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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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International Standard IEC 60311 has been prepared by subcommittee 59E: Ironing and pressing appliances, of IEC technical committee 59: Performance of household electrical appliances.

This consolidated version of IEC 60311 consists of the fourth edition (2002) [documents 59E/148/FDIS and 59E/149/RVD] and its amendment 1 (2005) [documents 59L/22/FDIS and 59L/24/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 4.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annexes B and C form an integral part of this standard.

Annexes A and D are for information only.

In this standard, the following print types are used:

– *test specifications: in italic type*
– notes: in small roman type
– other texts: in roman type

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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 applicances – 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.

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

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
device provided by the manufacturer to interrupt the heating element if the iron is not moved for a stated period of time

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	Thermostatic steam irons and vented steam irons with a motor pump	Thermo-static steam irons with non-self resetting thermal cut out	Cordless irons	Cordless irons having a mains supply attach-ment
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

Item of measurement	Thermo-static dry irons	Thermostatic dry irons with non-self-resetting thermal cut out	Thermostatic steam irons and vented steam irons with a motor pump	Thermo-static steam irons with non-self resetting thermal cut out	Cordless irons	Cordless irons having a mains supply attach-ment
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)
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 polytetra-fluorethylene (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 thermo-static 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:

a) the hottest point determined in 7.4;

b) the mid-point of the sole-plate;

c) the point on the longitudinal centre line 20 mm from the tip of the sole-plate;

d) 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 °C ± 2 °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 g ± 10 g.*

In order to indicate the effect of water, the cloth may be impregnated by using a 10 % solution of cobalt chloride (CoCl2).

After impregnation the cloth is dried in a cabinet provided with air circulation at a temperature of 100 °C ± 10 °C.

The cloth is placed flat and after drying is smoothed using an iron with a sole-plate temperature of approximately 120 °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.

It is noted if the spray pattern is concentrated in one area or if there are areas without any spray.

When evaluating different irons, a visual comparison can be made of the cloths.

9 Measurements concerning steaming operation

9.1 Measurement of heating-up time for steaming operation

9.1.1 For vented steam irons

For vented steam irons, the water reservoir is filled with distilled water having a temperature of 20 °C ± 2 °C up to the capacity specified by the manufacturer and then the iron is placed on its stand or in its upright position. The thermostat is set to the maximum setting indicated for steam ironing.

For irons with a separate water reservoir, the reservoir is filled up to the capacity specified by the manufacturer.

The iron is connected to the supply and immediately after the thermostat has switched off for the second time, the steam control is operated to give the maximum flow rate. If there is no signal lamp, the second opening of the thermostat is determined with a measuring apparatus.

The iron is then suspended with the sole-plate in a horizontal position with a tolerance of ±1° by means of a balance having an accuracy of at least ±0,1 g, as shown in Figure 4a. A container of known mass within ±0,1 g is placed under the sole-plate at a distance of approximately 200 mm in order to collect any water which may flow out of the iron during the test. In order to avoid condensing steam collecting in the container, a slow-running fan may be used to blow the steam away.

The total mass of the iron is measured at intervals of 1 min, from the instant after switching-off of the signal lamp and steaming operation. The steaming rate is measured for 1 min and calculated in g/min and then introduced in a graph as a function of time. The heating-up time is the time between the connection to the mains and the instant when the steaming flow reaches 5 g/min.

The test is repeated but with the thermostat set to the minimum setting for steam ironing.

The heating-up time is expressed in seconds for both the maximum and minimum thermostat setting for steam ironing.

This measurement is not carried out on

– *irons provided with a shut-off device which automatically switches off the supply mains, when the iron is not moved;*

– *irons constructed so that steaming is irregular when the iron is in a rest position.*

NOTE Some irons may need a preliminary preparation. In this case, before the test is carried out, the iron is prepared according to the instructions.

9.1.2 For pressurized steam irons or instantaneous steam irons

For pressurized steam irons or instantaneous steam irons, the boiler is filled with distilled water having a temperature of 20 °C ± 2 °C up to the rated capacity and then placed on its stand.

The thermostat of the iron is set to the maximum setting indicated for steam operation and when applicable any maximum temperature pressure setting of the boiler.

The iron is connected to the supply and the following times t_1 and t_2 are recorded where

t_1 is the time necessary for the iron to reach the temperature rise of 160 K;

t_2 is the time necessary for the heating up process of the boiler.

The test is repeated, but with the thermostat of the iron set to the minimum setting indicated for steam operation and, if applicable, any minimum temperature or pressure setting.

The heating-up time is recorded, in minutes and seconds, for both the minimum and maximum thermostat setting for the steam ironing.

The heating-up time is recorded as the greater of the two values t_1 and t_2.

This measurement is not carried out on

– *irons constructed so that steaming is irregular when the iron is in a rest position.*

NOTE Some irons may need a preliminary preparation. In this case, before the test is carried out, the iron is prepared according to the instructions.

9.2 Measurement of steaming time, steaming rate and water leakage rate

9.2.1 For vented steam irons

For vented steam irons, without separate water reservoir, the test described in 9.1, at the maximum setting of the thermostat, is continued until 90 % of the water poured into the iron has evaporated.

The steaming time is the time between the end of the heating-up time for steaming operation and when 90 % of the water has evaporated. This time is stated in minutes and seconds.

The container referred to in 9.1.1 is weighed again and the mass of the water which has leaked from the iron without being evaporated is determined.

*For **vented steam irons with motor pump**, the motor pump may be controlled by external means during the test.*

For cordless irons, the measurement is carried out for 20 s without power supply and repeated again without power supply until 90 % of the water capacity of the container has evaporated.

The steaming rate S_R is calculated as follows:

$$S_R = \frac{W_1 - W_2 - W_3}{t}$$

where

W_1 *is the mass of the iron and water at the end of the heating-up time;*

W_2 *is the mass of the iron and water after 90 % evaporation;*

W_3 *is the mass of the water which has leaked without being evaporated.*

t *is the steaming time, in minutes.*

The water leakage rate L_R is calculated as follows:

$$L_R = \frac{W_3}{t}$$

The steaming rate and leakage rate are expressed in grams per minute.

9.2.2 For pressurized steam irons and instantaneous steam irons

For pressurized steam irons and instantaneous steam irons, the measurement procedure is carried out according to Figure 4b (see also annex A).

The sole-plate shall be on a horizontal position ±1° and at the same level as the lower face of the reservoir.

A container is placed under the iron to receive the water which leaks without being evaporated.

The height between the container and the sole-plate shall be at least 200 mm.

The test shall be done under the free steaming conditions.

Fill the empty reservoir or boiler/generator according to the manufacturer's instructions. The amount of water has to be noted: W_7

Turn on the iron, setting the thermostat at the maximum setting. The steaming regulator, if any, is set at the maximum setting.

Immediately after the steady conditions are reached, the steaming generation starts according to the following cycle:

- *5 s ON (the steam switch is turned on, there is steam generation);*
- *15 s OFF (the steam switch is turned off, there is no steam generation).*

This cycle is repeated until 12 times. Then the complete ironing system is weighed: W_4

Repeat the above-mentioned cycle 24 times and make the following measurements:

- *the mass of the complete ironing system is measured: W_5;*
- *the mass of the water which has leaked without being evaporated is measured: W_6.*

The steaming rate S_R is calculated as follows:

$$S_R = \frac{(W_4 - W_5) - W_6}{t}$$

Water leakage rate L_R can be calculated as follows:

$$L_R = \frac{W_6}{t}$$

The theoretical time of steaming generation T is calculated as follows:

$$T = \frac{W_7 \times \left(\frac{t_1}{t}\right)}{S_R + L_R}$$

where

W_4 *is the mass of the complete ironing system after the first 12 cycles, in grams;*

W_5 *is the mass of the complete ironing system after the following 24 cycles, in grams;*

W_6 *is the mass of the water that has leaked without being evaporated, in grams;*

W_7 *is the mass of the water poured into the reservoir or boiler/generator according to the manufacturer's instructions, in grams;*

S_R *is the steaming rate, in grams per minute;*

L_R *is the leakage rate, in grams per minute;*

T *is the theoretical time of steam generation, in minutes;*

t *is the steaming time, 24 × 5 s = 2 min;*

t_1 *is the total running time during the 24 cycles, 24 × 20 s = 8 min.*

9.3 Determination of mass of a shot of steam

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

Any thermostat is set at the highest point of the steaming range or the shot of steam range specified by the manufacturer.

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 with the sole-plate horizontal position within ±1° on the metallic supports.

A container of known mass within ±0,1 g is placed under the sole-plate at a distance of approximately 200 mm in order to collect any leaking water.

NOTE In order to avoid condensing steam collecting in the container, a slow-running fan may be used to blow the steam away.

The iron is connected to the supply and immediately after the thermostat has switched off for the second time or 5 min after switch-on, whichever is the shorter, the shot of steam device is operated 50 times at intervals of 15 s.

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

The container is weighed again and the mass of the water W_3 which has leaked from the iron without being evaporated is determined.

The mass of a shot of steam M is calculated as follows:

$$M = \frac{W_1 - W_2 - W_3}{50}$$

The result of the test is expressed as the mass of a shot of steam in grams.

The leakage for each shot of steam L is calculated as follows:

$$L = \frac{W_3}{50}$$

The result is expressed as the leakage for each shot of steam in grams.

For cordless irons, the iron is heated up between the shot of steam operation in intervals according to the instructions.

10 Assessment of smoothing

The smoothing ability of an electric iron is determined by the following procedure.

NOTE This method is suitable for comparison purposes between different irons.

10.1 Creasing of test cloth

10.1.1 Test cloth

Samples of textile material of wool, cotton, viscose and polyester which are specified in ISO 105-F, together with polyester/cotton are washed and tumble-dried according to ISO 6330 and smoothed by steam ironing in order to remove all wrinkles. Any moisture is then removed by ironing without steam.

The samples have dimensions of 14 cm × 30 cm with the sides parallel to the warp. The samples are cut using pinking scissors, and maintained in a dry atmosphere at a temperature of 20 °C ± 5 °C for at least 48 h.

NOTE 1 The samples are made from the same batch, two samples of each textile material being used.

NOTE 2 Test material of polyester/cotton:

– composition: 65 % polyester and 35 % cotton;
– yarn number: 14 ± 2 tex;[1]
– number of threads in warp: 40 ± 4 per centimetre;
– number of threads in weft: 28 ± 3 per centimetre;
– dry mass per square metre: 0,09 kg.

NOTE 3 Instead of pinking, a loose over-lock stitch may be used to prevent fraying.

[1] 1 tex = 10^{-6} kg/m.

10.1.2 Conditioning of test cloth before creasing

The dried test cloth is exposed to a uniform hot-water spray of 45 °C ± 5 °C, until the amount of water reaches 10 % to 15 % of the mass of test cloth.

NOTE It is not necessary to subject polyester to the water-spray treatment.

The test cloth is then rolled up loosely and maintained at a temperature of 30 °C ± 2 °C, and a relative humidity of 90 % to 95 % for at least 24 h, but not exceeding 72 h.

10.1.3 Creasing tool

The creasing tool, as shown in Figure 5, is maintained at a temperature of 30 °C ± 2 °C.

10.1.4 Wrapping and creasing of test cloth

The test cloth is wrapped around the core of the rod and the pencil, with a pull force of 1 N (see Figure 6). The end of the test cloth is retained by a small piece of adhesive tape, and the pencil removed.

Circular blocks having a total mass of 4 kg are slid over the core of the rod in order to load the cloth. They are separated from the base by 10 mm by inserting a rectangular block as shown in Figure 7.

The fixture is then maintained in a cabinet at a temperature of 30 °C ± 2 °C and relative humidity of 90 % to 95 % for 30 min.

The test cloth is then removed from the fixture and, still wrapped, maintained in a cabinet at a temperature of 30 °C ± 2 °C and relative humidity of 90 % to 95 % for between 2 h and 24 h before use.

10.2 Conditioning of the iron

The iron is operated according to clause 5, the thermostat being set so that the mean sole-plate temperature is maintained at 200 °C when testing cotton and 150 °C when testing wool, viscose, polyester and polyester/cotton.

If there is no thermostat, the sole-plate peak temperature is maintained by switching the supply off at

- *200 °C for cotton;*
- *150 °C for wool, viscose, polyester and polyester/cotton;*

and by switching the supply on at

- *185 °C for cotton;*
- *140 °C for wool, viscose, polyester and polyester/cotton.*

The ironing tests are carried out immediately after the supply has been switched off for the third time. For steam ironing, the water reservoir has to be filled up to the capacity specified by the manufacturer, and the steam supply has to be operated at the maximum steaming rate for 15 s ± 1 s before using the iron.

10.3 Ironing

The tests are conducted at a relative humidity of 65 % ± 15 %.

The creased cloth is taken out of the cabinet and is unwrapped slowly on the ironing board (see annex B).

A mass of 3 kg is applied to the handle of the conditioned iron, as shown in Figure 8. The tip of the iron is applied to the outer end of the unwrapped creased test cloth and the iron pulled horizontally with a speed of 0,1 m/sec ± 0,03 m/sec. The pull is applied at the point of 20 mm above the sole-plate of the iron (see Figure 9). The iron is pulled over the cloth once. For cotton and wool, the iron is operated in the steaming mode, while for polyester, polyester/cotton and viscose, the iron is operated in the dry mode.

NOTE For comparison purposes, each test may be followed by a test with a reference iron.

10.4 Ironing with shot of steam

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

The thermostat, if any, is set to the highest setting of the steaming range or highest setting of the shot of steam range specified by the manufacturer.

A creased test cloth prepared in accordance with 10.1 is placed on a standardized ironing board.

The stretching test is conducted at 65 % ± 15 % RH.

The iron is then connected to the power supply and heated up.

In the first instance, the test is made without steam function, then, for a second time, it is made with the steam function.

Immediately after the thermostat has switched off for the second time, the iron is moved by hand forward over the test cloth by operating the shot of steam device three times with a speed of 0,10 m/s ± 0,03 m/s and also backward without steam function.

Two additional strokes consisting of one stroke forward and the other back are added to dry the test cloth without any steam function.

After the ironing, the evaluation of the test cloths shall be carried through in accordance with 10.5.

For steam irons the thermostat is set to the highest temperature setting for steam/shot of steam and the maximum steaming rate.

The first backward stroke and the two additional strokes are operated with steam.

10.5 Evaluation

Immediately after ironing, the test cloth is left in an atmosphere having a relative humidity of 65 % ± 15 % for 24 h ± 4 h.

The test cloth is placed on a flat board and the central portion is evaluated, as shown in Figure 10.

If necessary, the test cloth is illuminated at an angle of 45° and the results compared with the charts shown in Figure 11.

For comparative tests of different irons, the evaluation is made using the same materials for the test cloth. The tests are repeated and the poorer results stated.

11 Measurement of input power and energy consumption

11.1 Measurement of input power

The iron is placed on the three metallic supports; for cordless irons, the iron is placed on its stand (see 5.4). The voltage shall be kept at the rated value(s), or at the mean value of the rated voltage range(s), if the difference between the limits of the rated voltage range is less than 10 % of the mean value of the range. When the difference between the limits of the rated voltage range is larger than 10 % of the mean value of the range, the input power shall be measured both at the upper and lower limits of the range. The measurement is made after the iron has reached steady conditions with the thermostat, if any, set at the highest temperature.

11.2 Measurement of energy consumption

11.2.1 Preparation of the test cloth

Samples of textile material composed of cotton are prepared according to 10.1.1. The test cloth is conditioned according to 10.1.2.

The samples have dimensions of 600 mm x 1 500 mm with the sides parallel to the warp. The samples are cut using pinking scissors, and maintained in a dry atmosphere at a temperature of 20 °C ± 5 °C for at least 48 h.

Each sample is subdivided into 5 strips of 300 mm (not cut, only marked with a pen).

NOTE Dimensions of standardized ironing-board: 650 mm x 350 mm.

11.2.2 Measurement of the energy consumed during heating-up operation

11.2.2.1 For dry irons

The iron is connected to a suitable energy meter, capable of measuring to an accuracy of ±1 %. The thermostat, if any, is set so that the mean sole-plate temperature of 190 °C ± 10 °C is reached.

The energy consumed during this heating-up interval is recorded as E_1 in kWh.

11.2.2.2 For vented steam irons

The iron is connected to a suitable energy meter, capable of measuring to an accuracy of ±1 %. The water reservoir is filled with distilled water having a temperature of 20 °C ± 2 °C up to the capacity specified by the manufacturer and then the iron is placed on its stand or in its upright position. The thermostat is set so that the mean sole-plate temperature of 190 °C ± 10 °C is reached.

For irons with a separate water reservoir, the reservoir is filled up to the capacity specified by the manufacturer.

The energy consumed during this heating-up interval is recorded as E_1 in kWh.

11.2.2.3 For pressurized steam irons

The iron is connected to a suitable energy meter, capable of measuring to an accuracy of ±1 %. The boiler is filled with distilled water having a temperature of 20 °C ± 2 °C up to the rated capacity and then placed on its stand.

The thermostat of the iron is set so that the mean sole-plate temperature of 190 °C ± 10 °C is reached, any setting of the boiler shall be set at the maximum.

The energy consumed during this heating-up interval is recorded as E_1 in kWh.

11.2.3 Measuring of energy consumed during an ironing operation

NOTE The results of energy consumption test should only be used in conjunction with assessment of smoothing according to Clause 10.

11.2.3.1 For all irons

For vented and for pressurized steam irons the steaming regulator, if any, is set at the maximum setting.

The iron is connected to a suitable energy meter, capable of measuring to an accuracy of ±1 %.

The test cloth with dimensions of 600 mm x 1 500 mm and marked according to 11.2.1 is placed on the ironing board, see Annex B.

The first marked strip of the cloth is ironed for 20 s (in case of pressurized steam irons 5 s with steam and 15 s without steam), a break of 10 s follows (one cycle). This procedure is repeated with the next 5 strips and then started again from the beginning, with the same cloth. This procedure is now continued for exactly 10 min.

The energy used for this operation is recorded as E_2 in kWh.

11.2.3.2 Calculation of the total energy consumed for the ironing process

The energy consumption for the iron is reported as the energy consumed during one hour of the ironing process plus the energy consumption during heat-up time, in kWh.

The energy consumed in one hour is then 6 times the value measured after 10 min., i.e. E_3 = 6 x E_2 kWh.

The total energy consumed during an ironing process is therefore:

$E_{total} = E_1 + E_3$ kWh

11.3 Ironing efficiency

(Under consideration)

12 Assessment of sole-plate

12.1 Determination of smoothness of the sole-plate

The smoothness of the sole-plate is evaluated by measuring the horizontal force required to pull the iron over the surface of a standard ironing-board (see annex B).

The measurement is made at a relative humidity of 65 % ± 15 %.

Before starting the test, the sole-plate is cleaned in accordance with the manufacturer's instructions. If such instructions are not given, the sole-plate is cleaned with a solution of 10 % by volume of acetic acid in water.

A standard ironing-board is positioned horizontally, the angle of inclination not exceeding 0,5° .

A conditioned dry cotton cloth, as specified in annex C, is stretched on the surface of the standard ironing-board.

The iron is operated without water with the thermostat set so that the mean sole-plate temperature is maintained at 190 °C ± 10 °C when measured in accordance with clause 5 at the mid-point.

The peak temperature is not to exceed 210 °C.

The iron, immediately after switch-off of the thermostat, is placed on the ironing-board, the supply cord being attached to the handle of the iron so that the results are not affected.

Steam irons are also tested with the water reservoir filled with distilled water to the maximum capacity specified by the manufacturer, any steam control set to the maximum flow rate. The iron is placed on the ironing-board after it has been preheated as specified for dry ironing and the thermostat has operated several times with steam emission.

Within 3 s of placing the iron on the ironing-board, the iron is pulled horizontally at a speed of 0,25 m/s ± 0,05 m/s.

The maximum force during the movement is measured.

The force in newtons required to pull the iron over the surface is measured by means of a spring balance having an accuracy of not less than 0,1 N, as shown in Figure 12.

The test is carried out three times, the cotton cloth being replaced each time.

The test is carried out three more times, but with the spring balance attached to the back of the iron.

NOTE The temperature of the supporting pad of the ironing-board is recorded to aid reproducibility of the test.

The average of the three measurements in each direction is calculated and the smoothness of the sole-plate is expressed in N rounded up to the nearest 0,1 N.

For steam irons it is stated for both ironing conditions.

12.2 Measurement of scratch resistance of sole-plate

12.2.1 General

The scratch resistance of sole-plate is evaluated following ISO 1518.

The principle of the test is that the sole-plate of an iron is scratched by a needle on which a certain force is applied. The width of the scratch is then measured and classified.

General instructions concerning the test procedure can be found in ISO 1518.

12.2.2 Test procedure

The iron is fixed in an apparatus such as that shown in Figure 13a so that the iron is in the horizontal position with the sole-plate upwards.

The needle has a hard hemispherical tungsten carbide tip of 1 mm in diameter and shall be examined before every set of measurements under 30 times magnification to check that the hard tip is smooth, hemispherical and free from contamination.

A force of 20 N ± 0,02 N is applied on the needle and the sole-plate is scratched with a constant speed of 35 mm/s ± 5 mm/s.

The sole-plate is scratched only in one direction, parallel to the centre-line of the iron. The test is carried out on flat unscratched surface areas of the sole-plate with the sole-plate at room temperature.

NOTE 1 The iron may be new or already used.

The sole-plate is scratched twice. The length of each scratch shall be at least 40 mm.

NOTE 2 Some irons, for example, highly polished surfaces, may need preliminary preparation. In this case, before the test is carried out a thin layer of contrasting coloured ink producing a matt finish is applied on the scratching area of the sole-plate.

The width of both scratches is measured then in the middle of each scratch as well as 10 mm ± 1 mm above and below the middle (see Figure 13b).

The width is measured between the top of the edges as shown in Figure 13c, using suitable optical measuring equipment, with an accuracy of ±0,001 mm. The results reported are rounded up to two decimal places.

The arithmetic mean $\bar{x}$ *of these six values is then calculated as follows:*

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

where

$\bar{x}$ *is the arithmetic mean;*

n *is the six measurements.*

12.2.3 Evaluation of results

The scratch resistance of a sole-plate is divided into three classes with different scratch widths $\bar{x}$ *as shown in Table 2.*

Table 2 – Classes of scratch resistance

Classes	Width $\bar{x}$ mm
Excellent scratch resistance	$\bar{x} < 0{,}15$
Good scratch resistance	$0{,}15 \leq \bar{x} < 0{,}30$
Poor scratch resistance	$\bar{x} \geq 0{,}30$

The measurement results, calculated scratch widths $\bar{x}$, are considered to be reproducible within the limits of ±10%.

NOTE More accurate test results can be achieved with a motor-driven scratch test apparatus.

12.3 Determination of adhesion of polytetrafluorethylene (PTFE) coating or similar coating on sole-plate

The iron is fixed on a suitable support and a thermocouple is attached at the mid-point of the sole-plate, if the sole-plate is coated with PTFE or similar material.

The iron is switched on, with the voltage specified in 5.2, and the thermostat is adjusted so that an average sole-plate temperature of approximately 150 °C is maintained under steady conditions.

For a non-thermostatic iron, the temperature at the mid-point of the sole-plate is maintained at 150 °C ± 10 °C by switching the supply on and off.

The temperature is maintained for at least 30 min.

The cross-cut test is performed according to ISO 2409 with temperature at the flat part of the sole-plate maintained at approximately 150 °C.

A cutting tool with six cutting edges is used in each direction of the lattice pattern.

If each cut does not penetrate the coating uniformly to the surface of the substratum, because of the curvature of the sole-plate, a single-edge cutting tool may be used.

The spacing of the cuts is 1 mm in each direction.

The cutting tool is applied in a plane normal to the test surface and the cut shall be at a rate of 20 mm/s to 50 mm/s with uniform pressure. The cuts are made at four different positions on the sole-plate and form 25 squares at each position.

Two of the positions are positioned approximately 50 mm apart from each other on the longitudinal centre-line, the others being positioned in the centre between the mid-point of the centre-line and both edges of the sole-plate (see Figure 14).

After cooling down to room temperature (20 °C ± 5 °C), the sole-plate is brushed lightly with a soft brush five times backwards and five times forwards along both lines of the lattice pattern.

Appropriate adhesive tape is then applied firmly over the area of lattice. The tape is then pulled off quickly to remove the flaked portion of the coating.

NOTE For this test the following adhesive tape is recommended: polyester film tape with non-thermosetting adhesive (width = 25 mm, thickness >0,02 mm), complying with sheet 3 of IEC 60454-3-3.

The test result is evaluated by observation of the cut surface at each position, and classified according to the table given in ISO 2409.

Tests are carried out on four positions on the sole-plate and only the worst lattice pattern is used for evaluation.

13 Measurement of thermostatic stability

13.1 Heating test

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 then heated up and the thermostat is set so that an average temperature of 190 °C ± 10 °C is maintained under steady conditions. The setting of the thermostat is fixed in an appropriate way so that the setting does not change during the measurement.

The average temperature T_1 is determined as in 7.3.

The iron is then operated for 11 h and then it is switched off for 1 h. The cycles, consisting of an on-period of 11 h and an off-period of 1 h, are repeated until the total sum of on-periods reaches 500 h. Immediately after this, the average sole-plate temperature T_2 is determined as for T_1.

13.2 Drop test

This test is performed immediately after the measurement in 13.1, with the thermostat fixed at the same setting.

During the drop test, cordless irons are not connected to the power supply.

The thermocouple is removed from the sole-plate and the iron is subject to 1 000 drops from a height of 4 cm at a rate of about five drops per minute. When the iron drops, it should strike in a horizontal position on a rigidly supported flat steel plate at least 5 mm thick and at least 15 kg in mass. Figure 15 illustrates the test device. During the drop test, the iron is connected to the power supply.

Immediately after the drop test, the average temperature T_3 at the mid-point is determined as for T_1.

13.3 Determination of drift of thermostat

As an indication of the thermostatic stability, the drifts of the thermostat after the tests are determined by the following formulae:

- *drift of the thermostat for the heating test* $= (T_2 - T_1)/T_1$
- *drift of the thermostat for the drop test* $= (T_3 - T_2)/T_1$
- *total drift* $= (T_3 - T_1)/T_1$

These are expressed in per cent.

14 Determination of total steaming time for hard water

The following test is made unless the manufacturer recommends the use of distilled or demineralized or similar water.

The test procedure for pressurized steam irons and instantaneous steam irons is under consideration.

This test is not carried out on cordless irons.

The iron is supported in an apparatus such as that shown in Figure 15 so that the sole-plate is in the horizontal position in still air and is moved backwards and forwards in a direction parallel to the centre-line of the sole-plate over the distance of 500 mm at a speed of approximately 0,4 m/s. The reciprocal motion is produced by the transformation from rotary motion of 15 r.p.m. with reciprocal motion of 15 cycles per minute. After 5 cycles (20 s) the movement is stopped and the iron is placed in the upright position as quickly as possible for a period of 10 s, after which the iron is returned to the horizontal position and the movement restarted. This procedure is repeated continuously.

NOTE 1 If the manufacturer recommends a different resting position, this position is used.

The water reservoir is filled with hard water to the capacity specified by the manufacturer. The hard water has a hardness of 300 $\times 10^{-6}$ prepared by method A as specified in IEC 60734. The iron is connected to the supply with the thermostat set to the maximum setting indicated for steam ironing. When the thermostat, if any, has switched off for the second time, the steam control is operated to give the maximum flow rate and the reciprocating movement started.

When the emission of steam ceases and when the iron is in an upright position, the steam control is closed and the water reservoir refilled with water as before. After 2 h of operation including 10 s rest times in the upright position, the iron is switched off for at least 1 h in order to cool. During this period, the iron is kept in the upright position with the steam control closed, any remaining water in the reservoir having been emptied away.

The above procedure is repeated continuously, the steaming rate SR and water leakage rate L_R being measured according to 9.2 each time 5 l of water have been evaporated and introduced in a graph as a function of the quantity of water used. The test is continued until the steaming rate has dropped to 5 g/min or the water leakage rate has increased to 3 % of the steaming rate.

*For **vented steam irons with motor pump**, the motor pump has to be switched off in the upright position.*

If the iron incorporates a descaling device, such as a means for providing a shot of steam, this cleaning procedure is carried out during the test according to the manufacturer's instructions.

The steaming time before descaling is the total time during the test when steam is emitted and is expressed in hours.

NOTE 2 The steaming time excludes the periods when the iron is in the 10 s rest time upright position and the cooling times.

After the test the iron is descaled according to the manufacturer's instructions and the steaming time, steaming rate and water leakage rate are measured according to 9.2 and recorded.

The above test is repeated for a sufficient number of times until the descaling procedure fails to improve the steaming rate higher than 5 g/min or the water leakage rate lower than 3 % of the steaming rate.

The total steaming time is the sum of the individual steaming times before descaling.

The results of the test are expressed as

– *the total steaming time, in hours;*

– *the quantity of water evaporated, in litres;*

– *the number of times the iron is filled.*

NOTE 3 The characteristics S_R and L_R for hard water are to be used for the determination of total steaming time for hard water, as indicated in clause 13, but are not useful information for the consumer.

15 Instruction for use

It shall be checked whether the manufacturer's instructions for use contain information about the use of the appliance and its accessories, if any, and about the cleaning necessary to ensure the proper performance of the appliance.

16 Information at the point of sale

The following information for the consumer shall be provided at the point of sale if applicable:

a) type of iron (dry iron, steam iron, **vented steam iron with motor pump,** irons with steam generator/boiler, etc.)

b) voltage/voltage range (V);

c) frequency (Hz);

d) power input (W);

e) cord length (m);

f) weight (g) (the iron without supply cord);

g) weight (g) (the whole appliance, e.g. including supply cord, water container/boiler);

h) sole-plate material and coating;

i) scratch resistance (excellent, good, poor);

j) water to be used (tap water up to a hardness as declared by the manufacturer, dematerialized water);

k) use of specific additives

l) steaming rate (g/min)

m) shot of steam; (g/shot)

n) additional functions/features, for example:

   – spray;

   – anti-scale device;

   – drip-stop;

   – auto-shut off;

   – detachable water tank.

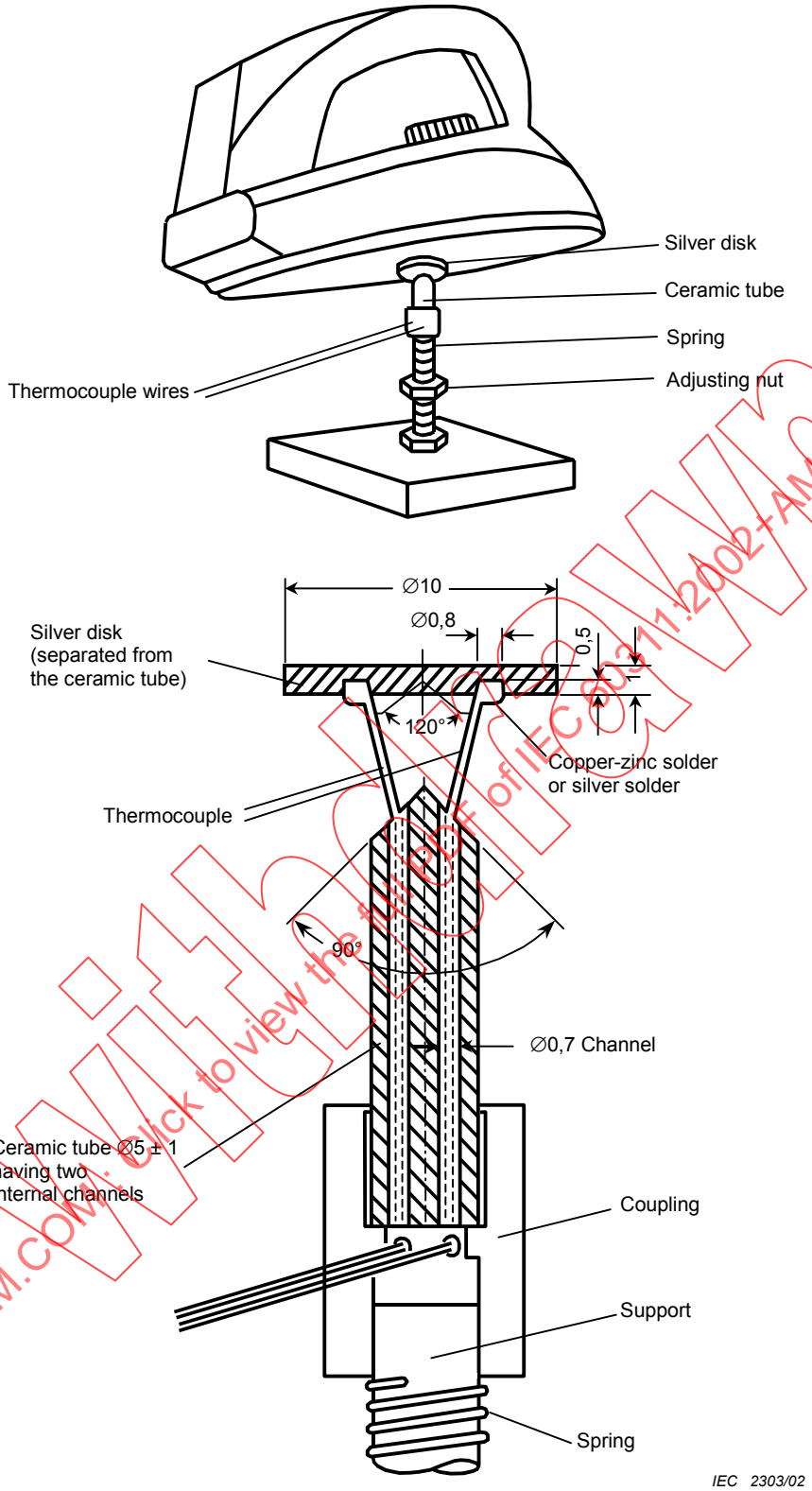


Figure 1 – Arrangement for measuring the sole-plate temperature

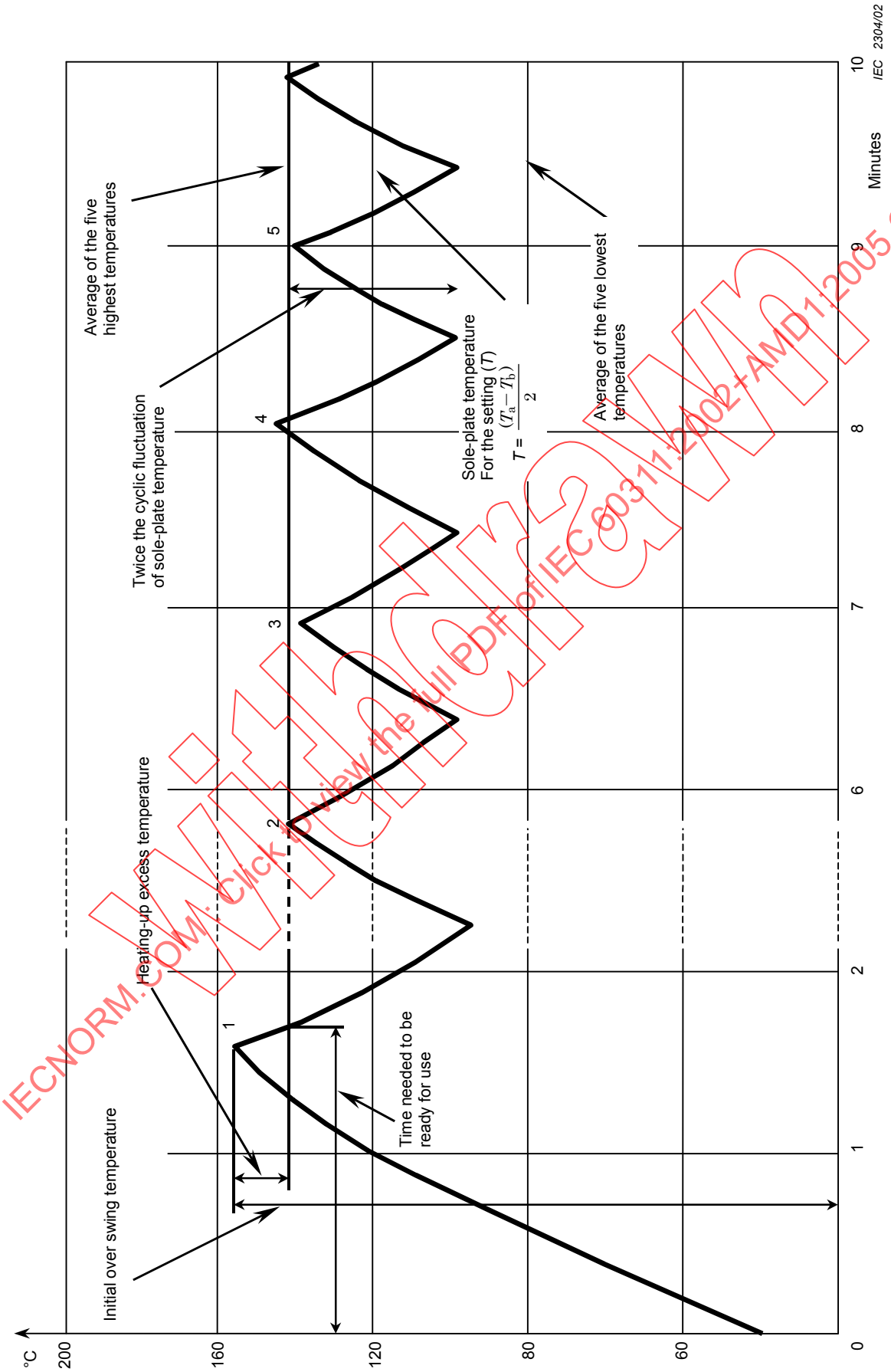


Figure 2 – Variation of sole-plate temperature after switching-on

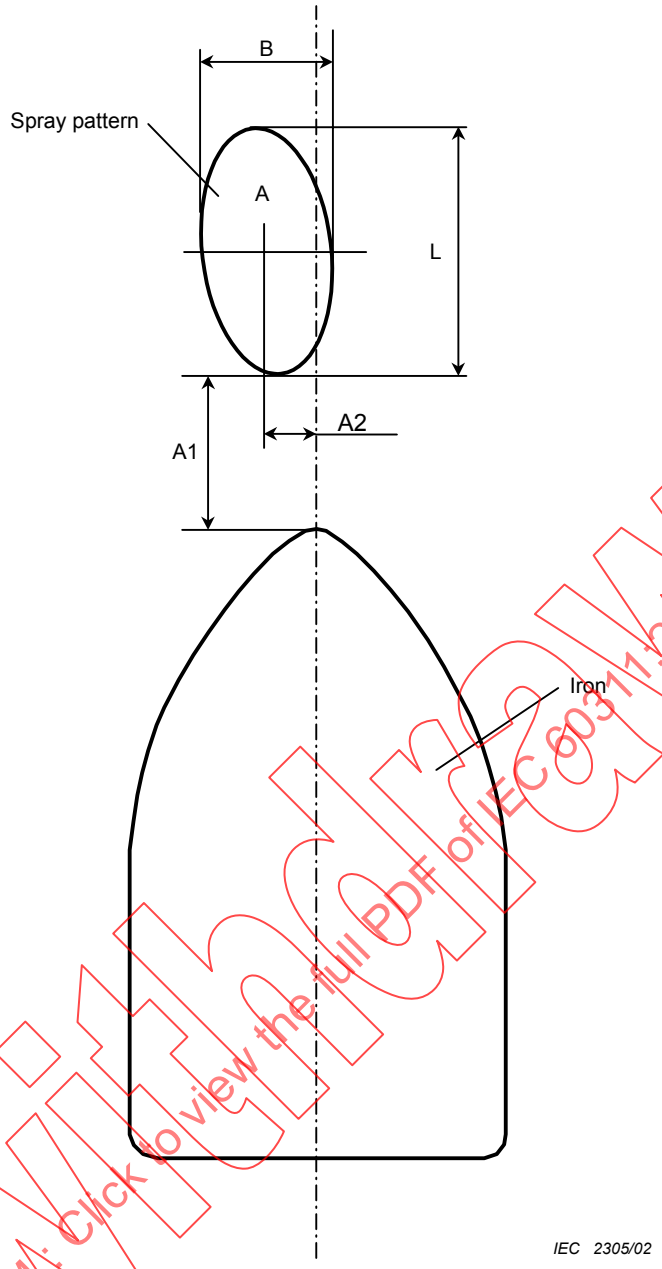


Figure 3 – Determination of spray pattern

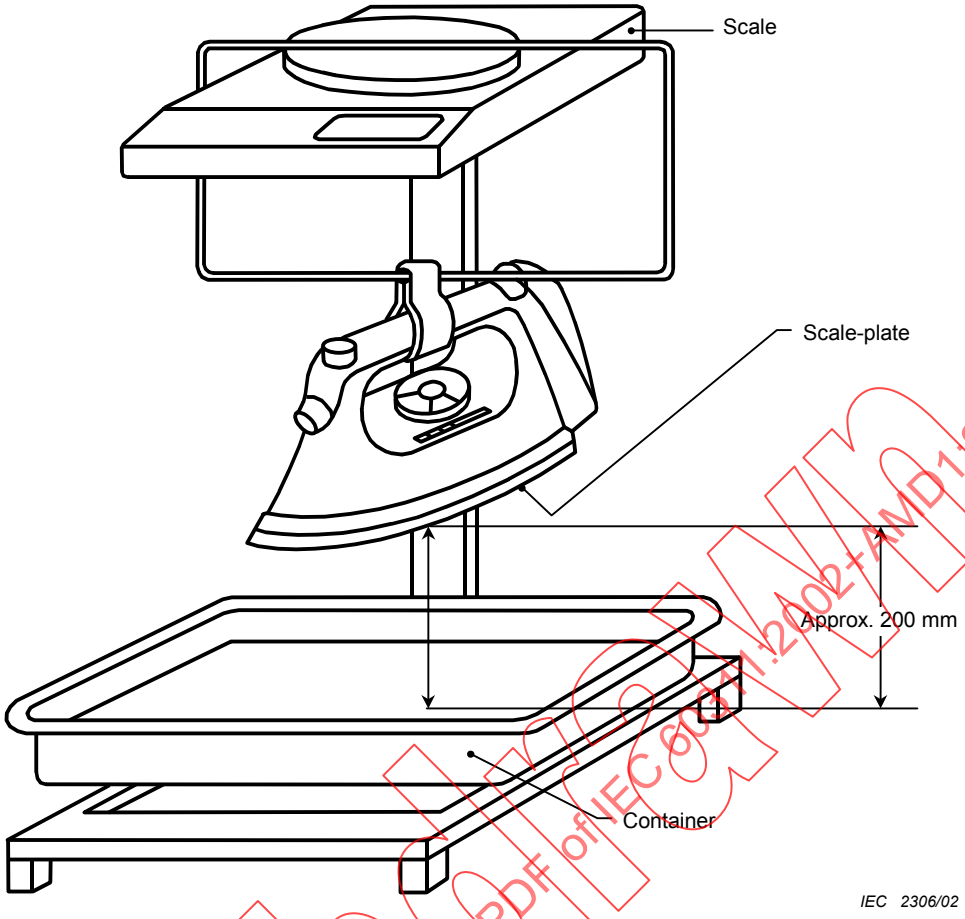


Figure 4a – Vented steam irons for steaming operation

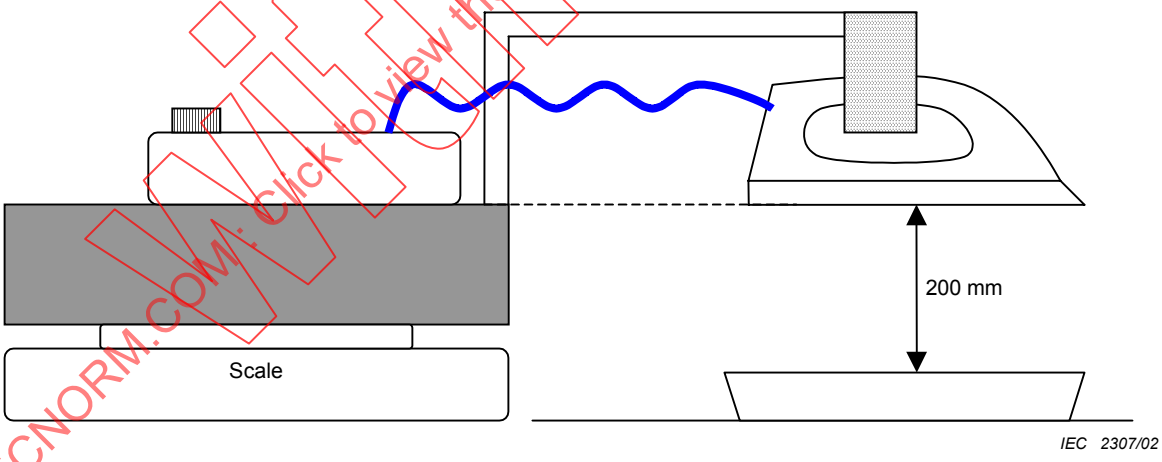


Figure 4b – Pressurized or instantaneous steam irons

Figure 4 – Test apparatus

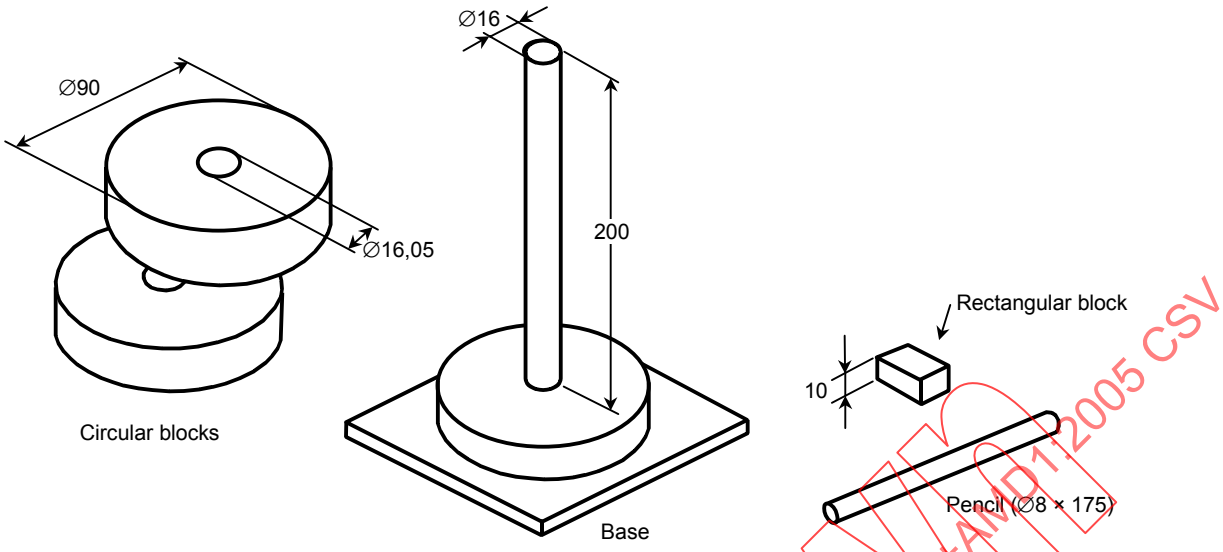


Figure 5 – Creasing tool

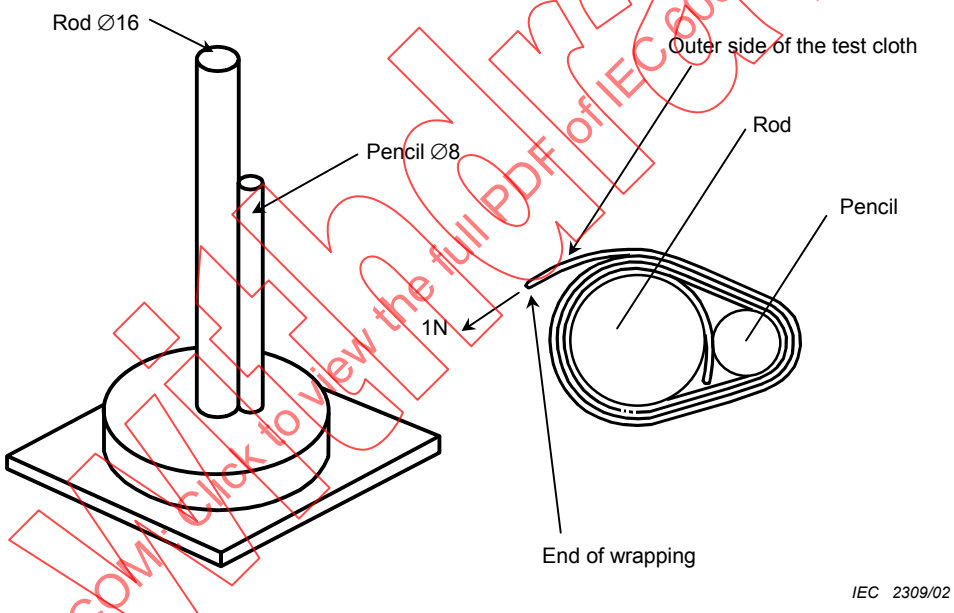


Figure 6 – Wrapping rod and pencil

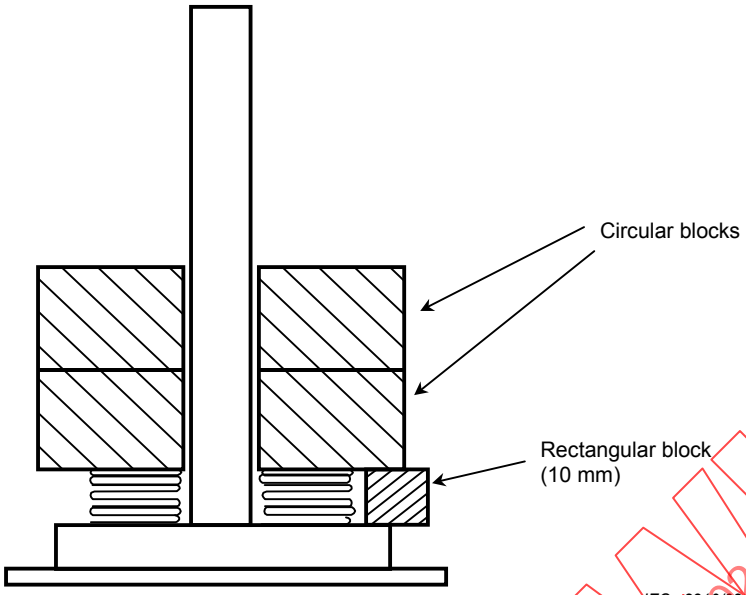


Figure 7 – Circular and rectangular blocks

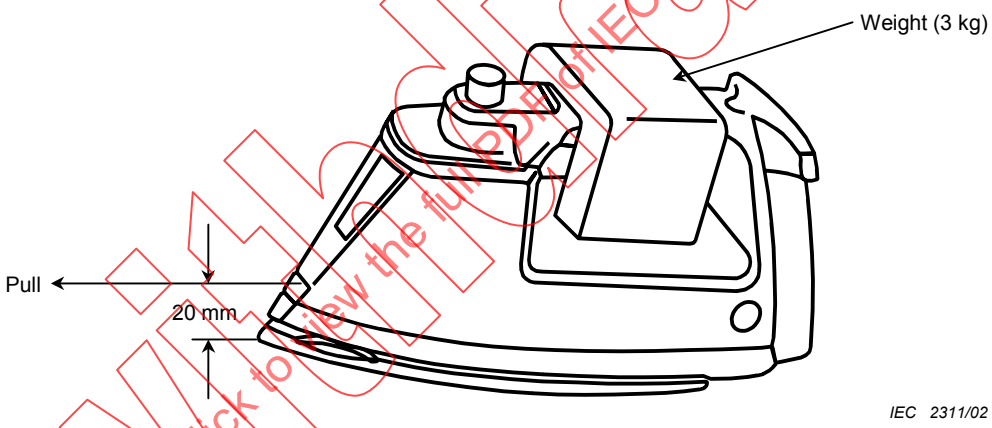


Figure 8 – Conditioning of the iron

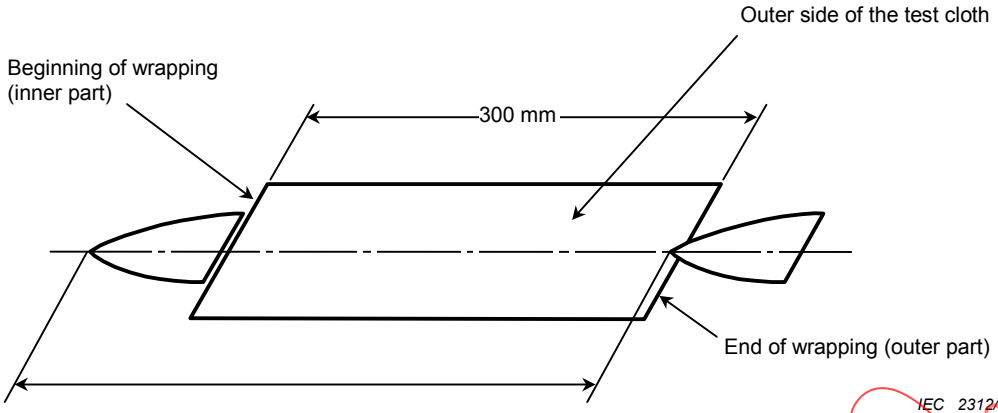


Figure 9 – Ironing

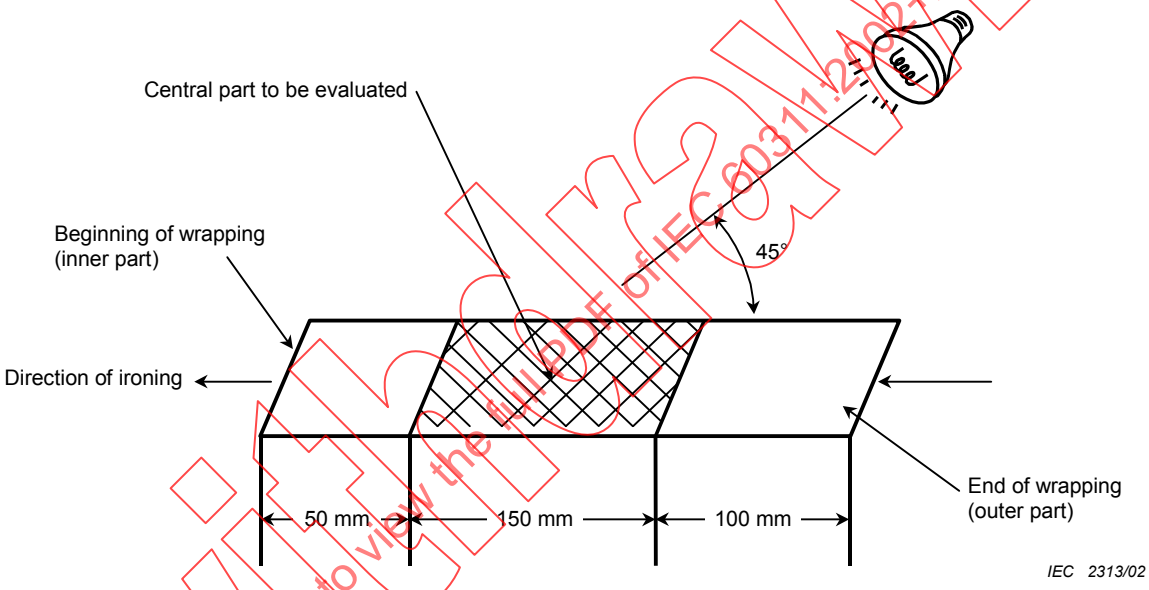
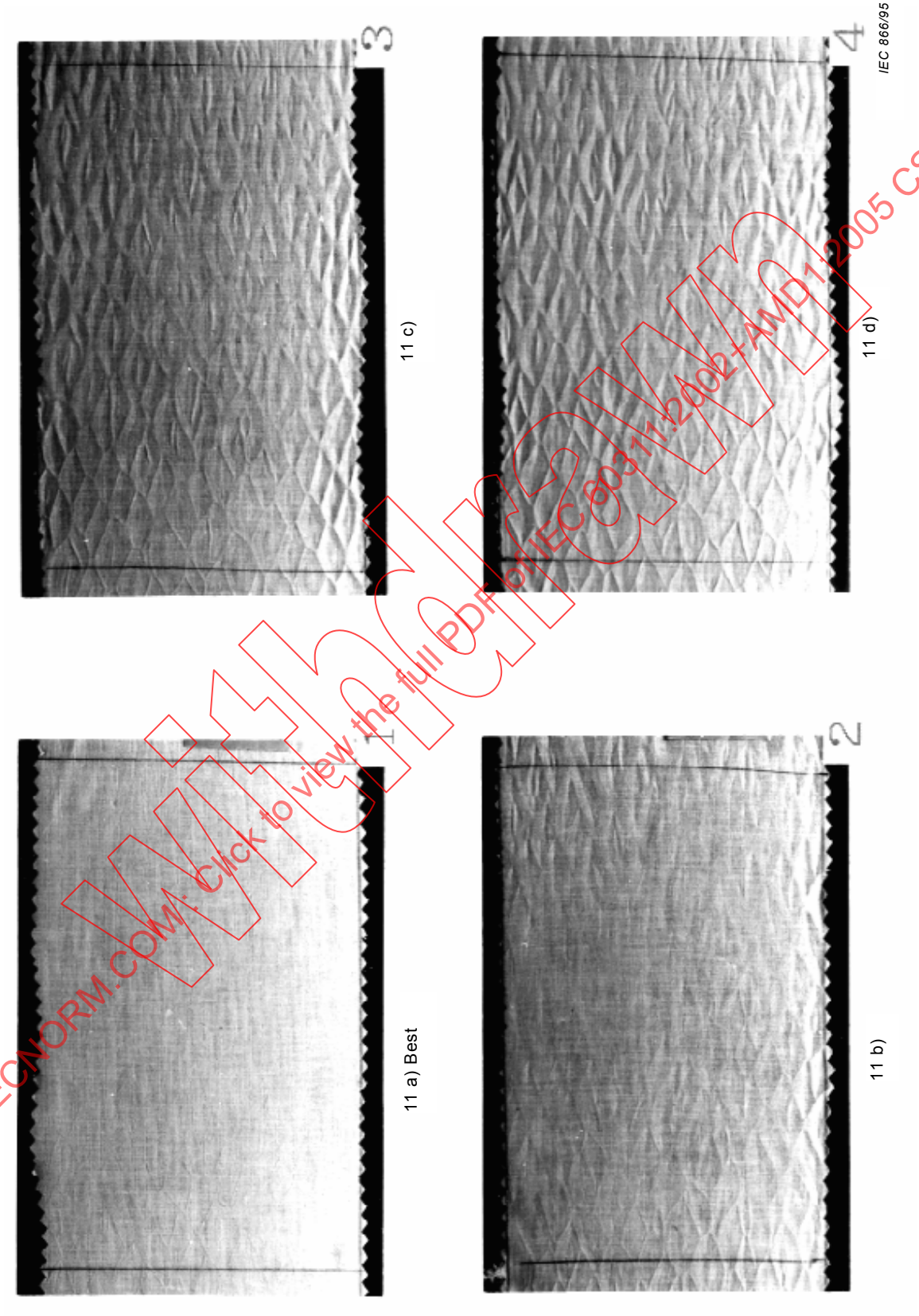


Figure 10 – Evaluation



11 a) Best

11 b)

11 c)

11 d)

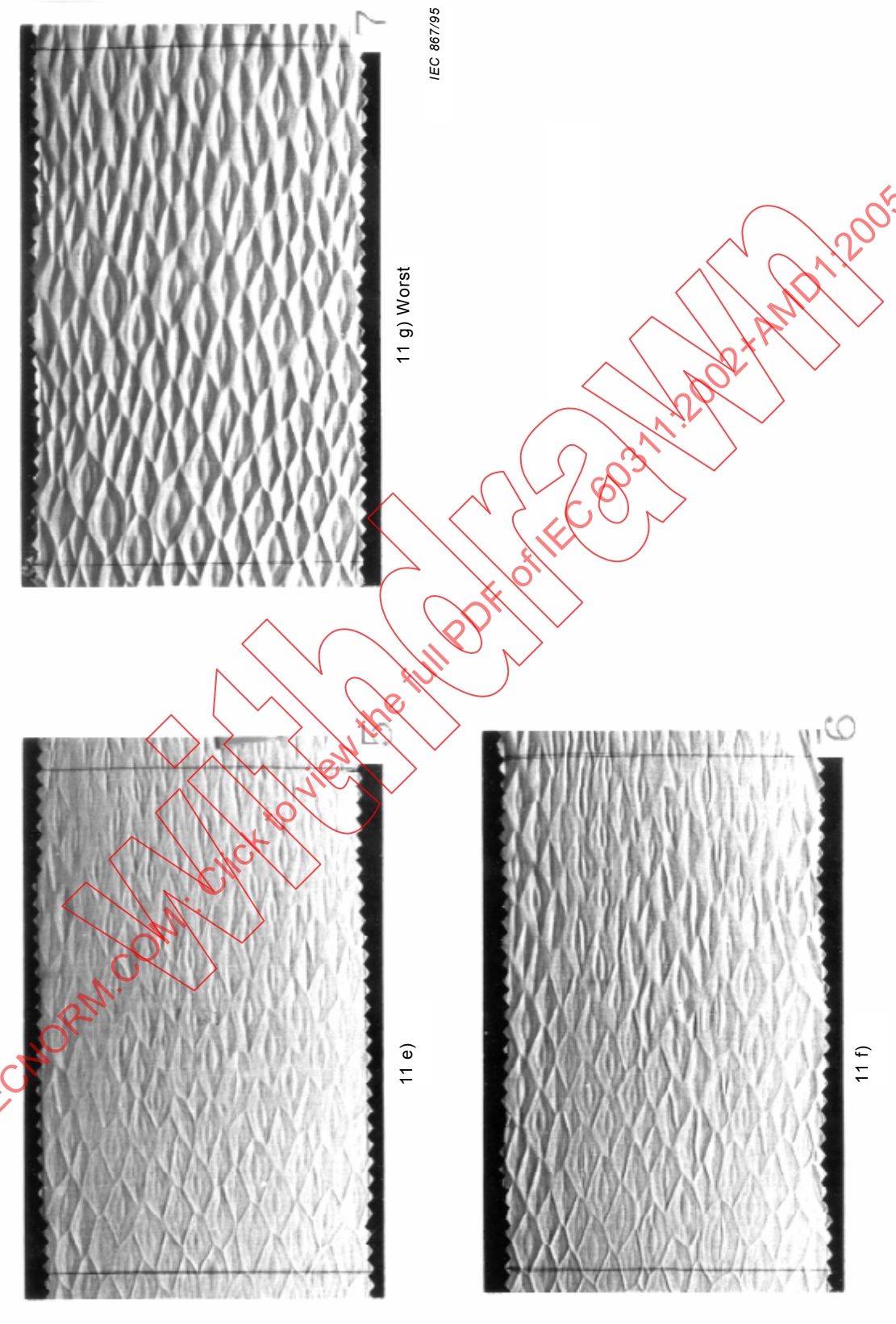


Figure 11 – Comparison charts

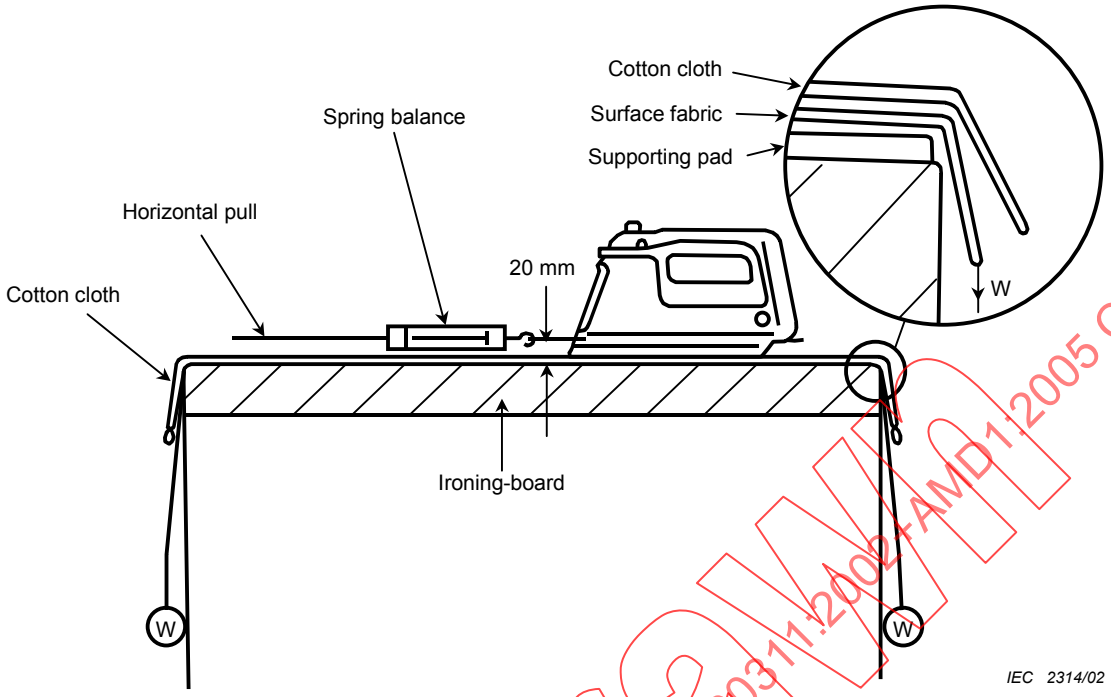


Figure 12 – Test apparatus for smoothness of sole-plate

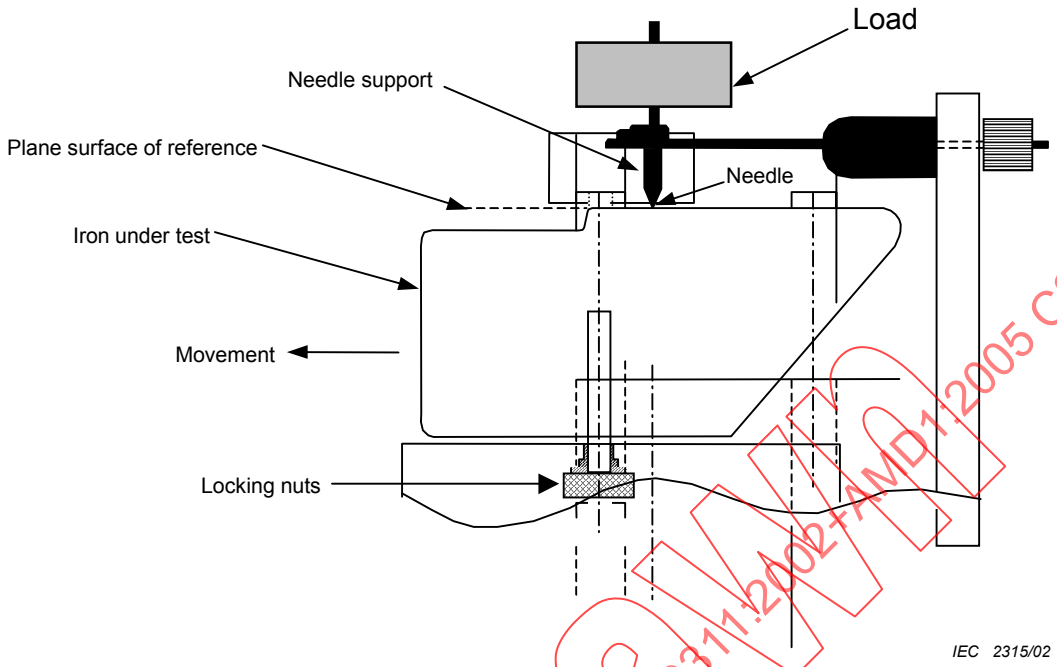


Figure 13a – Test apparatus for scratch resistance of sole-plate

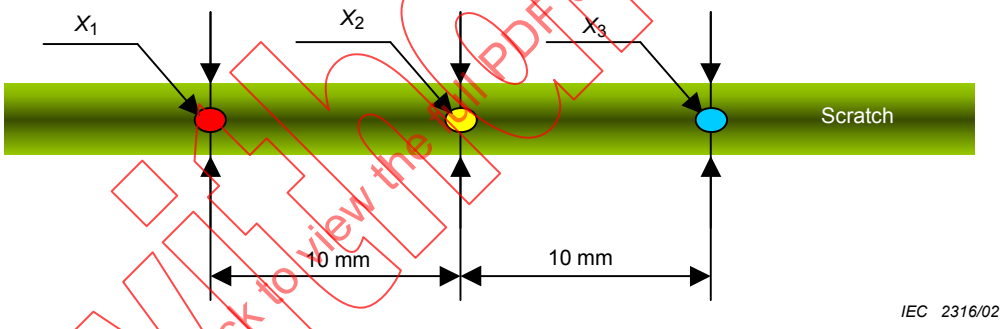


Figure 13b – Measurement position of scratch

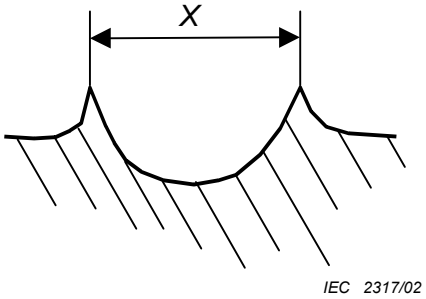


Figure 13c – Measurement position of the width of the scratch

Figure 13 – Scratch