

# PAKISTAN STANDARD

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



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

### **0. FOREWORD**

- 0.1 This Pakistan Standard was adopted by the authority of the Board of Directors for Pakistan Standards and Quality Control Authority after the draft prepared by the Technical Committee for “Electrical appliances and accessories (ENSC-3)” had been approved and endorsed by the National Standards Committee on \_\_\_\_\_.
- 0.2 This Pakistan Standard was formulated in 1980 on the basis of IEC: 60311/1970 and its supplement 60311/1973. Since IEC Standards have been revised in 1988, Pakistan standard was secondly revised on the bases of IEC: 60311 /1988, it deemed necessary to revised the Pakistan standard on the bases of IEC: 60311/2016 to keep abreast with the latest technology and at par with IEC Standard.
- 0.3 This standard is based on IEC: 60311/2016 “Electric Irons for Household or Similar use – Methods for Measuring Performance” and its use hereby acknowledged with thanks.
- 0.4 This Standard is subject to periodical review in order to keep pace with the changing requirements and latest development in the industry. Any suggestions for improvement will be recorded and placed before the revising committee in due course.
- 0.5 This Standard covers technical provisions and it does not purport to include all the necessary provision of a contract.

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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 document 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 document 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, 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 is not given to minor differences in any one result.

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

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

ISO 105–F01, *Textiles – Test for colour fastness – Specification for wool adjacent fabric*

ISO 105–F02, *Textiles – Test for colour fastness – Specification for cotton and viscose adjacent fabrics.*

ISO 105–F03, *Textiles – Test for colour fastness – Specification for polyamid adjacent fabric*

ISO 1518–1, *Paints and varnishes – Determination of scratch resistance – Part 1: constant-loading method*

ISO 2409:2013, *Paints and varnishes – Cross-cut test*

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

ISO 6330:2012, *Textiles – Domestic washing and drying procedures for textile testing*

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

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

ISO 13934-1, *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 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 <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.1

##### **electric iron**

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

Note 1 to entry: In this document, "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 the means to produce and supply steam nor to spray water onto textile materials while ironing

#### 3.5

##### **steam iron**

iron having the means to produce and supply steam to textile materials while ironing

Note 1 to entry: It can be provided with a means to supply a shot of steam.

#### 3.5.1

##### **shot-of-steam iron**

iron provided with the 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 1 to entry: 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 1 to entry: 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 1 to entry: 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



Note 1 to entry: 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 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'

## **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.

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**Table 1 – Measurements of various types of irons**

Item of measurement	Thermo-static dry irons	Thermo-static dry irons with non-self-resetting thermal cut out	Thermo-static 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 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)
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

Item of measurement	Thermo- static dry irons	Thermo- static dry irons with non-self- resetting thermal cut out	Thermo- static 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 attachment
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

### 5.1 General

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

### 5.2 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.*

### 5.3 Voltage and frequency for measurements

*The voltage to be applied to the iron under measurement is that required to give the rated input under steady conditions.*

*For appliances with a rated voltage range, measurements shall be carried out at the mean value of the voltage range.*

*Unless otherwise stated, measurements shall be carried out at rated voltage with a tolerance of ±1 % and, if applicable, at rated frequency.*

### 5.4 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.*

## 5.5 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.*

## 5.6 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.*

## 5.7 Cordless irons having a mains supply attachment

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

## 5.8 Irons fitted with separate steam generator/boiler

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

## 5.9 Irons fitted with auto switch-off devices

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

## 5.10 Test sample

*A new sample is used for the test of Clause 13.*

## 5.11 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.*

## 5.12 Circumvention

*Appliances cannot be designed to circumvent the test conditions in this document. As such, this means that appliances cannot be designed in order to automatically have their test results boosted when following a test protocol described in this document (i.e. the appliance recognises that it is undergoing a steam rate measurement test and consequently adapts its performance).*

## 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 5.5), 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 5.3, 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 5.5), and a thermocouple is attached at the mid-point of the sole-plate.*

*The iron is switched on, with the voltage specified in 5.3.*

*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 ( $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ); 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 5.5), 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 can 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 document 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 $T$ $^{\circ}\text{C}$	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 5.5), and is heated up with the voltage specified in 5.3 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 can be used 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 5.5); 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 can 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  $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ , 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 6330:2012, Clause 5, Clause 8 and 10.1.3;
- threads  $25 \pm 2$  per centimetre in warp and weft having a yarn of  $30\text{ tex} \pm 2\text{ tex}$ , 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 ( $\text{CoCl}_2$ ).

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 the iron tip and the beginning of the 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

All irons shall be given an initial preparation by steaming at least one reservoir capacity of water under dynamic conditions.

Weigh the empty iron ( $W_0$ ) by means of a balance having an accuracy of at least  $\pm 0,1$  g.

For vented steam irons, the water reservoir is filled with distilled water having a temperature of  $20\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$  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.

Weigh the full iron ( $W_1$ ).

The iron is then placed with the sole-plate in a horizontal position with a tolerance of  $\pm 1^\circ$  on the carriage, as shown in Figure 4a). A container of known mass within  $\pm 0,1$  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 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 heating-up time is the time between the connection to the mains and the instant when the steaming flow appears under the soleplate.

*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.*

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  $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  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 9.1.1, at the maximum setting of the thermostat, is continued. At the end of heating-up time, when steam appears under the soleplate, movements of the carriage for the steaming time ( $t$ ) are started. The carriage is moved backwards and forwards in a direction parallel to the centre line of the soleplate over a distance of 500 mm. The reciprocal motion is produced by the transformation from rotary movement of 15 rotations per minute with reciprocal motion of 15 cycles per minute. The duration of steaming time is 3 min. At the end of the steaming time close the steam control to stop the steam. Weigh the iron ( $W_2$ ).*

*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 ( $W_3$ ).*

*For cordless irons, appliances having a main supply attachment are tested as conventional irons. For appliances without a main supply attachment, dynamic steam rate is measured by sequences of 20 s without power supply. Between two sequences; the cordless iron is being reloaded on its stand. Repeat this cycle until 3 min of steaming have occurred.*

*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 before the heating-up time;

$W_2$  is the mass of the iron and water after 3 min steaming;

$W_3$  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.

The steaming time is the time when 90 % of the water has evaporated.

$$S_T = \frac{W_1 - W_0}{S_R} \times 0,9$$

where:

$W_0$  is the mass of the empty iron

0,9 is the 90 % of the water reservoir capacity

This time is stated in minutes and seconds.

### 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  $\pm 1^\circ$  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 500 mm  $\pm$  50 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 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,  $24 \text{ s} \times 5 \text{ s} = 2 \text{ min}$ ;
- $t_1$  is the total running time during the 24 cycles,  $24 \text{ s} \times 20 \text{ s} = 8 \text{ min}$ .

### 9.2.3 Tolerances and control procedures for the steaming rate

If the steaming rate of an ironing appliance is declared on the appliance, its packaging or in other communication, the following procedure shall apply.

The measurement of the steaming rate, determined according to 9.2.1 or 9.2.2. shall be carried out on that appliance three times and the average,  $S_{R1}$ , is taken.

A 5 % measurement variance of the steaming rate should be allowed to take into account repeatability variations and possible deviations between different laboratories.

The result  $S_{R1}$  shall not be lower than:

$$S_{R1} \geq S_D \times (1 - 10\%) - (S_{R1} \times 5 \%)$$

where

$S_{R1}$  is the steaming rate, in grams per minute

$S_D$  is the declared steaming rate in grams per minute;

5 % is the measurement variance in per cent.

10 % is the allowed tolerance of the declared steam rate value.

If the value of  $S_{R1}$  is lower, the measurement of the steaming rate shall be carried out on a further ten randomly selected appliances with the test being performed three times on each appliance and the average taken in each case.

The arithmetic mean of the final averages measured ( $S_{R2}$ ) on these ten appliances shall not be lower than:

$$S_{R2} \geq S_D \times (1 - 10\%) - (S_{R2} \times 5 \%)$$

### 9.3 Determination of mass of a shot of steam

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.

Any thermostat is set at the highest point of the steaming range or the shot of the 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  $\pm 1^\circ$  on the metallic supports.

A container of known mass within  $\pm 0,1$  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 can 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

### 10.1 General

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

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

### 10.2 Creasing of test cloth

#### 10.2.1 Test cloth

*Samples of textile material of wool as specified in ISO 105-F01, cotton and viscose as specified in ISO 105-F02, and polyester as specified in ISO 105-F03, 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;<sup>1</sup>
- 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 can be used to prevent fraying.

#### 10.2.2 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.*

#### 10.2.3 Creasing tool

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

#### 10.2.4 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.*

<sup>1</sup> 1 tex = 10<sup>-6</sup> kg/m.

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  $30\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  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  $30\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  and relative humidity of 90 % to 95 % for between 2 h and 24 h before use.

### 10.3 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  $200\text{ }^{\circ}\text{C}$  when testing cotton and  $150\text{ }^{\circ}\text{C}$  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

- $200\text{ }^{\circ}\text{C}$  for cotton;
- $150\text{ }^{\circ}\text{C}$  for wool, viscose, polyester and polyester/cotton.

and by switching the supply on at

- $185\text{ }^{\circ}\text{C}$  for cotton;
- $140\text{ }^{\circ}\text{C}$  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  $15\text{ s} \pm 1\text{ s}$  before using the iron.

### 10.4 Ironing

The tests are conducted at a relative humidity of  $65\% \pm 15\%$ .

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  $0,1\text{ m/s} \pm 0,03\text{ m/s}$ . 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 can be followed by a test with a reference iron.

### 10.5 Ironing with shot of steam

The water container of the iron 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 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 10.2 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 backward 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 10.6.*

*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.*

## **10.6 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 5.5). 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 10.2.1. The test cloth is conditioned according to 10.2.2.*



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  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  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  $\pm 1\%$ . The thermostat, if any, is set so that the mean sole-plate temperature of  $190\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$  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  $\pm 1\%$ . The water reservoir is filled with distilled water having a temperature of  $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  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  $190\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$  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  $\pm 1\%$ . The boiler is filled with distilled water having a temperature of  $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  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  $190\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$  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 are only used in conjunction with the 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  $\pm 1\%$ .

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), and 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 1 h of the ironing process plus the energy consumption during heat-up time, in kWh.

The energy consumed in 1 h is then 6 times the value measured after 10 min., i.e.  $E_3 = 6 \times E_2$  kWh.

The total energy consumed during an ironing process is therefore:

$$E_{\text{total}} = E_1 + E_3 \text{ kWh}$$

### 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  $65 \% \pm 15 \%$ .

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  $0,5^\circ$ .

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  $190^\circ\text{C} \pm 10^\circ\text{C}$  when measured in accordance with Clause 5 at the mid-point.

The peak temperature is not to exceed  $210^\circ\text{C}$ .

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  $\pm$  0,05 m/s.*

*The maximum force during the movement is measured.*

*The force in N 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 1518-1.*

*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 1518-1.*

### **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  $\pm$  0,02 N is applied on the needle and the sole-plate is scratched with a constant speed of 35 mm/s  $\pm$  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 can 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 then measured in the middle of each scratch as well as 10 mm  $\pm$  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  $\pm 0,001$  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  $\pm 10\%$ .

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 5.3, 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  $\pm$  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 ( $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ), 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.

For this test the following adhesive tape is recommended: polyester film tape with rubber thermoplastic adhesive (width = 25 mm, thickness >0,02 mm) complying with IEC 60454-3-2.

The test result is evaluated by observation of the cut surface at each position, and classified according to Table 1 in ISO 2409:2013.

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 5.5), 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  $190\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$  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

### 14.1 For non-pressurised steam irons

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

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 a 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 rotations per minute 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 3 mmol/l prepared by method C as specified in IEC 60734 if the chloride content is below 35,5 mg/l. 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  $S_R$  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.

*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 used for the determination of total steaming time for hard water, as indicated in Clause 13, but are not useful information for the consumer.

#### **14.2 For pressurised steam irons or instantaneous steam irons**

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

*The iron is supported in an apparatus such as that shown in Figure 4b) so that the sole-plate is in the horizontal position in still air.*

*The water reservoir or boiler is filled with hard water to the capacity specified by the manufacturer.*

*The hard water has a hardness of 3 mmol/l prepared by method C as specified in IEC 60734 if the chloride content is below 35,5 mg/l. The iron and boiler are connected to the supply with the thermostat of the iron set to the maximum setting indicated for steam operation and where applicable any maximum setting of the boiler.*

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

- $t_{on} = 5$  s ON (the steam switch is turned on, there is steam generation);
- $t_{off} = 15$  s OFF (the steam switch is turned off, there is no steam generation).

*When the boiler is empty or the water reservoir has been filled twice, the system is unplugged and rested to allow cooling to ambient temperature. If a water level indicator is present, then it should be used as criterion to determine whether the water reservoir or boiler is empty.*

*The above procedure is repeated continuously, the steaming rate  $S_R$  and water leakage rate  $L_R$  being measured according to 9.2 each time a maximum of 50 l of water has been evaporated. The test is continued until:*

- the steaming rate has dropped to 5 g/min, or
- the water leakage rate at the iron has increased to 3 % of the steaming rate, or
- significant damage or failure occurs, for example leakage, no steaming functioning, no heating etc., or
- 500 l standard hard water has been evaporated.

NOTE 1 500 l is considered to be approximately equivalent to 5 years of normal use. Any deviation is reported.

If the system incorporates a descaling or rinsing device, this cleaning procedure is carried out during the test according to the manufacturer's instructions.

The total steaming time is the sum of the individual steaming times without considering descaling or rinsing times.

The results of the test are expressed as:

- the total steaming time, in hours (sum of  $t_{on}$ );
- the total running time in hours, (sum of  $t_{on}$  and  $t_{off}$ );
- the quantity of water evaporated, in litres.

NOTE 2 The characteristics  $S_R$  and  $L_R$  for hard water are used for the determination of total steaming time for hard water, as indicated in 9.2.2, but are not considered to be useful consumer information.

## 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.

Dimensions in millimetres

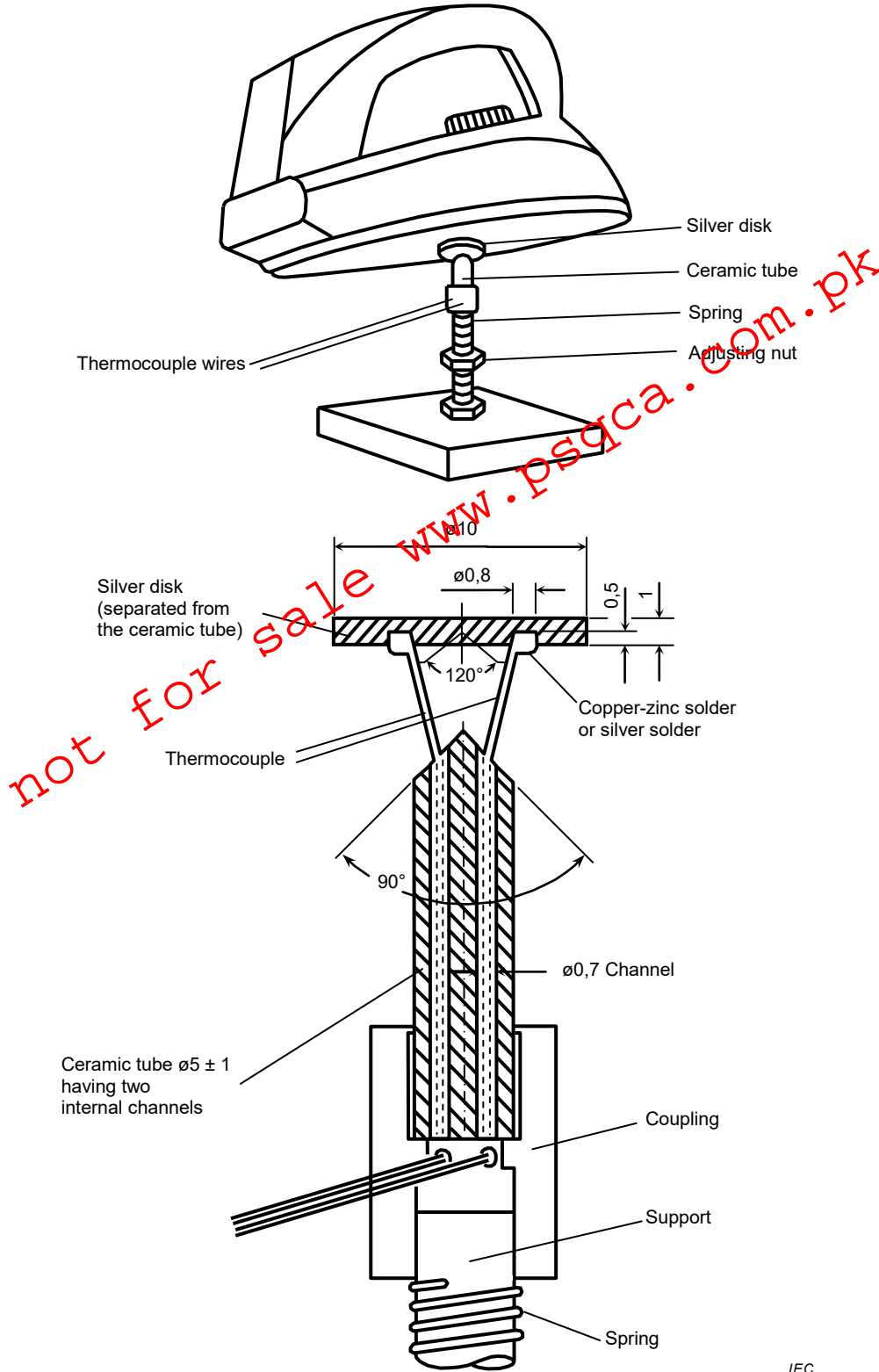


Figure 1 – Arrangement for measuring the sole-plate temperature

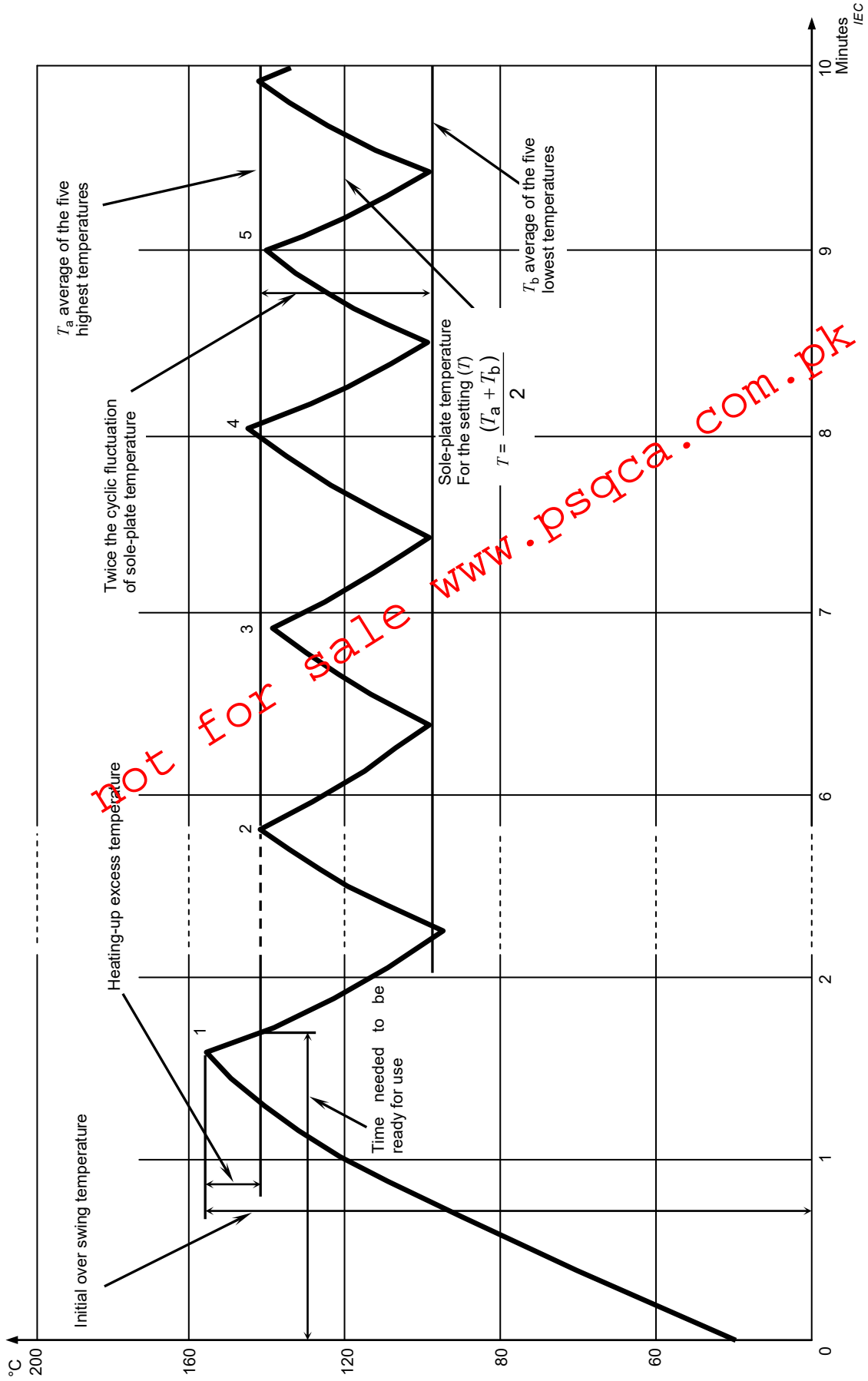


Figure 2 – Variation of sole-plate temperature after switching-on

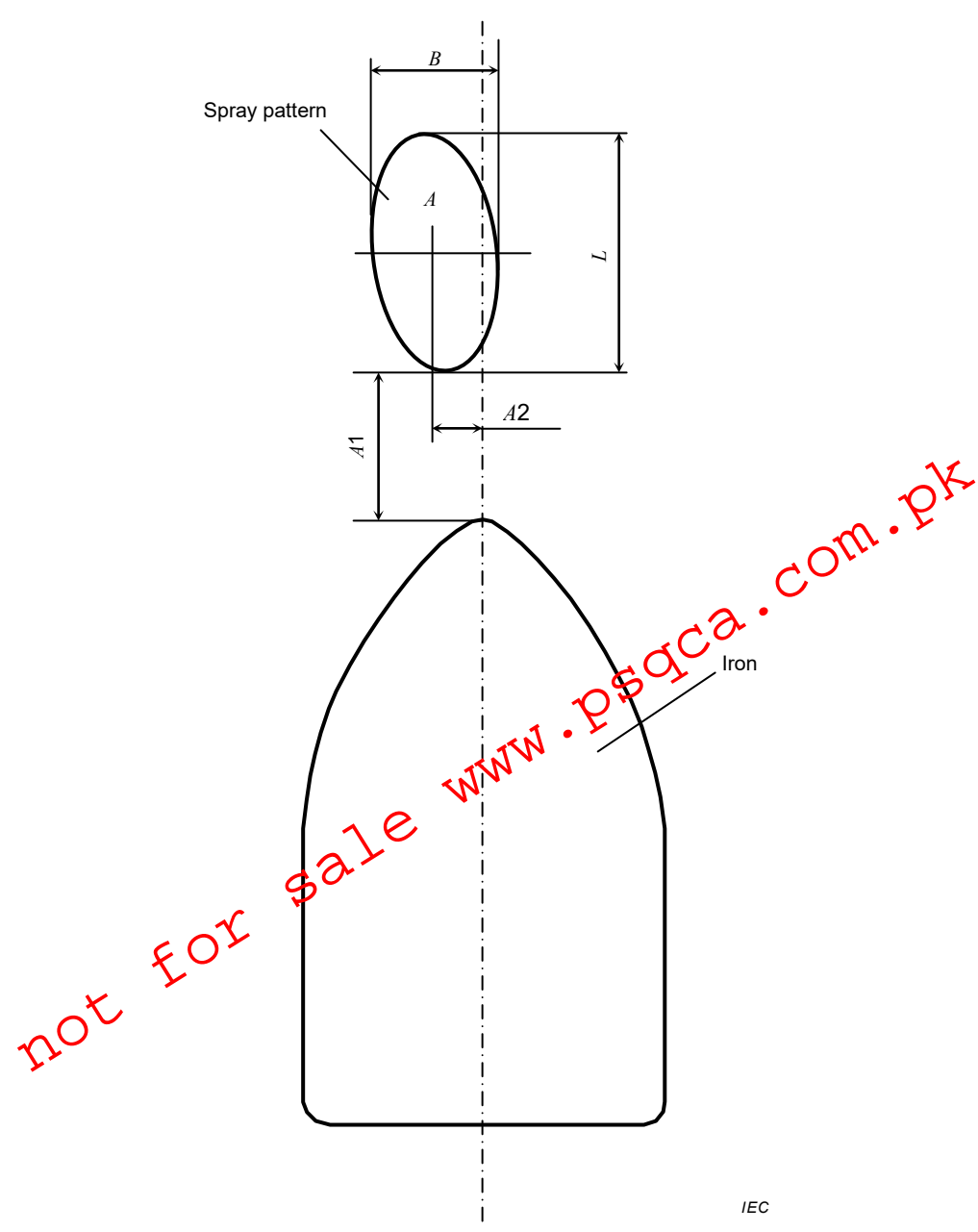
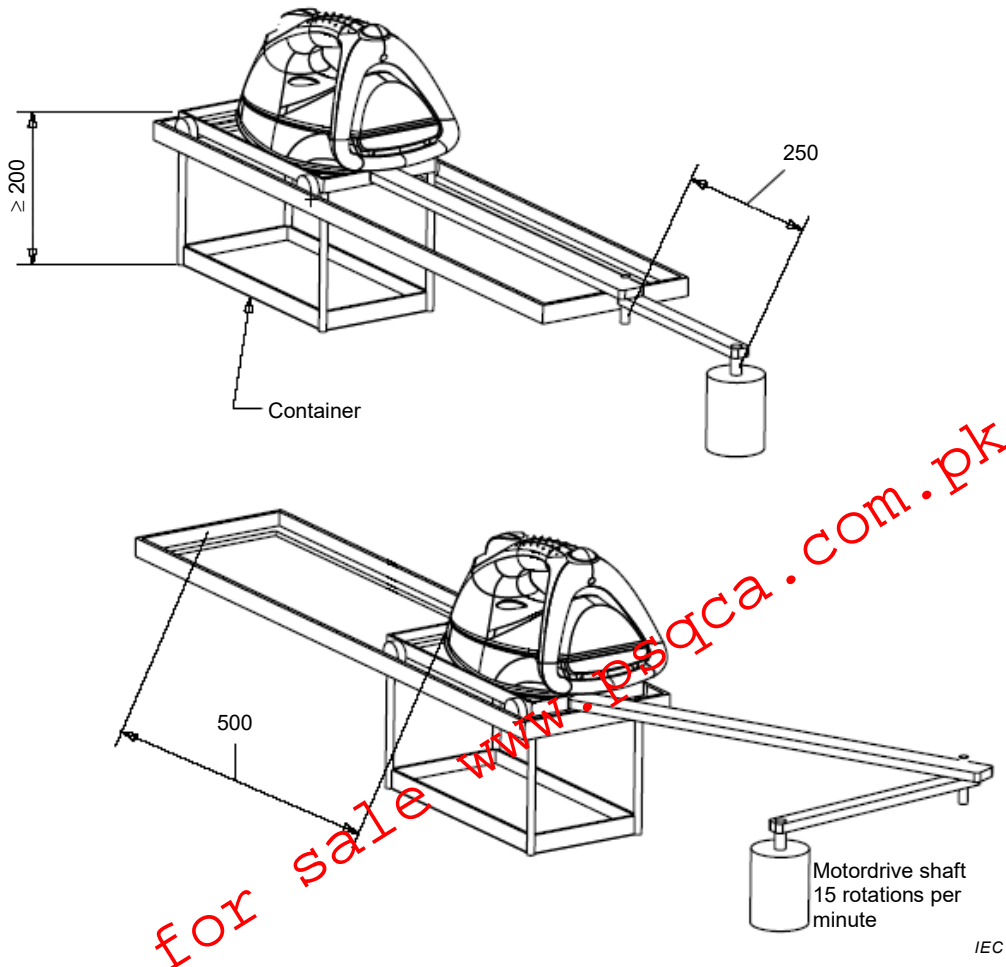


Figure 3 – Determination of spray pattern

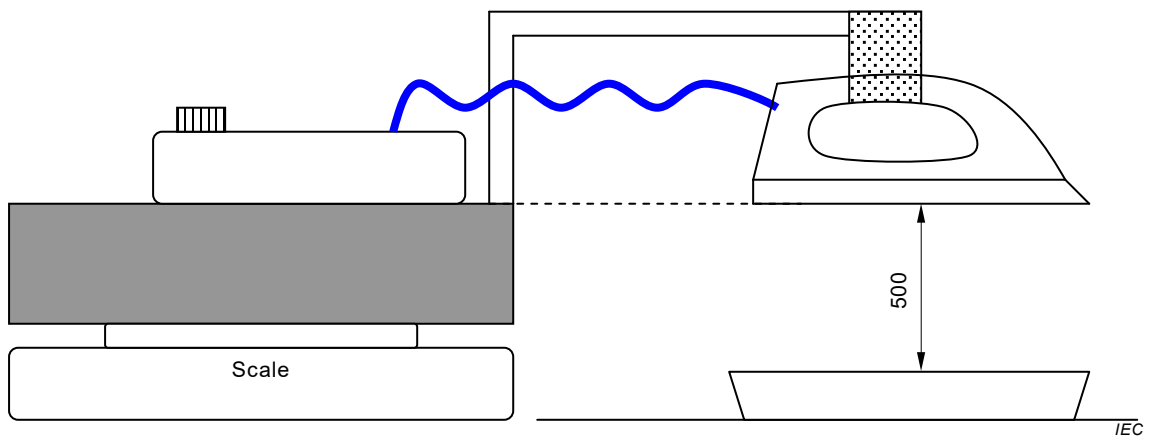
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Dimensions in millimetres



a) – Vented steam irons for steaming operation

Dimensions in millimetres



b) – Pressurized or instantaneous steam irons

Figure 4 – Test apparatus

Dimensions in millimetres

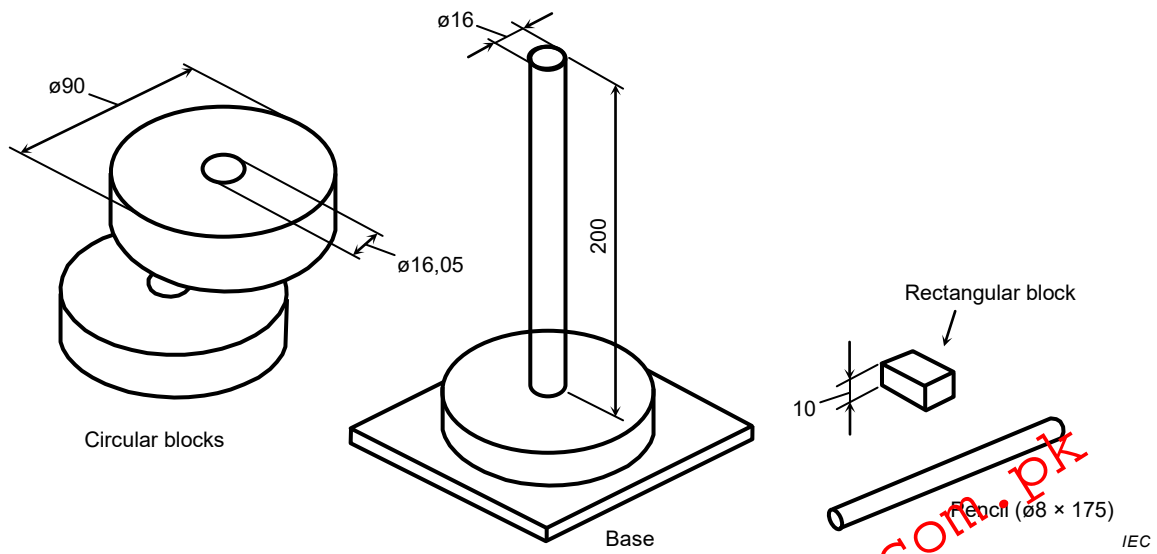


Figure 5 - Creasing tool

Dimensions in millimetres

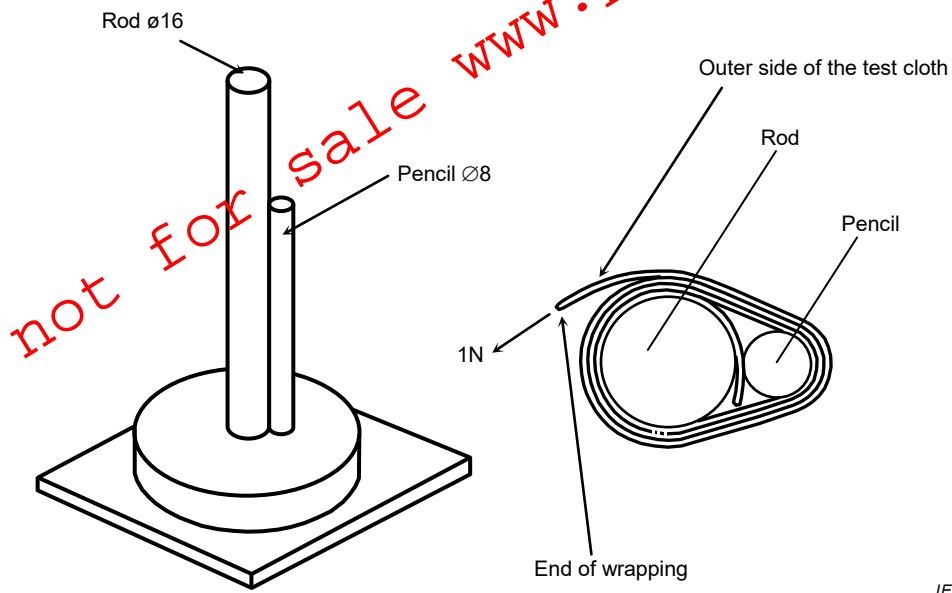


Figure 6 - Wrapping rod and pencil

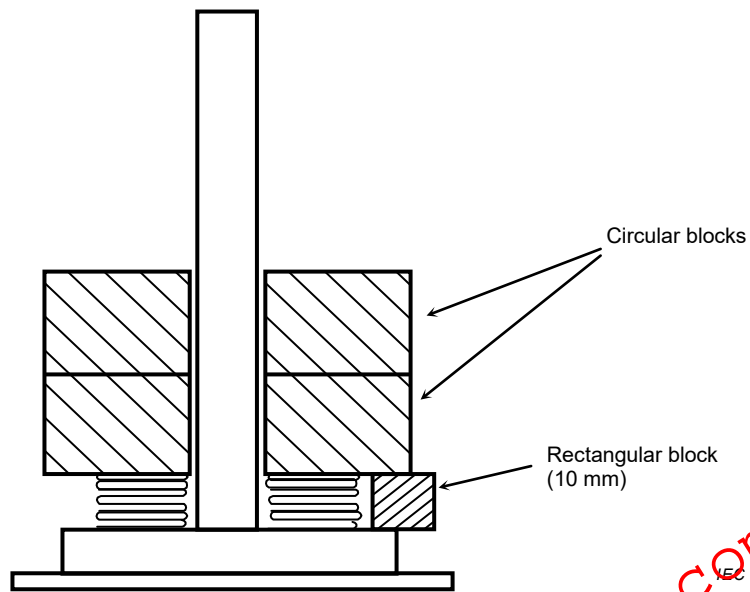


Figure 7 – Circular and rectangular blocks

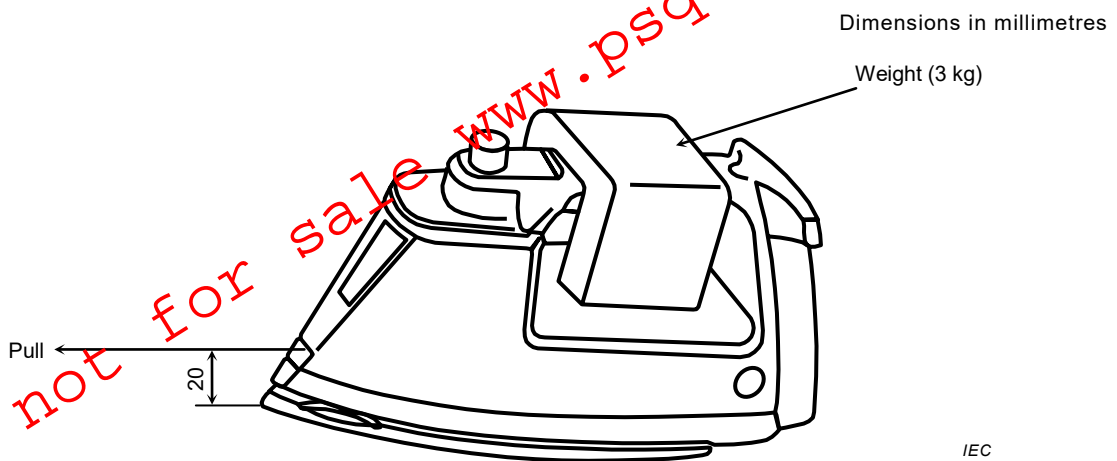


Figure 8 – Conditioning of the iron

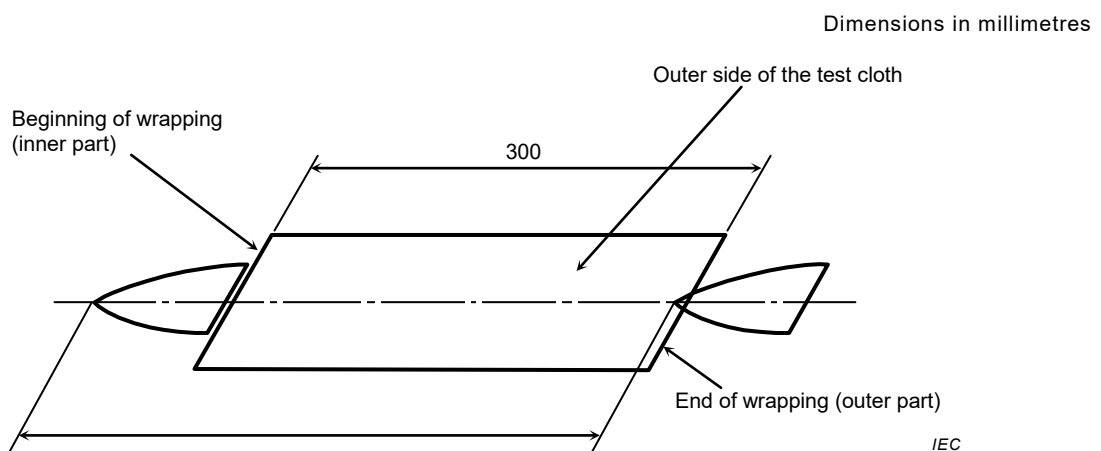


Figure 9 – Ironing

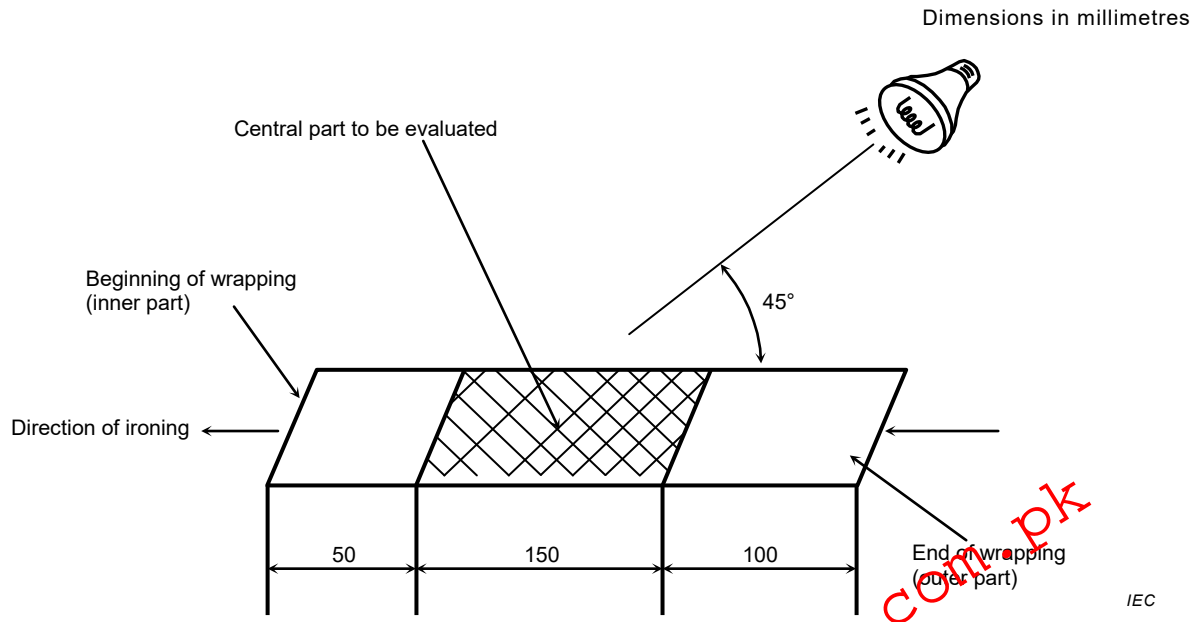
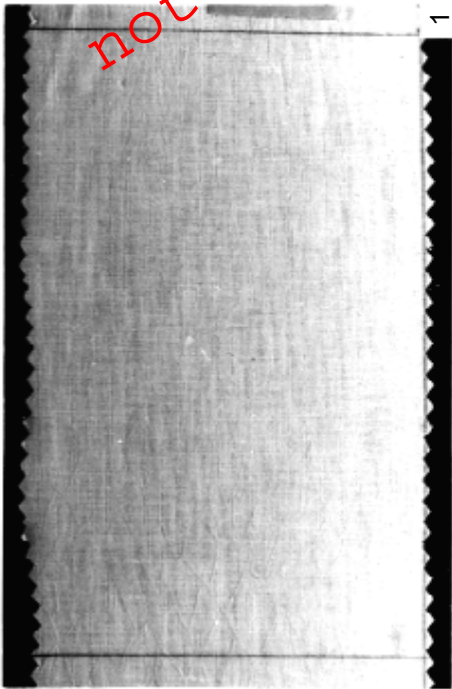


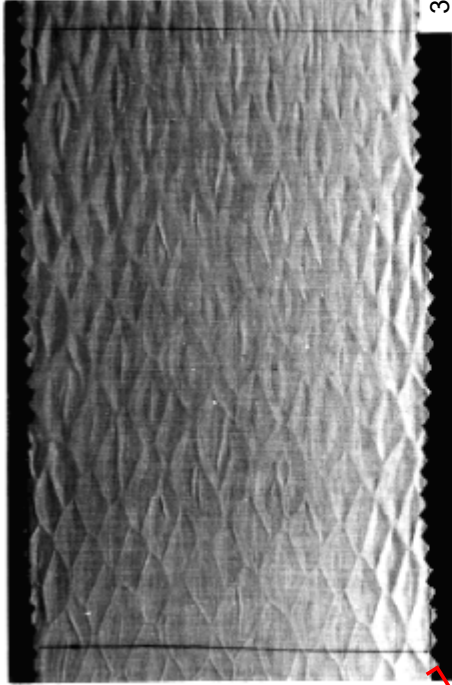
Figure 10 – Evaluation

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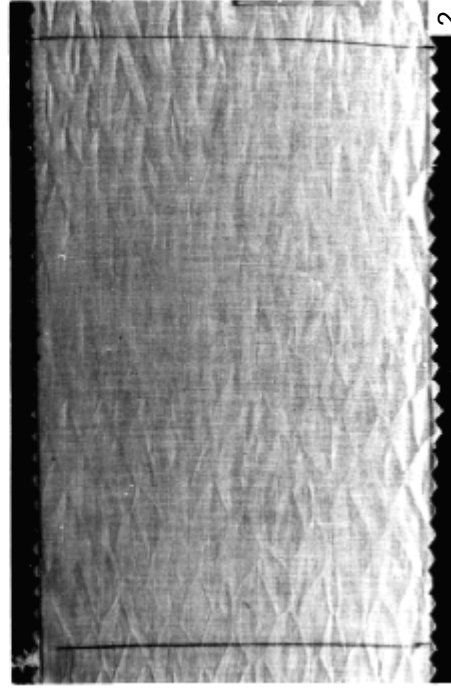
11 a) Best

1



11 c)

3



11 b)

2



11 d)

4

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Figure 11 – Comparison charts

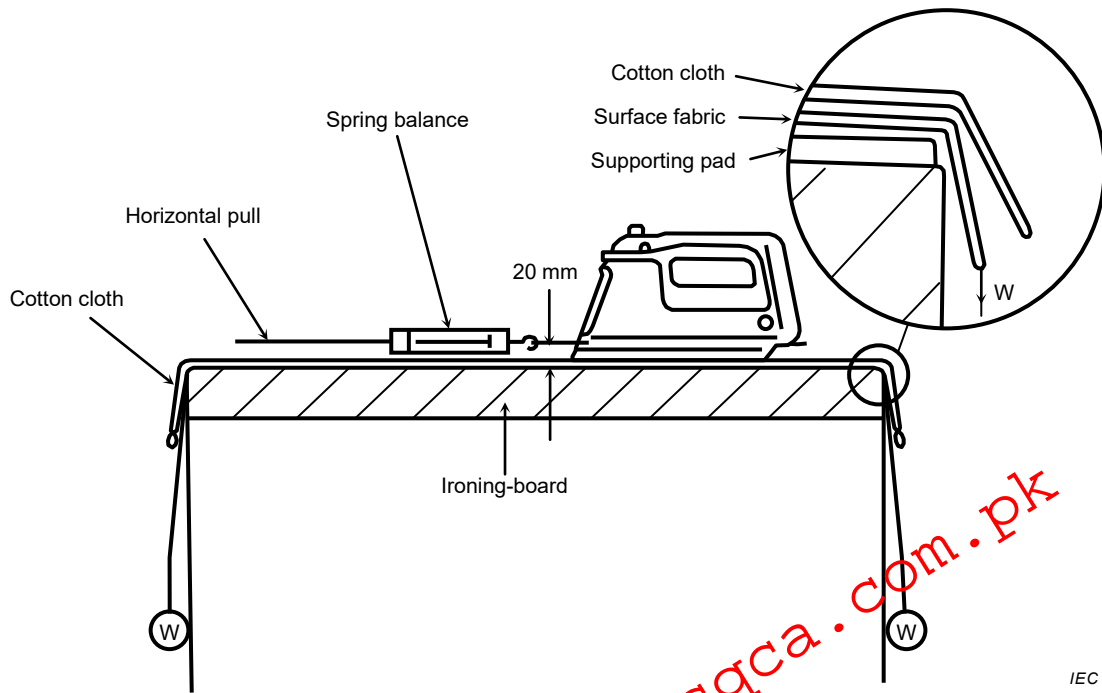
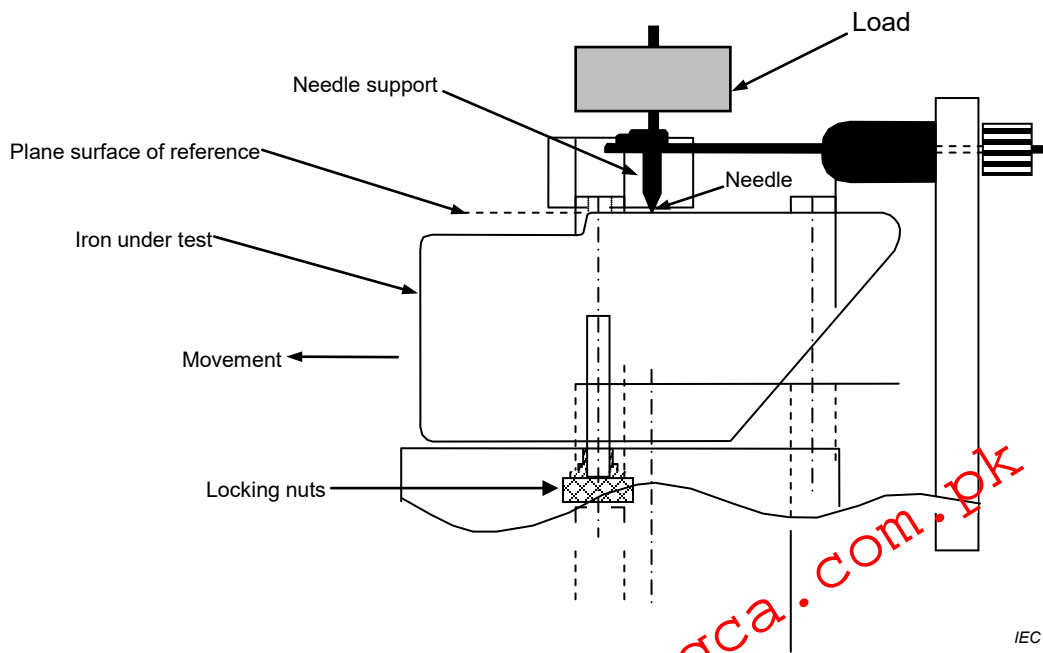


Figure 12 – Test apparatus for smoothness of sole-plate

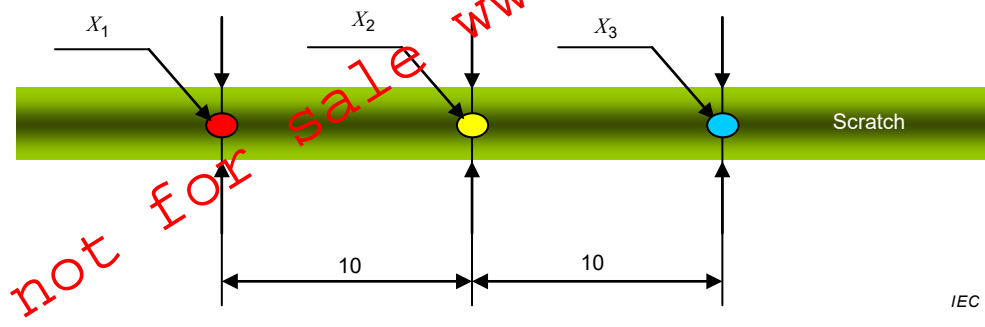
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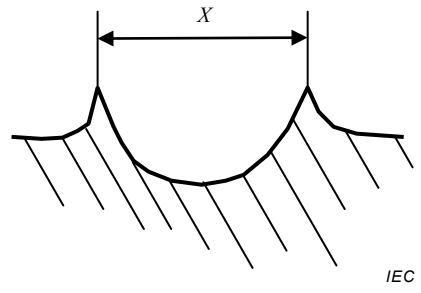
a) - Test apparatus for scratch resistance of sole-plate

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Dimensions in millimetres



b) - Measurement position of scratch

IEC



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c) - Measurement position of the width of the scratch

Figure 13 - Scratch

Dimensions in millimetres

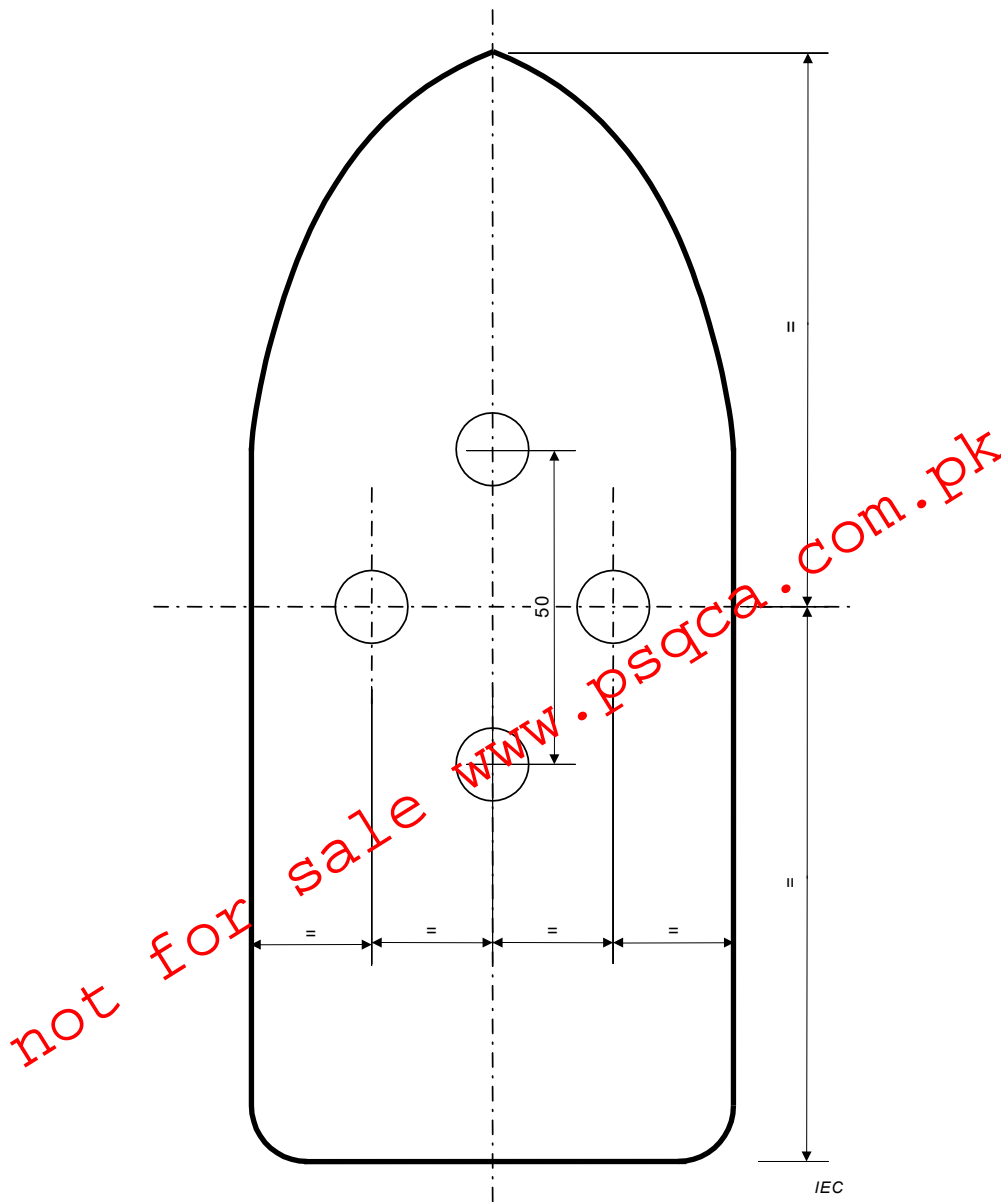


Figure 14 – Positions of cutting area

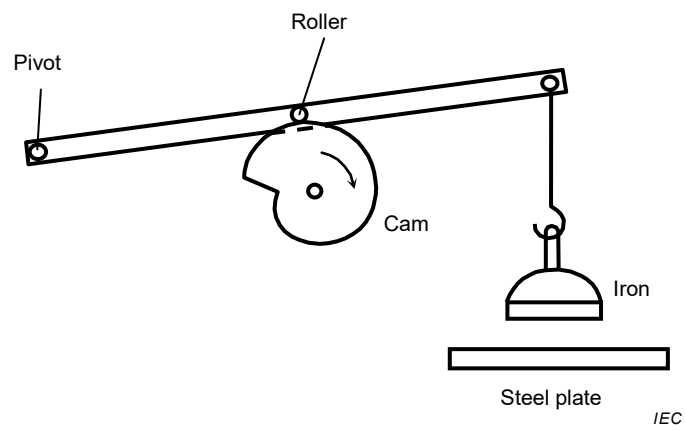


Figure 15 – Apparatus for drop test

Dimensions in millimetres

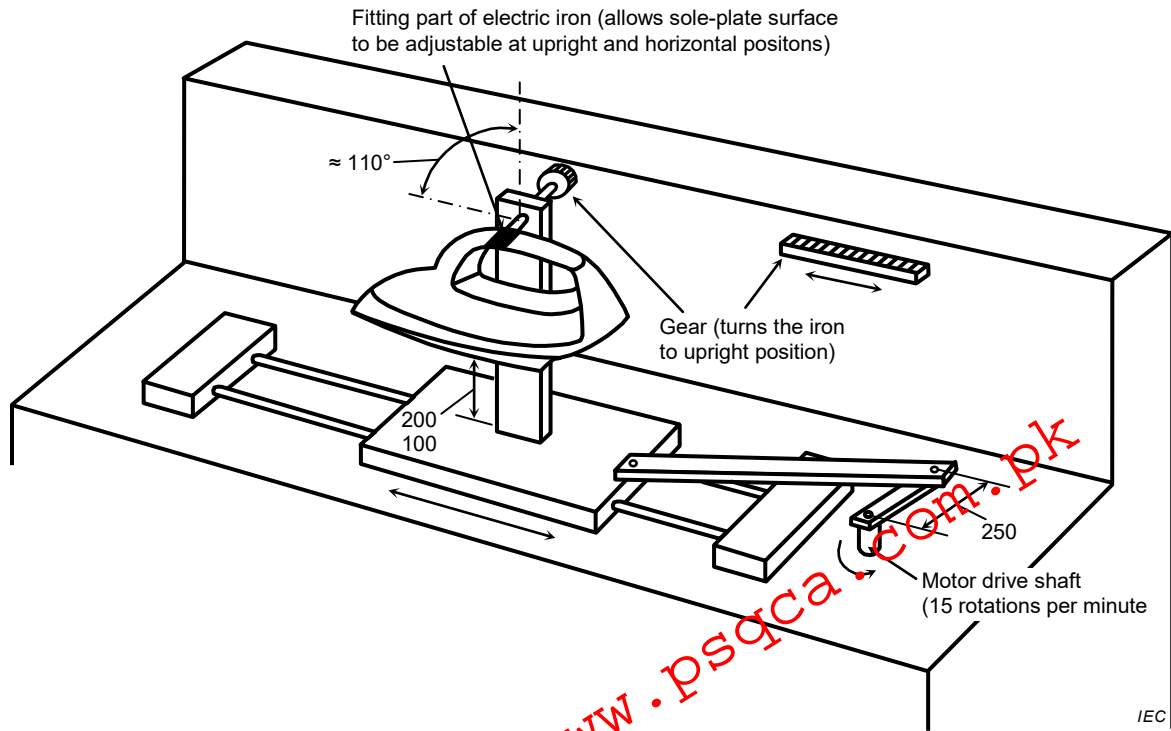
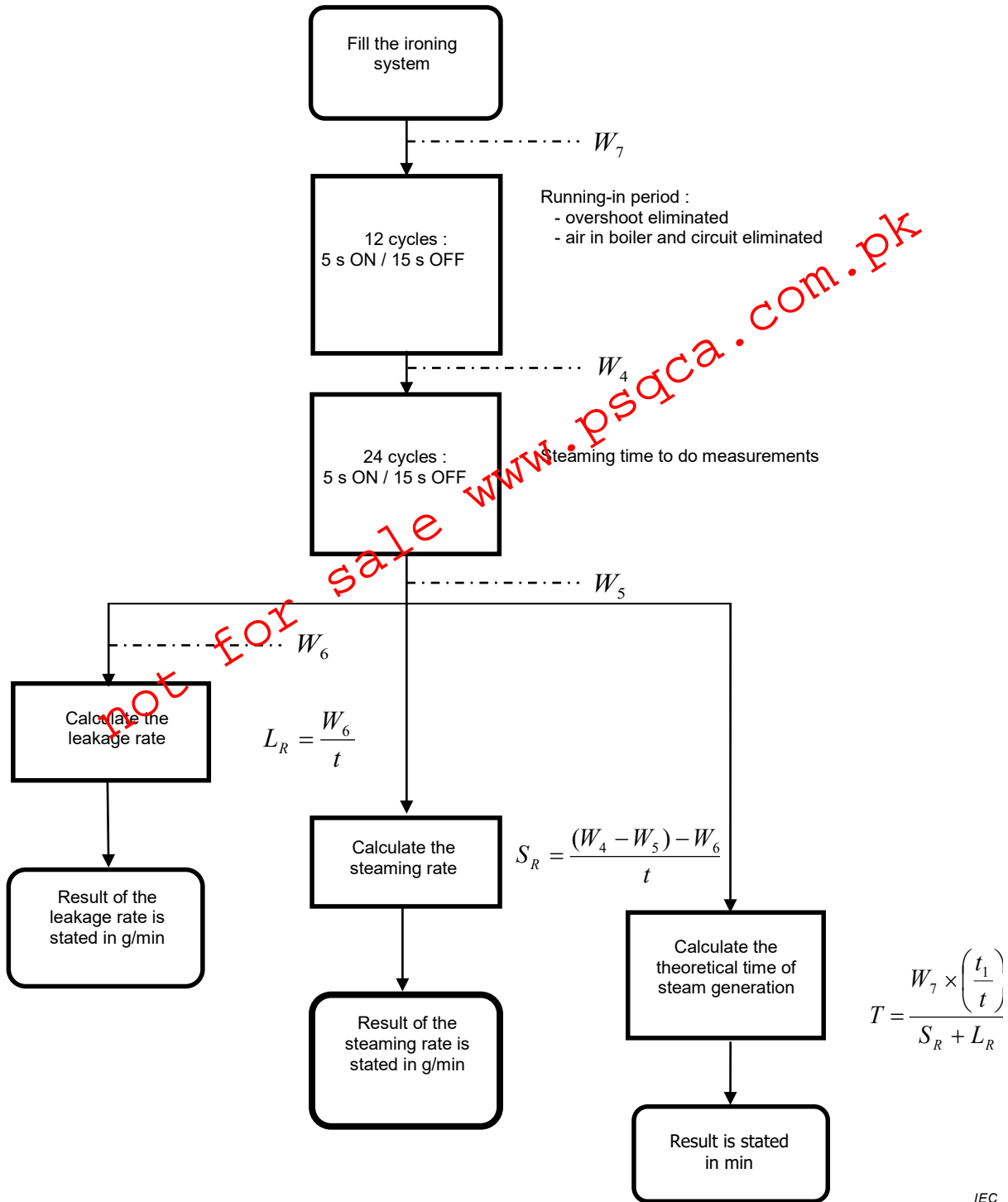


Figure 16 – Test apparatus for total steaming time

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**Annex A**  
(informative)

**Measurement of steaming time, steaming rate and water leakage rate for pressurized steam irons or instantaneous steam irons**



**Figure A.1 – Measurements concerning steaming operation**

## Annex B (normative)

### Ironing board

The ironing board shall be flat, cushiony, resistant to moisture absorption and be supported by means of a mesh steel plate or rigid steel lattice.

The ironing board shall be constructed as follows, an example being illustrated in Figure B.1:

- dimensions:
  - the dimensions of the top surface should be at least 35 cm wide and 65 cm long;
- surface fabric:
  - non-starched cotton textile, washed and rinsed according to ISO 6330:2012, Clause 5, Clause 8, and 10.1.2, 10.1.3 or 10.1.4, stretched over the supporting pad;
  - number of threads in warp and weft, per cm (according to ISO 7243-2), plain weave 1/1,  $25 \pm 2$  threads of  $30 \pm 2$  tex;
  - mass per square metre (according to ISO 3801):  $170 \text{ g} \pm 10 \text{ g}$ ;
  - tensile strength in warp (according to ISO 13934-1), at least 500 N (50 cm wide test sample);
- supporting pad:
  - material: non-woven aramids (aromatic polyamide) or similar heat-resistant material;
  - thickness:  $9 \text{ mm} \pm 1 \text{ mm}$  (according to ISO 9073-2: reference plate 20 mm diameter, applied pressure 0,5 kPa);

NOTE 1 Interwoven glass fibre is an example of heat-resistant material.

- intermediate metal support:
  - either expanded mesh or punched steel plate:
    - the dimension of the side of the square should be at least  $1,4 \text{ mm} \times 1,4 \text{ mm}$  and the length of side shall be 10 mm;
    - the sides of the square should be inclined  $45^\circ \pm 5^\circ$  to the centre-line of the ironing board;
    - the total open area should not be less than 60 % of the surface;
  - or metal lattice support, with welded intersection:
    - approximate diameter 1,6 mm steel: wire lattice;
    - $10 \text{ mm} \times 10 \text{ mm}$  lattice;
- metal base:
  - U-section steel strips are intersected and welded or riveted to form a solid metal base;
- stretching means for the surface fabric:
  - weights of 200 g are suspended every 20 cm along each side;
- quick cooling device:
  - a device for cooling and humidity extraction shall be provided in the ironing board, the air flow shall be as uniform as possible at a rate of  $10 \text{ m}^3/\text{min}$  to  $15 \text{ m}^3/\text{min}$ , for each square metre of the supporting pad;
  - the cooling device is switched on after using the ironing board so that the supporting pad be cooled quickly to the ambient temperature;
  - the temperature is measured by a fine thermocouple located between the supporting pad and the surface fabric at the starting-point of the ironing.

NOTE 2 The surface fabric is conditioned at a temperature of  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  and relative humidity of  $65\% \pm 5\%$  for at least 24 h and is replaced each day before starting the tests.

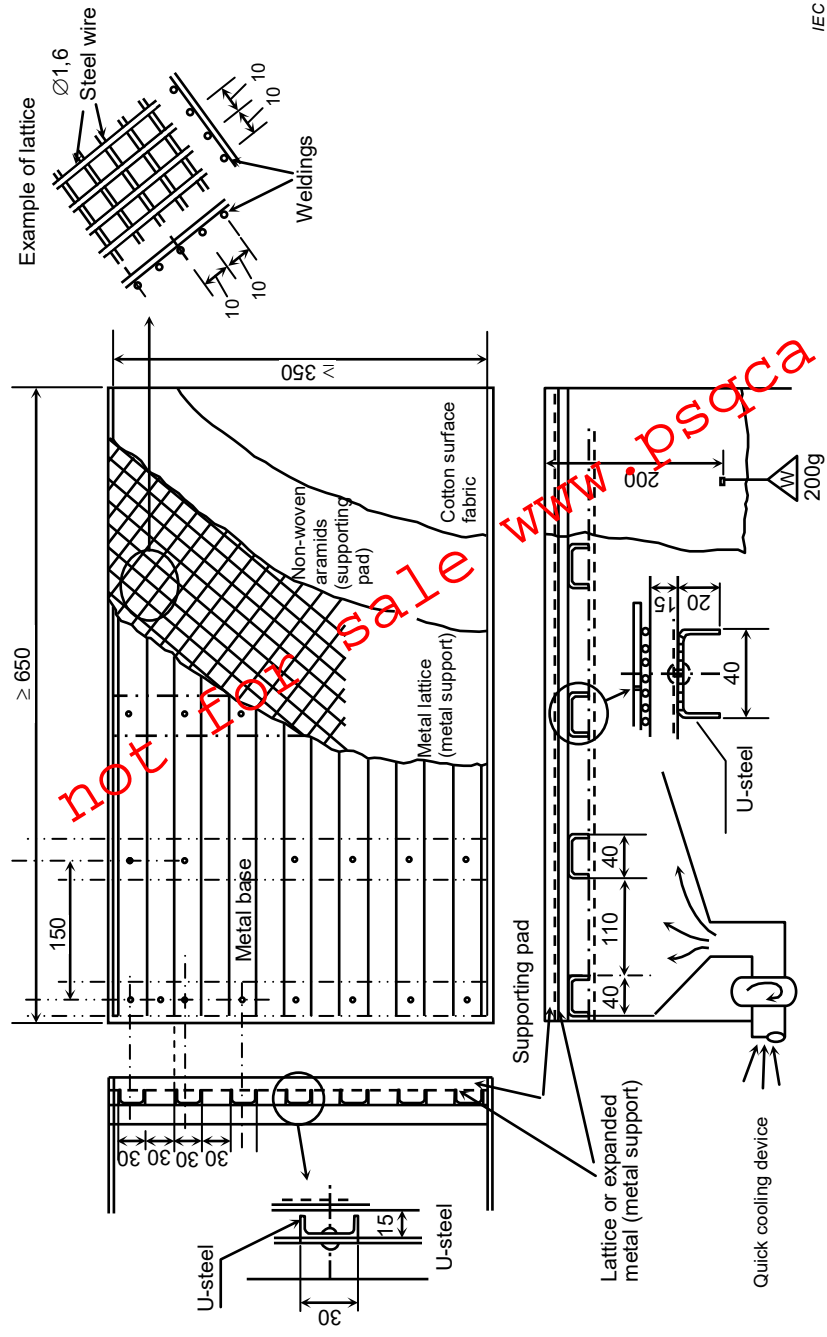
NOTE 3 The tests are carried out at a temperature of  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  and relative humidity of  $65\% \pm 15\%$ .

NOTE 4 The surface fabric and supporting pad are replaced when worn. The supporting pad is considered to be worn when its thickness has been reduced to 90 % of the original.

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Dimensions in millimetres



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Figure B.1 – Example of construction of the ironing board

## **Annex C** (normative)

### **Cotton cloth**

The composition of the cotton cloth used during the measurement of the smoothness of the sole-plate shall be as follows.

- Size: sufficient length to cover the ironing board and be wider than the sole-plate.
- Preparation: non-starched, washed and rinsed according to ISO 6330:2012, Clause 5, Clause 8, 10.1.2 , or 10.1.3.
- Number of threads per cm in warp:  $25 \pm 2$  threads of  $30 \pm 2$  tex.
- Number of threads per cm in weft:  $25 \pm 2$  threads of  $30 \pm 2$  tex.
- Mass per  $m^2$ :  $170 \text{ g} \pm 10 \text{ g}$ , after conditioning at  $20 \text{ }^\circ\text{C}$  and 65 % relative humidity.
- Tensile strength in warp: at least 500 N, determined on a 50 cm wide test sample.
- The cloth used for comparative testing of different irons shall be from the same batch.
- The cloth is kept in a container at  $20 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ ,  $65 \text{ \%} \pm 5 \text{ \% RH}$  for at least 24 h, and then used within 1 h.

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## **Annex D** (informative)

### **Classification of electric irons**

#### **D.1 Classification according to temperature control**

- Thermostatic iron
- Iron with non-self-resetting thermal cut-out
- Non-thermostatic iron without thermal cut-out

#### **D.2 Classification according to the existence or non-existence of steam-producing ability**

- Steam iron
- Dry iron
- Shot of steam iron

#### **D.3 Classification of steam irons according to steam control**

Steam irons whose steam emission can be switched on and off manually with the steam control valve, and whose steam emission usually stops when the sole-plate is held in a vertical position are often called drip-feed type irons.

Steam irons which have no means to control steam emission and continue to emit steam until the water container becomes empty are often called boiler-type irons.

#### **D.4 Classification according to existence or non-existence of spraying ability**

- Spray iron
- Non-spray iron

#### **D.5 Classification according to nature of power supply**

- AC iron
- AC/DC iron

#### **D.6 Classification according to voltage**

- Single-voltage iron
- Multi-voltage iron
- Iron with one voltage range
- Iron with two or more voltage ranges

#### **D.7 Classification according to usage**

- General purpose iron
- Travel iron

## D.8 Designation of irons

Irons are designated by combining as many terms of classification as are necessary, such as:

- thermostatic, dry iron;
- steam iron with self-resetting thermal cut-out;
- cordless iron with shot of steam.

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