability and reproducibility. Changes during a test should be avoided.

5.6.2 Test equipment

The test equipment, as shown in Figure 10, consists of a balance, a stand for the **hair dryer**, a support for the test cloth and a stopwatch.

The balance shall have an accuracy of 0,02 g.

The test cloth shall be the control cloth defined in ISO 2267 and is fixed to the aluminium circular frame by a rubber O-ring or other suitable means. Surplus cloth is removed.

NOTE Annex B lists two recommended suppliers of the test cloth.

The measurement of time shall be accurate to within 0,1 s.