

Electric irons for household or similar use — Methods for measuring performance

ICS 97.060

National foreword

This British Standard is the UK implementation of EN 60311:2003+A2:2009. It is identical to IEC 60311:2002, incorporating amendment 2:2009. It supersedes BS EN 60311:2003 which is withdrawn.

The start and finish of text introduced or altered by IEC amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated in the text by **A1** **A1**.

The UK participation in its preparation was entrusted by Technical Committee CPL/59, Performance of household electrical appliances.

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

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English version

**Electric irons for household or similar use –
Methods for measuring performance
(IEC 60311:2002)**

Fers à repasser électriques
pour usage domestique ou analogue -
Méthodes de mesure de l'aptitude
à la fonction
(CEI 60311:2002)

Elektrische Bügeleisen für Haushalt und
ähnliche Zwecke –
Verfahren zur Messung
der Gebrauchseigenschaften
(IEC 60311:2002)

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of the International Standard IEC 60311:2002, prepared by SC 59E, Ironing and pressing appliances, of IEC TC 59, Performance of household electrical appliances, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60311 on 2003-07-01 without any modification.

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Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, Annexes B, C and ZA are normative and Annexes A and D are informative.

Annex ZA has been added by CENELEC.

In this standard, the following print types are used:

- *test specifications: italic type;*
- In small roman type;
- other texts: in roman type;

Words in **bold** in the text are defined in Clause 3.

Endorsement notice

The text of the International Standard IEC 60311:2002 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 59L/22/FDIS, future amendment 1 to IEC 60311:2002, prepared by SC 59L, Small household appliances, of IEC TC 59, Performance of household electrical appliances, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60311:2003 on 2006-02-01.

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Foreword to amendment A2

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The text of amendment 2:2009 to the International Standard IEC 60311:2002 was approved by CENELEC as an amendment to the European Standard without any modification.

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ELECTRIC IRONS FOR HOUSEHOLD OR SIMILAR USE – METHODS FOR MEASURING PERFORMANCE

1 Scope

This International Standard applies to electric irons for household or similar use.

The purpose of this standard is to state and define the principal performance characteristics of electric irons for household or similar use which are of interest to the user and to describe the standard methods for measuring these characteristics.

Electric irons covered by this standard include

- dry irons;
- steam irons;
-  – vented steam irons with motor pump; 
- spray irons;
- steam irons with separate water reservoir or boiler/generator having a capacity not exceeding 5 l.

This standard is concerned neither with safety nor with performance requirements.

NOTE The primary characteristic to be taken into account in assessing the performance of an electric iron is its basic ability to produce a smooth finish to textile materials, without risk of scorching or other damage. It has not proved possible to devise a single method which will measure this characteristic in a consistently reproducible way and measurements have therefore been included to check certain factors, such as the temperature of the sole-plate at the mid-point, sole-plate temperature distribution, etc., which affect the basic characteristic. In evaluating the results, it must be realized that, while a very exceptional result in any one of them may significantly affect performance, there is considerable latitude in the combination of results which will give satisfactory ironing performance, and too much significance should not be attached to minor differences in any one result.

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.

IEC 60051-1:1997, *Direct acting indicating analogue electrical measuring instruments and their accessories – Part 1: Definitions and general requirements common to all parts*

IEC 60454-3-3:1998, *Pressure-sensitive adhesive tapes for electrical purposes – Part 3: Specifications for individual materials – Sheet 3: Polyester film tapes with rubber thermoplastic adhesive*

IEC 60734:2001, *Household electrical appliances – Performance – Hard water for testing*

ISO 105-F:1985, *Textiles – Tests for colour fastness – Part F: Standard adjacent fabrics*

ISO 1518:1992, *Paints and varnishes – Scratch test*

ISO 2409:1992, *Paints and varnishes – Cross-cut test*

ISO 3758:1991, *Textiles – Care labelling code using symbols*

ISO 3801:1977, *Textiles – Woven fabrics – Determination of mass per unit length and mass per unit area*

ISO 6330:2000, *Textiles – Domestic washing and drying procedures for textile testing*

ISO 7211-2:1984, *Textiles – Woven fabrics – Construction – Methods of analysis – Part 2: Determination of number of threads per unit length*

ISO 9073-2: 1995, *Textiles – Test methods for nonwovens – Part 2: Determination of thickness*

ISO 13934-1:1999, *Textiles – Tensile properties of fabrics – Part 1: Determination of maximum force and elongation at maximum force using the strip method*

3 Terms and definitions

For the purposes of this standard the following definitions apply.

3.1

electric iron

portable appliance, which has an electrically heated sole-plate and is used for ironing textile materials

NOTE In this standard, "electric iron" is referred to as "iron".

3.2

thermostatic iron

iron fitted with a thermostat, the setting of which can be adjusted manually to alter the sole-plate temperature over a range and maintain it within certain limits

3.3

electric iron with non-self-resetting thermal cut-out

iron fitted with a non-self-resetting thermal cut-out, such as a fusible link, for the purpose of disconnecting the heating element if the iron attains excessive temperature

3.4

dry iron

iron having neither means to produce and supply steam nor to spray water onto textile materials while ironing

3.5

steam iron

iron having means to produce and supply steam to textile materials while ironing. It can be provided with means to supply a shot of steam

3.5.1

shot-of-steam iron

iron provided with means to supply a shot of steam to textile materials while ironing

3.5.2

shot of steam

single emission of an increased volume of steam from the sole-plate for a short duration

3.5.3

vented steam iron

steam iron in which steam is produced when the water contacts the sole-plate, the water reservoir being at atmospheric pressure.

NOTE The water reservoir may be incorporated in the iron or connected by a hose to the iron.

3.5.4**pressurized steam iron**

steam iron in which steam is produced in a boiler at a pressure exceeding 50 kPa

NOTE The boiler may be incorporated in the iron or connected by a hose to the iron.

3.5.5**instantaneous steam iron**

steam iron in which small quantities of water are pumped from the water reservoir and in which steam is produced when the water contacts the walls of the boiler/generator, the water reservoir being at atmospheric pressure

NOTE The water reservoir and the boiler are connected to the iron by a tube.

A₁ 3.5.6**vented steam iron with motor pump**

vented steam iron in which the water is pumped from the internal water reservoir to the steam chamber by means of an (electric) motor pump **A₁**

3.6**spray iron**

iron provided with means to spray water onto textile materials while ironing

3.7**rated voltage****3.7.1****rated voltage**

voltage assigned to the iron by the manufacturer

3.7.2**rated voltage range**

range of voltage assigned to the iron by the manufacturer, expressed in terms of its lower and upper limits

3.8**rated input**

input power of the iron under normal operating conditions assigned by the manufacturer

3.9**sole-plate**

flat surface of the iron, which is heated electrically and pressed against textile materials while ironing

3.10**mid-point**

point of the sole-plate in the geometrical centre of the centre-line of the sole-plate.

If this point is on a steam outlet, a groove or a cover, the nearest point of the sole-plate on the centre-line as is practicable is chosen

3.11**upright position**

vertical still position for a heel-standing iron or normal resting position according to the manufacturer's instructions for other than a heel-standing iron

3.12**cordless iron****3.12.1****cordless iron**

iron which is connected to the supply mains only when placed on its stand

3.12.2**cordless iron having a mains supply attachment**

cordless iron which is provided, in addition, with a detachable part to which the supply cord is fixed, and which can be connected to the supply mains directly during ironing

3.13**auto switch-off device**

- A₂** device provided by the manufacturer to switch off the heating element if the iron is not moved for a stated period of time and not intended to activate a 'standby mode' or any kind of 'low power mode' **A₂**

4 Measurements for various types of irons

The performance of the iron is determined by the measurements indicated in table 1. Relevant measurements for various types of irons are indicated in table 1 by x.

Measurements are performed in the order given in table 1.

Table 1 – Measurements of various types of irons

Item of measurement	Thermo-static dry irons	Thermostatic dry irons with non-self-resetting thermal cut out	A₁ Thermo-static steam irons and vented steam irons with a motor pump A₁	Thermo-static steam irons with non-self resetting thermal cut out	Cordless irons	Cordless irons having a mains supply attachment
6.1 (Determination of mass)	x	x	x	x	x	x
6.2 (Measurement of length of the supply cord)	x	x	x	x	x	x
7.1 (Measurement of heating-up time)	x	x	x	x	x	x
7.2 (Measurement of initial overswing temperature and heating-up excess temperature)	x	x	x	x	x	x
7.3 (Measurement of sole-plate temperature)	x	x	x	x	x	x
7.4 (Determination of the hottest point)	x	x	x	x	x	x
7.5 (Measurement of temperature distribution)	x	x	x	x	x	x
7.6 (Measurement of cyclic fluctuation of temperature of the hottest point)	x	x	x	x	x	x
8 (Assessment of spray function)	(x)	(x)	(x)	(x)	(x)	(x)
9.1 (Measurement of heating-up time for steaming operation)	x	x	x	x	x	x
9.2 (Measurement of steaming time)			x	x		x
9.2 (Measurement of steaming rate)			x	x	x	x
9.3 (Determination of mass of a shot of steam)			(x)	(x)	(x)	(x)
10 (Assessment of smoothing)	x	x	x	x	x	x
10.4 (Ironing with shot of steam)			(x)	(x)	(x)	(x)

Item of measurement	Thermo-static dry irons	Thermostatic dry irons with non-self-resetting thermal cut out	^[A1] Thermo-static steam irons and vented steam irons with a motor pump ^[A1]	Thermo-static steam irons with non-self resetting thermal cut out	Cordless irons	Cordless irons having a mains supply attachment
11.1 (Measurement of input power)	x	x	x	x	x	x
11.2 (Measurement of energy consumption)	x	x	x	x	x	x
12.1 (Determination of smoothness of the sole-plate)	x	x	x	x	x	x
12.2 (Measurement of scratch resistance of sole-plate)	x	x	x	x	x	x
12.3 (Determination of adhesion of polytetrafluorethylene (PTFE) coating or similar coating on sole-plate)	x	x	x	x	x	x
13 (Measurement of thermostatic stability)	x	x	x	x	x	x
14 (Determination of total steaming time for hard water)			x	x		x
NOTE 1 Measurements for the spray iron are determined according to the table, whether it is of thermostatic type, steam or shot-of-steam-producing type, cordless iron type, or cordless iron having mains supply attachment type. For the non-steam-producing spray irons, the measurements for dry irons are applied. Steam and spray irons are tested with water container empty. NOTE 2 (x) means if applicable. NOTE 3 Reporting the data should be made according to the testing authorities.						

5 General conditions for measurements

Unless otherwise specified, the measurements are conducted under the following conditions.

5.1 Ambient conditions

The measurements are conducted at an ambient temperature of 20 °C ± 5 °C, and the place for the measurements shall be free from any draughts.

5.2 Voltage for measurements

The voltage to be applied to the iron under measurement is that required to give the rated input under steady conditions. If an input power range is marked on the iron, the voltage is that required to give the mean of the input power range.

5.3 Steady conditions

The steady conditions for measurements are considered to be reached 30 min after switching-on of the iron or when the thermostat has operated four times, if this occurs earlier.

5.4 Iron support for measurements

The iron is placed on the three pointed metallic supports while under measurement. The three pointed supports are constructed so that they support the sole-plate of the iron horizontally at least 100 mm above the base surface on which the iron is placed.

For cordless irons, the iron is placed on its stand.

5.5 Temperature measurement

The temperature of the iron is measured by a fine-wire thermocouple, the wire diameter of which shall not exceed 0,3 mm.

Accuracy of the measuring instrument shall be better than, or equal to, class 1 in IEC 60051-1.

A movable silver disk, having a diameter of 10 mm and a thickness of 1 mm, rests on the top of a pointed ceramic tube which contains the thermocouple wires in two separate bores. An example of the arrangement is shown in figure 1.

The centre of the silver disk is pressed on to the sole-plate of the iron by applying a force of at least 1 N. In order to improve the heat transfer between the silver disk and the sole-plate, silicone grease or heat transfer paste can be used.

For the measurement of cordless irons, except cordless irons having a mains supply attachment, a thermocouple with silver disk as shown in figure1 is attached to the sole-plate directly.

5.6 Cordless irons having a mains supply attachment

Cordless irons having a mains supply attachment are tested as conventional irons.

5.7 Irons fitted with separate steam generator/boiler

Irons fitted with separate steam generator/boiler have to be kept in ironing mode under measurements.

5.8 Irons fitted with auto switch-off devices

Irons fitted with auto switch-off devices have to be kept in ironing mode under measurements.

5.9 Test sample

A new sample is used for the test of clause 13.

5.10 Irons with additives

If the manufacturer requires the use of specific additives as an integral part of the functioning of the iron, then the iron shall be tested using the additives. 

6 General requirements

6.1 Determination of mass

For all types of irons without separate water reservoir or boiler/generator, the mass is measured without the supply cord. The supply cord is removed from the iron by disconnection from the terminals or by removing the connector.

For steam irons with a separate water reservoir or boiler/generator, the mass is measured in two steps:

- the total mass of the system, not filled up with water, and*
- the iron with the interconnection hose.*

The mass is expressed in grams, rounded off to one decimal place.

For cordless irons, the mass is measured without its stand.

6.2 Measurement of length of the supply cord

The length of the supply cord of irons without separate water reservoir or boiler/generator is measured from the inlet point of the iron or connector to the inlet point of the plug including any cord guards.

The length is expressed in meters, rounded off to the nearest 50 mm.

7 Temperature measurements

7.1 Measurement of heating-up time

The iron is placed on the three metallic supports; for cordless irons, the iron is placed on its stand (see 5.4), and the thermocouple is attached at the mid-point of the sole-plate.

Starting from ambient temperature, the iron is heated up with the voltage specified in 5.2, the thermostat, if any, set at the highest temperature.

The time necessary for the temperature to exceed the ambient temperature by 180 K is measured, and is expressed in minutes and seconds.

7.2 Measurement of initial overswing temperature and heating-up excess temperature

The iron is placed on the three metallic supports, for cordless irons, the iron is placed on its stand (see 5.4), and a thermocouple is attached at the mid-point of the sole-plate.

The iron is switched on, with the voltage specified in 5.2.

Using a recording-type instrument, the time and temperature are measured at the mid-point with the thermostat set at the 1 dot marking position and at the highest position over five successive cycles to produce a graph of the type shown in figure 2.

The thermostat is first set to the 1 dot marking position. If there is no dot marking, the thermostat is so adjusted as to obtain an average temperature of the sole-plate as close as possible to 95 °C under steady conditions.

After the first measurement, the iron is allowed to cool to room temperature (20 °C ± 5 °C); then the sole-plate temperature is measured again at the highest setting position of the thermostat.

From the graph the following are determined:

- a) the initial overswing temperature, which is the first peak temperature between the first and second cut-outs of the thermostat;*
- b) the mean peak temperature, which is the mean value of the last three peak temperatures;*
- c) the heating-up excess temperature, which is the difference between the initial overswing temperature and the mean peak temperature.*

7.3 Measurement of sole-plate temperature

The iron is placed on the three metallic supports; for cordless irons, the iron is placed on its stand (see 5.4), and a thermocouple is attached at the mid-point of the sole-plate. The iron is switched on and, for each setting of the thermostat, the highest and the lowest temperatures are measured during five successive cycles of temperature variation after the iron has reached steady conditions. The mean value of the five highest and five lowest temperatures is the sole-plate temperature for the setting.

For irons having thermostat settings which are indicated by a sector, the setting is to be at the centre of the range.

The adjustment of the thermostat control to obtain the required setting is to be made in the direction of increasing temperature.

NOTE 1 The measurements of 7.2, 7.3 and 7.6 may all be carried out at the same time.

NOTE 2 ISO 3758 has introduced textile care markings for maximum ironing temperatures. The textile care labelling of the ISO standard is indicated by one, two and three dots placed within an iron symbol. This standard takes those recommendations into account but to obtain improved ironing results the temperatures have been adjusted as shown in the following table.

Marking	Sole-plate temperature T °C	Material, for example
• (1 dot)	$70 < T < 120$	Acetate, elastane, polyamide, polypropylene
•• (2 dots)	$100 < T < 160$	Cupro, polyester, silk, triacetate, viscose, wool
••• (3 dots)	$140 < T < 210$	Cotton, linen

With the thermostat set to the middle of each of these dot markings the sole-plate temperatures are measured after steady conditions have been reached.

The sole-plate temperature for the setting (T) is the average of the five highest temperatures (T_a) and the five lowest temperatures (T_b) of the mid-point of the sole-plate during five successive cycles of temperature variation.

7.4 Determination of the hottest point

The iron is placed on the three metallic supports; for cordless irons, the iron is placed on its stand (see 5.4), and is heated up with the voltage specified in 5.2 with the thermostat set at the highest position. Immediately after the thermostat has operated twice, the iron is placed for several seconds on a sheet of white paper spread over flannel cloth, which covers a wooden board. After removal of the iron, darkening of the paper indicates the temperature distribution over the sole-plate. The hottest point is determined as the centre of the darkest area.

NOTE Positive phototype paper, which is unexposed and developed, white tracing paper or white blotting paper is recommended as the white paper for this measurement.

7.5 Measurement of temperature distribution

The iron is placed on the three metallic supports; for cordless irons, the iron is placed on its stand (see 5.4); a thermocouple is attached at each of the following four points of the sole-plate:

- the hottest point determined in 7.4;*
- the mid-point of the sole-plate;*
- the point on the longitudinal centre line 20 mm from the tip of the sole-plate;*
- the point on the longitudinal centre line 20 mm from the back end of the sole-plate.*

For a thermostatic iron, the thermostat is set so that the temperature at the mid-point is maintained at approximately 150 °C under steady conditions, and the measurement is performed after the iron has reached steady conditions. For other iron types, the temperature at the mid-point is maintained at approximately 150 °C for at least 15 min by switching the supply on and off before taking temperature measurements.

Using a recording-type instrument, the varying temperature is recorded for 10 min and the average temperature for the 10 min is determined for each of the four points. The mean of the four average temperatures is then determined, and the difference between each average temperature and the mean temperature is also calculated. The four temperature differences are recorded as the indication of the temperature distribution over the sole-plate.

7.6 Measurement of cyclic fluctuation of temperature of the hottest point

The procedure for the temperature measurement is the same as in 7.2, except that highest and lowest temperatures of each cycle are measured for five successive cycles after the iron has reached steady conditions. The mean value for the highest temperatures and that for the lowest temperatures are determined. One-half of the difference between the mean values is the cyclic fluctuation of the temperature of the hottest point and is expressed in ± Celsius degrees.

NOTE This measurement may be combined with the measurements in 7.2.

8 Assessment of the spray function

8.1 Determination of the mass of spray

8.1.1 Determination of the mass of spray for irons with manual spray pumps

The water container is filled with distilled water at a temperature of 20 °C ± 2 °C, to the capacity specified by the manufacturer.

The spraying system is prepared by operating the spray device several times.

The mass W_1 of the iron including the power supply cord is determined on a balance having an accuracy of at least 0,1 g.

The iron is placed on a horizontal plane and the spray device is operated 50 times at intervals of 5 s.

The mass W_2 of the iron including the power supply cord is then measured.

NOTE The iron is not connected to the supply and the steam setting is at dry position, if any.

The mass of spray M for each operation is calculated as follows:

$$M = \frac{W_1 - W_2}{50}$$

The result of the test is expressed as the mass of spray per operation in grams.

8.1.2 Determination of the mass of spray for irons with means for continuous spray

The water container is filled with distilled water at a temperature of 20 °C ± 2 °C, to the water capacity specified by the manufacturer.

The spraying system is prepared by operating the spray device for 3 s.

The mass W_1 of the iron including the power supply cord is determined on a balance having an accuracy of at least 0,1 g.

The iron is placed on a horizontal plane and the spray device is operated for 20 s continuously.

The mass W_2 of the iron including the power supply cord is then measured.

The mass of spray for continuous operation M_{SC} is then calculated as follows:

$$M_{SC} = 3 (W_1 - W_2) \quad [\text{g/min}]$$

8.2 Determination of the spray pattern

The water container is filled with distilled water at a temperature of $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ to the capacity specified by the manufacturer.

The spraying system is prepared by operating the spray device several times.

The iron is placed in a horizontal position on a flat under-layer. A piece of cotton cloth having dimensions of 500 mm × 500 mm is placed in front of the tip of the iron.

NOTE The iron is not connected to the supply and the steam setting is at dry position, if any.

The cloth has the following specifications:

- *non-starched cotton textile, washed and dried according to ISO 6330, clause 5 and 6.3 – procedure C (dry flat);*
- *threads 25 ± 2 per centimetre in warp and weft having a yarn of 30 ± 2 tex, plain weave 1/1;*
- *mass per square meter: $170\text{ g} \pm 10\text{ g}$.*

In order to indicate the effect of water, the cloth may be impregnated by using a 10 % solution of cobalt chloride (CoCl_2).

After impregnation the cloth is dried in a cabinet provided with air circulation at a temperature of $100\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$.

The cloth is placed flat and after drying is smoothed using an iron with a sole-plate temperature of approximately $120\text{ }^{\circ}\text{C}$.

The dry impregnated cloth is coloured blue and turns light pink when wet.

The spray device is then operated once and the spray pattern evaluated in accordance with figure 3.

The spray device of irons featuring continuous spray is operated for 1 s.

The following dimensions are measured:

- *the distance between iron tip and the beginning of spray pattern (A1);*
- *the distance between the centre-line of the iron and the centre-line of the spray pattern (A2);*
- *the width of the spray pattern (B);*
- *the length of the spray pattern (L);*
- *the area of the concentrated spray pattern (A).*

The test is carried out three times and the average of the results calculated.