Electric toasters for household and similar use — Methods and measurements for improving accessibility

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National foreword

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

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

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IEC TS 62835

TECHNICAL SPECIFICATION

Electric toasters for household and similar use – Methods and measurements for improving accessibility

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRIC TOASTERS FOR HOUSEHOLD AND SIMILAR USE – METHODS AND MEASUREMENTS FOR IMPROVING ACCESSIBILITY

FOREWORD

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a Technical Specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or

- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62835, which is a Technical Specification, has been prepared by IEC technical committee 59: Performance of household and similar electrical appliances.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
59/618/DTS	59/631/RVC

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this Technical Specification, the following type is used:

– *compliance statements: in italic type*.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

INTRODUCTION

Ever greater demands are now being placed on the accessibility of products, but despite this, there has been no easily available data for assessing and evaluating products from an accessibility perspective. An effective way to conduct product development is to work on the basis of adequate testing methods for assessing various properties, as accessibility recommendations can be formulated more clearly and be given greater emphasis during the development of appliances. Accessibility properties must be prioritised alongside functional, technical and production-related properties.

For this purpose, an inventory of sources with a product-accessibility focus has been drawn up, which has given useful basic information and data for setting recommendations for the design of products. This Technical Specification on toasters is a result of this work, and provides information in the form of accessibility facts and an understanding of the interaction of user and appliance.

This Technical Specification is being issued in the Technical Specification series of publications (according to the ISO/IEC Directives, Part 1, 3.1.1.1) as a "prospective standard for provisional application" in the field of accessibility of household appliances because there is an urgent need for guidance on how standards in this field should be used to meet an identified need.

This Technical Specification provides recommendations and measurements for product characteristics of household toasters, which contribute to their accessibility and underlying ergonomic principles. These recommendations originate from scientific knowledge and the theory of ergonomics, physiology, product design and other relevant disciplines. This Technical Specification applies ISO/IEC Guide 71 and ISO/TR 22411 to toasters. Data is drawn from ISO/TR 22411 and, if not specified there, from other sources.

The purpose of designing and evaluating toasters with regard to accessibility is to maximize the number of people who can readily use the products. Accessible products can be designed by incorporating product characteristics that are beneficial for the user. This Technical Specification explains the characteristics, which meet the needs and abilities of an intended user.

However, the characteristics that a product needs for accessibility are dependent on the type of user and task. This Technical Specification therefore includes objective criteria regarding accessibility for product characteristics of the toaster.

ELECTRIC TOASTERS FOR HOUSEHOLD AND SIMILAR USE – METHODS AND MEASUREMENTS FOR IMPROVING ACCESSIBILITY

1 Scope

This Technical Specification contains accessibility recommendations to enable the use of toasters by older persons and persons with disabilities. It provides guidance to achieve more accessible toasters.

This Technical Specification provides test methods and data that support accessible design.

This Technical Specification gives guidance to apply ISO/TR 22411 and ISO/IEC Guide 71 to the design of toasters and to IEC 60442**.** It does not deal with safety issues nor cover toasters for professional use.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60335-1, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-2-9, *Household and similar electrical appliances – Safety – Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances*

IEC 60417, *Graphical symbols for use on equipment* (available at: http://www.graphical-symbols.info/equipment)

IEC 60442:1998, *Electric toasters for household and similar purposes – Methods for measuring the performance*
IEC 60442:1998/AMD1:2003[1]

IEC TR 61592, *Household electrical appliances – Guidelines for consumer panel testing*

IEC 82079-1:2012, *Preparation of instructions for use – Structuring, content and presentation – Part 1: General principles and detailed requirements*

ISO/IEC Guide 37, *Instructions for use of products by consumers*

ISO/IEC Guide 71:2014, *Guide for addressing accessibility in standards*

ISO 2813, *Paints and varnishes – Determination of gloss value at 20 degrees, 60 degrees and 85 degrees*

ISO/TR 22411:2008, *Ergonomics data and guidelines for the application of ISO/IEC Guide 71 to products and services to address the needs of older persons and persons with disabilities*

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[1] There exists a consolidated edition 2.1 including IEC 60442:1998 and its Amendment 1:2003.

ISO 7000, *Graphical symbols for use on equipment – Registered symbols* (available at: http://www.graphical-symbols.info/equipment)

EN 12464-1, *Light and lighting – Lighting of work places – Part 1: Indoor work places*

EN 13300, *Paints and varnishes – Water-borne coating materials and coating systems for interior walls and ceilings. Classification*

3   Terms and definitions

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

3.1
accessibility
extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use

Note 1 to entry: Context of use includes direct use or use supported by assistive technologies.

Note 2 to entry: Adapted from ISO/TR 22411:2008, definition 3.6.

[SOURCE: ISO 26800:2011, 2.1]

3.2
accessible design
design focused on diverse users to maximize the number of potential users who can readily use a system in diverse contexts

Note 1 to entry: This aim can be achieved by (1) designing systems that are readily usable by most users without any modification, (2) making systems adaptable to different users (by providing adaptable user interfaces) and (3) having standardized interfaces to be compatible with assistive products and assistive technology.

Note 2 to entry: Terms such as universal design, accessible design, design for all, barrier-free design, inclusive design and transgenerational design are often used interchangeably with the same meaning.

[SOURCE: ISO/IEC Guide 71:2014, 2.19]

3.3
assistive product
any product (including devices, equipment, instruments and software), especially produced or generally available, used by or for persons with disability for participation, to protect, support, train, measure or substitute for body functions/structures and activities, or to prevent impairments, activity limitations or participation restrictions

[SOURCE: ISO/IEC Guide 71:2014, 2.15]

3.4
assistive technology
equipment, product system, hardware, software or service that is used to increase, maintain or improve capabilities of individuals

Note 1 to entry: Assistive technology is an umbrella term that is broader than assistive products.

Note 2 to entry: Assistive technology can include assistive services, and professional services needed for assessment, recommendation and provision.

[SOURCE: ISO/IEC Guide 71:2014, 2.16]

3.5
bread carriage
part of the toaster that supports the bread and releases it at the end of the toasting process

[SOURCE: IEC 60442:1998, 3.5]

3.6
browning control range
certain setting on a scale that can be marked with numbers, symbols or shades of colour

[SOURCE: IEC 60442:1998, 3.6]

3.7
impairments
problems in body function or structure related to a significant deviation or loss

Note 1 to entry: Impairments can be temporary or permanent; progressive, regressive or static; intermittent or continuous.

[SOURCE: ISO/IEC Guide 71:2014, 2.5]

3.8
lever
device used to operate the bread carriage which may start, stop and abort the toasting process

Note 1 to entry: There may be other kinds of levers, e.g. to raise a warming rack.

3.9
mechanical selection wheel
partially exposed wheel that can be turned by moving the exposed edge and also used as a button by pressing on it to activate a function or select a setting

3.10
touch control
control actuated by contact with or proximity of a finger with little or no movement of the contact surface

3.11
user
person who accesses or interacts with the toaster

[SOURCE: ISO/IEC Guide 71:2014, 2.2, modified]

4   Source of accessibility recommendations

4.1   General

Recommendations and values used in this Technical Specification have been taken from documents listed under Clause 2 and the Bibliography where possible.

4.2   Users' characteristics

Detail about human abilities and the consequences of impairment are described in ISO/IEC Guide 71:2014, Clause 7.

Abilities and characteristics of people change during their life and vary substantially among individuals within the same age group.

Impairments can be temporary or permanent and generally increase with age. Sensory, physical and cognitive limitations vary from comparatively minor (such as mild seeing impairment) to significant limitations (such as deafness).

Although some impairments are minor in nature, combinations of impairments can impose significant limitations, as is often the case in ageing.

For ergonomic data see ISO/TR 22411:2008, Clause 9.

For principles of accessible design see ISO/TR 22411:2008, Annex A.

4.3   Body measurements

For details of body measurements applicable to toasters, for example hand and finger sizes, see Annex A.

5   Assessment of accessibility

5.1   General

It is intended that following this Technical Specification will result in a more accessible toaster that will meet the needs of most users.

To assess the accessibility of a toaster, a wide range of abilities needs to be considered.

5.2   Tasks the user has to carry out

When a toaster is used by a disabled person it is useful to analyse the tasks involved in five steps:

1) **Perceive**: to find the product or its parts required to perform the task

2) **Recognize**: to identify and understand the parts required to perform the task

3) **Reach**: physical access to the parts required to perform the task

4) **Operate**: to perform the task

5) **Monitor**: to receive feedback of the operation

Table 1 lists the tasks usually involved in using a toaster. For each task and step there are implications for people with different impairments and these are also specified.

Details about human abilities and the consequences of impairment are described in ISO/IEC Guide 71:2014, Clause 7 and briefly summarized below. The following impairments are considered:

Partial sight   **PS**
Seeing images indistinctly, reduced field of vision, inability to distinguish colours
Blindness   **B**
No useful vision and dependent on tactile and auditory input
Deafness   **D**
Inability to hear sound and dependent on visual and tactile input
Hearing impairment   **H**
Reduced ability to sense the presence of sounds and to discriminate and comprehend sound
Touch impairment   **T**
Reduced ability to sense surfaces and their texture or quality
Dexterity impairment   **DI**
Restricted use of hand and arm for handling objects
Manipulation impairment   **MA**
Restricted use of hands, arms, feet or legs to reach, carry, move and manipulate objects

Movement impairment   **MO**
Restricted range of movement of arms, legs and spine for changing the body position and moving from one area to another

Strength impairment   **S**
Lack of force that can be exerted for example when pulling, lifting, pressing, gripping, pinching and twisting

Intellect/memory impairment   **IM**
Lack of knowing, understanding, reasoning and concentration

Language impairment   **L**
Difficulty in comprehending or expressing written or spoken language

Table 1 can be used for different purposes, for example:

- to evaluate the accessibility of a toaster or a range of toasters;

- as a checklist for designers of toasters since it applies relevant methods from ISO/TR 22411;

- as a tool to identify difficulties for certain user groups.

Table 1 – Task assessment

	Task	Perceive (find object)	Recognize (identify / understand)	Reach (physical)	Operate (perform the task)	Monitor (feedback of operation)
1	Open package	PS, B	PS, B, IM	MA,	DI, MA, S	-
2	Remove toaster from package	-	-	MA, MO	DI, MA, MO, S	-
3	Use printed instructions for use	PS, B	PS, B, IM, L	DI, MA	PS, B, IM, L, DI, MA	PS, B, IM, L
4	Plug into socket	-	-	DI, MA, MO	DI, MA, MO, S	-
5	Unplug from socket	-	-	MA, MO	MA, MO,S DI	-
6	Store cable	-	IM	DI, MA	B, DI, IM, MA, PS, S	-
7	Release cable	-	IM	DI, MA	DI, MA, S	-
8	Switch toaster on/off	PS, B, IM, L	PS, B, IM, L	MA	DI, MA, B, PS	B, PS
9	Set time	PS, B, L, IM	PS, B, IM, L	MA	B, PS, DI, MA, IM, L	PS, B, L
10	Set browning control	PS, B, IM, L	PS, B, IM, L	MA	B, PS, DI, MA, IM, L	PS, B, IM, L
11	Insert bread item	-	-	MA	DI, MA	-
12	Start toasting	-	-	MA	DI, MA, S	-
13	Interrupt toasting	IM.	IM.	MA	DI, MA, S, IM	-
14	Continue toasting	-	-	MA	DI, MA, S	-
15	Check status of	-	-	-	-	-

	Task	Perceive (find object)	Recognize (identify / understand)	Reach (physical)	Operate (perform the task)	Monitor (feedback of operation)
	toasting					
16	Remove toasted item	-	-	MA	DI, MA, T, B	-
17	Remove crumb tray	B, IM	B, IM	MA	DI, MA, S, IM	-
18	Clean crumb tray	-	-	-	B, DI, MA, MO, PS, S	B, PS
19	Insert crumb tray	-	B, PS, IM	MA	PS, B, DI, MA, S, IM	-
20	Use of attachment(s)	B, PS, IM	B, PS, IM	MA	DI, MA, B,PS,IM,S	IM
21	Error e.g. remove sticking toast item	B, PS, IM	IM and olfactory impairment	MA	DI, MA, IM, S, T	B, PS, IM
NOTE "-" means that there is no particular problem for any impairment group							

5.3   Procedure for accessibility assessment

5.3.1   General

The accessibility assessment requires consideration of both objective and subjective aspects of using a toaster:

- objective aspects can be assessed by engineers and other professionals;
- subjective aspects should be assessed by at least one of the following methods:
  - assessors trained to consider the needs of a wide group of users, for example an ergonomist or people with ergonomics training such as a designer, occupational therapist, etc.;
  - a user trial that comprises users with a wide range of disabilities.

NOTE   Details can be found in IEC TR 61592.

5.3.2   Ambient conditions

Ambient conditions concerning temperature and lighting are defined as follows:

- Temperature shall be in accordance with IEC 60442.
- Ambient lighting shall be 500 lx (in accordance with EN 12464-1).

5.3.3   Assessment procedure

The assessment procedure is as follows:

1) Start the assessment with the toaster inside the unopened package.
2) Evaluate unpacking the toaster.
3) Move the toaster to a flat and horizontal surface and install it in accordance with the manufacturer's instructions.
4) Make all measurements described in Clause 7.
Before testing the parameters described in 7.4, 7.5 and 7.6, carry out the toasting

procedure according to IEC 60442:1998, 12.1, first paragraph in order to validate the results.

5) All data have to be reported.

6   Measurement accuracy

6.1   General

Instruments that are used during the evaluation shall satisfy the following specifications:

6.2   Linear dimensions

Measurement range: 0 mm to 0,15 m

Accuracy: ±0,1 mm

Measurement range: 0,15 m to 3 m

Accuracy: ±1 mm

6.3   Angle

Measurement range: 0° to 180°

Accuracy: ±1°

6.4   Force

Measurement range: 0 N to 20 N

Accuracy: ±0,1 N

Measurement range: 20 N to 100 N

Accuracy: ±1 N

6.5   Torque

Measurement range: 0 Nm to 1 Nm

Accuracy: ±0,01 Nm

Measurement range: 1 Nm to 6 Nm

Accuracy: ±0,1 Nm

6.6   Reflection

Under consideration.

7   Test procedure

7.1   General

In order to achieve more accessible toasters all recommendations in Clause 7 have to be followed.

7.2   General recommendations for printing, markings and displays

7.2.1   General

All recommendations are applicable generally for all printing and markings on the appliance itself, on the packaging and in the instructions for use unless otherwise specified below.

7.2.2 Contrast

For measuring the contrast of letters/symbols printed on paper or control panels or displays, a photometer shall be used. The instrument shall be placed close to the object in order to minimize scatter. The luminance of the letter/symbol and the background shall be measured separately. The largest field of view of the instrument shall be used which lies totally within an area of background and an area of the printed part of the letter/symbol.

The luminance of the letter/symbol and of the background is measured and the contrast calculated from the following:

The contrast is a quotient $L_1:L_2$ of the higher light density L_1 to the lower light density L_2 of letter/symbol and the background.

To be legible, the contrast should be greater than 4:1. Values between 6:1 and 10:1 are recommended for self-illuminated displays (see DIN Technical Report 124:2002, 6.1.2.2.2).

Compliance by measurement.

7.2.3 Colour contrast

Written instructions should be in strongly contrasted colours against their background (see ISO/TR 22411:2008, 8.5.2, 9.2.1.3).

Combinations of green/red and blue/yellow should not be used (see ISO/TR 22411:2008, 8.5.2).

Only a few colours should be used in written text and diagrams (see ISO/TR 22411:2008, 8.5.1).

Certain combinations of colour should not be used, for example green/red and yellow/blue which cause confusion of the colours for people with colour deficiencies.

Compliance by inspection (see ISO/TR 22411:2008, 9.2.1.3 Table 12).

7.2.4 Reflection and gloss

Reflectometer values from 20 % to 60 % measured at an angle of 60° in accordance with ISO 2813 are recommended for surfaces (such as table tops or worktops), furnishing and equipment housing. Reflectometer values between 10 % and 60 % are classified as medium gloss according to EN 13300.

Reflectometer values greater than 75 % should be avoided.

Visual assessment of the level of gloss is possible by comparison with reference samples.

Compliance by measurement.

NOTE   General guidance is given in ISO/IEC Guide 37.

7.2.5 Upper and lower case letters

Printed text should be written in upper and lower case letters (see ISO/TR 22411:2008, 8.6).

Individual words, prompts and letters may have all upper case letters (e.g. "CAUTION").

Compliance by inspection.

7.2.6 Font style

The font used in text instructions should incorporate consistent stroke widths, no serifs, open counter forms and clearly visible ascenders and descenders (ISO/TR 22411:2008, 8.6.3 shows examples of best practice).

Compliance by inspection.

7.2.7 Font size

With the font used in text instructions the distance from top to bottom of the font is measured on an upper case letter in the smallest text. The measurement should be at least 12 DTP points (4,2 mm) (see IEC 82079-1:2012, 6.2.1).

NOTE 1   For the size of the font used on the toaster itself see 7.7.3.

NOTE 2   Further details about font size and measurement can be found in ISO/TR 22411:2008, 8.6.2.

NOTE 3   DTP means "Desktop-Publishing". 1 DTP point is 1/72 of the Anglo-Saxon compromise inch (25,4 mm).

Compliance by measurement.

7.2.8 Symbols

When symbols are used they should be in accordance with IEC 60417 or ISO 7000 wherever possible.

Concerning the size of symbols see the recommendations in 7.7.4.

When symbols are used in the instructions, they should be followed by their meaning.

Compliance by checking against relevant standards and by inspection.

7.3 Information supplied with the toaster (e.g. instructions for use)

7.3.1 General

In addition to the printed instruction manual supplied with the toaster the information supplied should be assessed and comply with the following:

7.3.2 Availability of alternative formats

Information should be made available in alternative formats.

Examples of alternative formats for printed or electronic documents are:

- large print for example font size 16 DTP points (5 mm) (see ISO/TR 22411:2008, Clause C.3),
- audible formats (see ISO/TR 22411:2008, 8.2.7, 8.7.4.2, 8.9, 8.10), or
- Braille,
- video formats, or
- sign language videos (see WCAG 2.0, 2008, 1.2.6).

For essential information, the use of graphics and graphic elements should be supplemented by explanations in text (see DIN Technical Report 124:2002, 7.2), which also support the preparation of audio user instructions.

Information should be made available in electronic text format, in addition to other forms, to facilitate recognition and translation into speech and other languages for those who have trouble seeing, recognizing or deciphering non-text information presentations (see ISO/TR 22411:2008, 8.7.1).

Electronic user instructions (such as those on the Internet or on data media supplied with the product) should be provided in accessible format (e.g. PDF, HTML.) by applying the respective accessibility recommendations (see ISO/TR 22411:2008, 8.7.1) such as:

• provision of alternative texts for graphics or graphic elements (see WCAG 2.0, 2008, 1.1.1)

• no provision images of texts (e.g. scanned text) (see WCAG 2.0, 2008, 1.4.5)

• provision of a meaningful reading sequence and structure (see WCAG 2.0, 2008, 1.3.1 and 1.3.2)

NOTE   More information is available at:

– WCAG 2.0,

– ISO 14289-1.

Audio user instructions should be provided in established formats (audio CD, MP3, DAISY Book, etc.) on commonly used media or as download on the Internet.

They are accessible for people with different abilities including blind persons not familiar with Braille. Braille users often prefer Braille user instructions as they can be used more conveniently.

Audio user instructions should be understandable without the need to see the symbols and figures (see ISO/TR 22411:2008, 8.2.7).

Compliance by inspection.

NOTE More information about Digital Accessible Information System (DAISY) is available from http://www.daisy.org.

7.3.3   Clarity of instructions for use

General information can be found in ISO/IEC Guide 37, IEC 82079-1 and in ISO/TR 22411:2008, 8.7.

The instructions should be relevant only to the appliance supplied. If the instructions for use cover variants of an appliance the requirements of IEC 82079-1:2012, 4.8.1.2 should be met.

They should be ordered and laid out in a logical sequence (see ISO/TR 22411:2008, 8.7.2).

The language and graphics should be simple (see ISO/TR 22411:2008, 8.7.2, 8.8).

Each language should have its own section and be labelled with the name of the language (see ISO/TR 22411:2008, 8.7.5).

Compliance by inspection.

7.3.4   Index

The instructions for use should have an index (see ISO/TR 22411:2008, 8.7.6.1).

Compliance by inspection.

7.3.5 Construction of printed documents

Printed instructions should be constructed so that pages/sheet stay open (see ISO/TR 22411:2008, 8.12.2).

To be tested in the following way: open instruction document on to a smooth horizontal surface and check that pages/sheet lie flat. Test should be carried out with bound documents open at one quarter of the way through the document.

Compliance by testing.

7.3.6 Paper reflectance

Highly reflective paper should be avoided (see ISO/TR 22411:2008, 8.18.4). Conditions and tests apply as in 7.2.4.

Compliance by measurement.

7.3.7 Line spacing

The space between lines of text should be at least twice the font size of printed text or a line space setting of 1,5 for computer-generated text.

Compliance by measurement.

7.4 Mechanical aspects

7.4.1 Layout of interactive parts

Layout of interactive parts (e.g. controls, displays, lights, crumb tray) should be logically arranged considering their grouping and relationship to the actions to be undertaken. Interactive parts should be easily accessible. For example, they should not be obstructed by a different control or by holding a control in a different way by someone with manipulation or strength impairment (see ISO/TR 22411:2008, 8.3.1.2, 8.3.3).

Compliance by task based testing (see 5.3).

7.4.2 Lifting and carrying

In order to lift or carry the toaster it should be shaped to facilitate grasping with either or both hands (see ISO/TR 22411:2008, 8.12.1). If a carrying handle is provided, it should not be recessed i.e. it should protrude from the surface of the toaster and be designed so that the knuckles of the carrying hand(s) do not touch the body of the toaster.

The gripping area should be situated so that the toaster remains balanced during lifting or carrying.

Compliance by inspection.

NOTE   A good balance can be achieved when the centre of mass stays below the handles.

7.4.3 Attachments

If there are attachments (e.g. accessories for heating rolls and for toasting sandwiches) they should be identifiable by sight and touch (see ISO/TR 22411:2008, 8.11.1, 8.11.2, 9.4).

Attachments should be easy to fit for people of all abilities (see ISO/TR 22411, 8.12.1, 8.17.1, 9.3.1, 9.3.2, 9.3.4.2, 9.4.2). Fitting should be simple and it should be possible to do with only one hand, preferably either hand.

Compliance by testing.

7.4.4   Removal of toasted items

It should be easy to remove the toasted item by hand.

If the toaster has a pop-up function, the toasted item should protrude at least 2 cm above the top of the toaster without the use of an additional lift-up function. The distance between parallel toasted items should be at least 1,5 cm.

The distance between parallel toasted items is to be measured at the surface of the toaster where the toast projects.

Compliance by measurement. The measurement should be done according to IEC 60442.

7.4.5   Crumb removal

It should be possible to identify the crumb removal facility by sight and touch (see ISO/TR 22411:2008, 8.11.1, 8.17.1, 9.4), for example having tactile features that could be detected without sight.

It should be possible to remove and correctly replace the crumb tray for people of all abilities (see ISO/TR 22411:2008, 8.12.1, 8.12.3.1, 9.3.1, 9.4). Removal and replacement should be simple and should be possible to do with only one hand, preferably either hand. Incorrect replacement of the crumb tray should not be possible.

If there is no crumb tray it should be possible to remove the crumbs for people of all abilities (see ISO/TR 22411:2008, 9.3.1, 9.4).

Compliance by inspection.

7.4.6   Power plug and cord

7.4.6.1   Power plug

The shape of the plug should enable easy plugging and unplugging (see ISO/TR 22411:2008, 8.12.1, 9.3.1).

The shape of the gripping area of the plug should enable a secure grip that minimizes the effort required to insert and remove the plug into and from the socket.

Compliance by inspection.

7.4.6.2   Cord storage facility

If there is a cord storage facility it should be easy for people of all abilities to take out the cord and place it back in position.

To take out the cord and place it back in position should be simple and should be possible to do with only one hand, preferably either hand, and not require excessive force.

If there is a cord storage facility the cord should stay in place when the toaster is lifted from the work surface or carried.

Compliance by inspection.

7.4.7   Operation of the toaster

It should be possible to operate the toaster with either hand and the toaster should not slip or tilt when operated with one hand only.

Compliance by testing according to 5.3.3. One hand is used to start the toasting process as in normal use. The test is repeated with the other hand.

7.5   Controls

7.5.1   General

Controls should be grouped so that those used sequentially are grouped together and so that usage is progressed in a linear manner.

It should be possible to locate and identify all controls by either visual and tactile or visual and audible means.

Different shapes and forms could help to distinguish functions and setting positions.

NOTE   Tactile dots and tactile bars on or beside controls can help to identify their function. ISO 24503 specifies requirements for the design of tactile dots and tactile bars for use on consumer products.

Controls should be easy to access. The distance between controls are specified in 7.5.2.3 and 7.5.3.3.

When the control interacts with a scale or markings, the position on the scale should be clearly identifiable by the position of the control.

Compliance by measurement and inspection.

Controls with settings should have detents which are synchronized with the change of selection (e.g. 5 steps with the control are 5 changes of selection). A change of selection independent of turning speed should be avoided.

Audio signals can be used to provide feedback.

Compliance by inspection.

7.5.2   Push buttons

7.5.2.1   General

If the control panel has different types or sizes of push button, an evaluation is carried out for each type and size of button.

Countersunk push buttons should be avoided.

A countersunk push button is within an indentation in the product and therefore it is difficult to access. No part of the push button should be below the surface of the product (including during operation).

Compliance by inspection.

7.5.2.2   Button size

The contact area of a push button should be sufficiently large i.e. the diameter or one side length is greater than or equal to 15 mm.

The protruding height of a push button should be greater than or equal to 5 mm.

Light touch push buttons, i.e. buttons that are actuated by very little physical force, should have a diameter or one side length greater than or equal to 10 mm.

Compliance by measurement and inspection.

7.5.2.3   Spacing between push buttons

Push buttons should be spaced to avoid interference when another one is being operated. The spacing between push buttons (between adjacent sides) should be greater than or equal to 10 mm.

Compliance by measurement and inspection.

7.5.2.4   Shape of activation surface

The pressure point should be identifiable by touch. Different shapes and forms for example with a finger recess (with a slight indentation), could help to distinguish functions.

Compliance by inspection.

7.5.2.5   Activation force

Force required for activation of push buttons should be in the range of 1,5 N to 8 N. Force required for activation of light touch push buttons is less than 1,5 N.

Compliance by measurement.

It should be avoided that light touch push buttons could be operated accidentally.

Compliance by inspection.

7.5.3   Knobs

7.5.3.1   General

There are a number of different knobs of different types, including cylindrical knobs and bar-grip knobs, which can be seen in Figure 1.
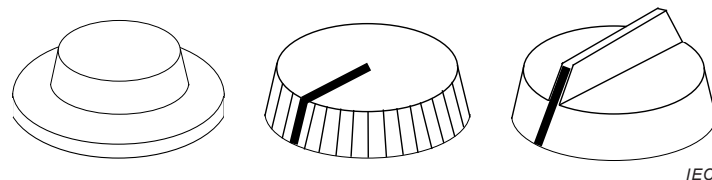

IEC

Figure 1 – Cylindrical knobs and a bar-grip knob

Countersunk knobs should be avoided.

A countersunk knob is within an indentation in the product and therefore it is difficult to access. No part of the knob should be below the surface of the product (including during operation).

Compliance by inspection.

7.5.3.2   Size, cylinder and bar-grip knobs

The dimension of knobs should be in the range given in Table 2 and Table 3.

Compliance by measurement.

Table 2 – Cylinder knobs

Accessibility recommendations, dimensions in mm	
Height of grip	≥ 15
Diameter	≥ 20

Table 3 – Bar-grip knobs

Accessibility recommendations, dimensions in mm unless otherwise noted	
Length of bar with parallel sides	at least equal to the diameter
Width of bar	≥ 4
Height of bar	≥ 18
Diameter	≥ 20
Bar/knob-surface angle (Angle between the surface of the knob's base and the side wall of the bar)	90° ± 10°
NOTE Where the height or the width of a bar is not uniform, the values apply to the smallest dimension(s).	

7.5.3.3   Distance between knobs and other adjacent components

The distance between knobs and other adjacent protruding components should be equal to or greater than 25 mm.

This distance is required for using the knob comfortably and without inadvertently operating adjacent controls.

Compliance by measurement and inspection.

7.5.3.4   Multiple actions for activation

Multiple actions (e.g. pushing and turning at the same time) should be avoided.

Compliance by inspection.

7.5.3.5   Torque

Torque required should be higher than 0,02 Nm and less than 0,33 Nm (see ISO/TR 22411, 8.12.3.1, Table 10).

Compliance by measurement.

7.5.3.6   Direction of rotation

Clockwise rotation should increase settings.

Compliance by inspection.

7.5.3.7   Recognition of control positions

The zero / off position, if existing, should be recognizable by visual and tactile or visual and audible means.

Other important positions like neutral position (e.g. browning control) may also be indicated similarly.

Compliance by inspection.

7.5.4   Lever

7.5.4.1   Size

Either the width or the protrusion should be at least 40 mm and the other dimension should be at least 20 mm.

The operating surface(s) of the lever should be horizontal.

If the lever is recessed the width of the recess should be at least 70 mm.

NOTE   Values are based on Annex A. Final dimensions are considered suitable for operation of a lever by hand or finger(s).

Compliance by measurement.

7.5.4.2   Force

The operation of the lever should not require excessive force.

ISO/TR 22411:2008, 8.12.3.1, Table 10 suggests a negligible operation force higher than 7 N and less than 17 N while ADA require a maximum force of 22,2 N to activate operable parts.

Compliance by measurement.

7.5.5   Mechanical selection wheels and slide-controls

7.5.5.1   Mechanical selection wheels

The dimension of the mechanical selection wheels should be in the range given in Table 4.

Table 4 – Mechanical selection wheels (See Figure 2)

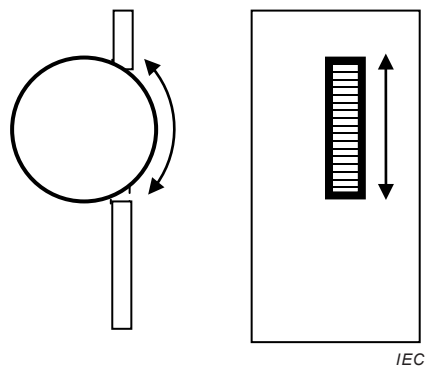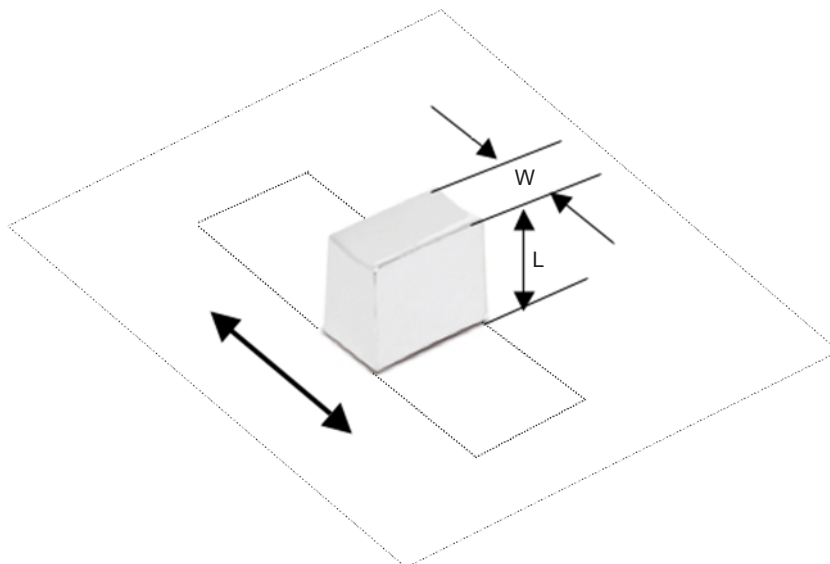| Accessibility recommendations, dimensions in mm unless otherwise noted	
Protrusion of wheel	> 3
Width (thickness) of the wheel	> 5
Diameter of the wheel	> 20
Force to push the wheel	1,5 N to 8 N (see 7.4.2.4)

Figure 2 – Mechanical selection wheel

Compliance by measurement.

7.5.5.2   Slide control

See Figure 3.

Key

W = width of slide control

L = length of slide control

NOTE   The double arrow shows the direction of operation.

Figure 3 – Slide control

The dimension of the slide control should be in the range given in Table 5.

Table 5 – Slide control (See Figure 3)

Accessibility recommendations, dimensions in mm unless otherwise noted	
Width of slider, W	$\geq$ 15
Length of slider, L	$\geq$ 15
Force to operate	2 N to 5 N

Compliance by measurement.

7.5.6 Touch controls

It should be possible to locate touch controls and identify their functions by touch without inadvertent operation.

The touch sensitive area of touch controls should be the same as the size of light touch push buttons (see 7.5.2.2).

The distance between the centres of the touch sensitive areas should be $\geq$ 25 mm.

Compliance by measurement and inspection.

7.6 Feedback

The operation of the controls should be recognizable by visual and tactile or visual and audible means (see ISO/TR 22411:2008, 8.12.3.3).

There should be a visual and audible or visual and tactile confirmation of the completion of toasting (see ISO/TR 22411:2008, 8.17.2).

In quiet surroundings, acoustic signals of a sound pressure of 55 dB(A) to 65 dB(A) are usually preferable for listeners including older people without serious hearing loss (see ISO/TR 22411:2008, 9.2.2.2.1).

Compliance by inspection.

7.7 Markings on the toaster

7.7.1 General

Since there is the risk of a burn, no controls should be in the area around an extraction part of the toasted item.

NOTE 1   Requirements concerning surface temperatures and markings related to safety are given in IEC 60335-1 and IEC 60335-2-9.

There should be markings on the toaster which help the user to identify and use its functions.

Tactile markings or audible indications, which are essential for blind people and people with severe visual impairment, should be provided.

Tactile markings should not be provided on hot surfaces.

The minimum distance between two tactile markings should be at least 4 mm (see ISO/TR 22411:2008, 8.2.2.1, Table 1).

NOTE 2   The dimension for Braille characters are also provided in ISO/TR 22411:2008, 8.2.2.1, Table 1.

NOTE 3   Tactile markings could be substituted by acoustic feedback in some cases.

Compliance by measurement and inspection.

7.7.2   Location of information

Markings (excluding tactile markings) should be placed above related controls and their respective displays, so that they are always visible during operation.

When a control interacts with a scale or markings, the position on the scale should be clearly identifiable by the position of the control.

Compliance by inspection.

7.7.3   Letter height of markings

Text on toasters should have a letter height of at least 12 DTP points (4,2 mm) (see IEC 82079-1:2012, 6.2.1).

Compliance by measurement.

7.7.4   Symbols

Symbols should be self-explanatory. Where appropriate, the use of standardized safety signs in ISO 7010 or graphical symbols for use on equipment in IEC 60417 and ISO 7000 should be considered in order to convey important messages such as warnings.

Safety related symbols (e.g. warnings) shall have a height of at least 32 DTP points (10 mm) (see IEC 82079-1:2012, 6.2.1).

Other symbols on toasters should have a height of at least 16 DTP points (5 mm) (see IEC 82079-1:2012, 6.2.1).

Compliance by measurement.

7.8   Packaging

7.8.1   Ease of unpacking and repacking

It should be easy for people of all abilities to unpack and repack the toaster (see ISO/TR 22411:2008, 8.12.4, 8.17.1).

Unpacking and repacking can be explained by figures or text.

Compliance by inspection.

7.8.2   Information provided

7.8.2.1   General

There should be information on the outside of the packaging that clearly indicates the content and is visible in the package's upright position.

It should be easy to understand and the print size should be at least 16 DTP points (5 mm) (see ISO/TR 22411, 9.2.1.2.2., Clause C.3).

Information at the point of sale shall be provided as required by IEC 60442:1998/AMD1:2003, Annex B.

NOTE   ISO/IEC Guide 37 is useful for reference.

Compliance by inspection.

7.8.2.2   Format

The information on the packaging should follow relevant recommendations and measurements in 7.1 and 7.3.

Compliance by inspection.

Annex A
(informative)

Hand measurements

Hand measurements are given in Figure A.1, Figure A.2, Figure A.3, Figure A.4, Figure A.5, Figure A.6, Figure A.7 and Figure A.8.

NOTE 1   Basis for the following values is an anthropological study carried out in Germany with 100 women and 100 men between 50 and 70 years of age.

NOTE 2   All dimensions are in cm.

NOTE 3   All ages are in years.

NOTE 4   P5 (P50, P95) means: 5 % (50 %, 95 %) percentile – percentage of population of which specific characteristics fall below or are equal to 5 % (50 %, 95 %) in a cumulative distribution.

NOTE 5   Under "Variation" the smallest and the greatest measured values are given.

IEC

	Age	P5	P50	P95	Variation
Men	50 – 59	19,3	20,6	22,4	18,7 – 23,0
	60 – 69	18,8	20,4	22.2	18,6 – 22,9
Women	50 – 59	17,2	18,5	20,4	16,6 – 20,5
	60 – 69	17,0	18,7	20,2	14,0 – 21,0

NOTE Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie*, 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

Figure A.1 – Hand length

IEC

	Age	P5	P50	P95	Variation
Men	50 – 59	8,7	10,2	12,9	8,5 – 13,7
	60 – 69	8,5	10,3	11,7	8,0 – 12,8
Women	50 – 59	7,4	9,4	11,2	7,0 – 14,3
	60 – 69	8,0	9,7	11,8	6,3 – 12,4

NOTE Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie*, 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

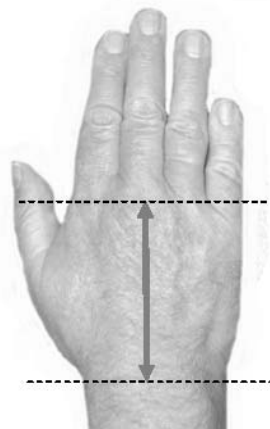**Figure A.2 – Dorsal length of middle finger**

IEC

	Age	P5	P50	P95	Variation
Men	50 – 59	8,5	10,4	12,6	7,5 – 12,9
	60 – 69	7,9	10,4	11,9	7,2 – 12,2
Women	50 – 59	6,9	9,1	12,1	5,5 – 12,5
	60 – 69	6,7	9,1	10,7	6,4 – 11,7

NOTE Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie,* 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

Figure A.3 – Back of the hand's length

	Age	P5	P50	P95	Variation
Men	50 – 59	8,3	8,9	9,2	8,3 – 9,6
	60 – 69	8,2	8,8	9,7	8,0 – 10,0
Women	50 – 59	7,2	7,8	8,4	7,1 – 8,8
	60 – 69	7,2	7,9	8,3	6,4 – 8,5

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Figure A.4 – "Projective" hand width

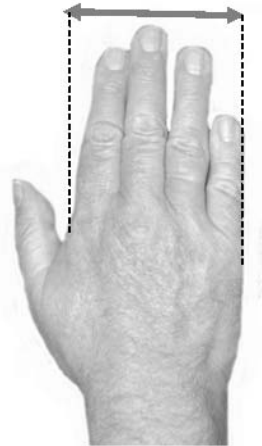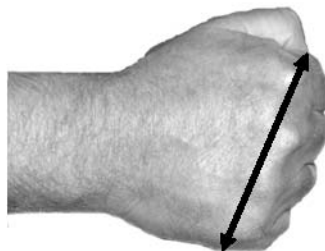

	Age	P5	P50	P95	Variation
Men	50 – 59	8,2	8,7	9,5	7,9 – 9,8
	60 – 69	8,1	8,7	9,6	7,6 – 10,3
Women	50 – 59	7,0	7,6	8,4	6,8 – 8,5
	60 – 69	7,1	7,7	8,3	7,0 – 8,4

NOTE Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie*, 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

Figure A.5 – Direct fist width

IEC
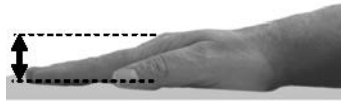
	Age	P5	P50	P95	Variation
Men	50 – 59	2,8	3,3	4,0	2,7 – 5,5
	60 – 69	2,9	3,3	3,9	2,8 – 4,4
Women	50 – 59	2,2	2,7	3,1	2,1 – 3,5
	60 – 69	2,4	2,8	3,3	2,2 – 3,4

NOTE Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie*, 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

Figure A.6 – Distal middle hand's (metacarpus') thickness
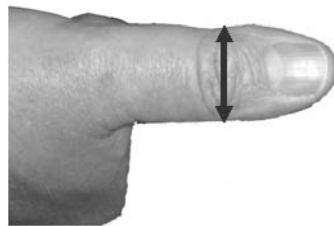

IEC

	Age	P5	P50	P95	Variation
Men	50 – 59	2,1	2,3	2,6	2,0 – 3,0
	60 – 69	2,1	2,4	2,8	2,1 – 2,9
Women	50 – 59	1,7	2,0	2,2	1,7 – 2,3
	60 – 69	1,8	2,0	2,2	1,7 – 2,2

NOTE Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie,* 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

Figure A.7 – "Projective" distal thumb joint's width

IEC
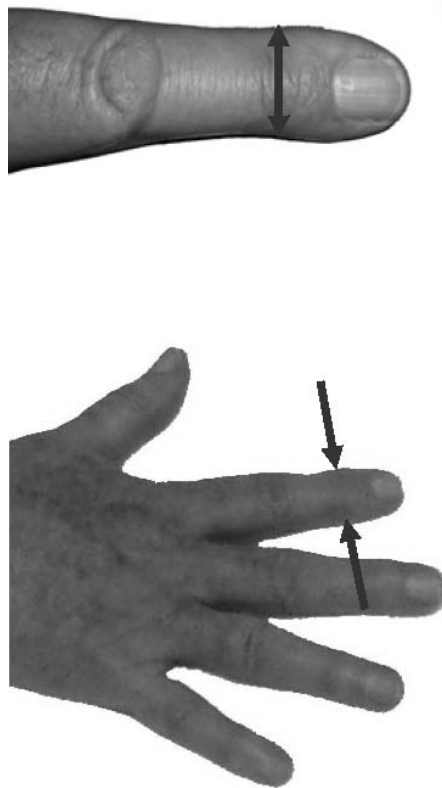
	Age	P5	P50	P95	Variation
Men	50 – 59	1,7	1,9	2,0	1,6 – 2,1
	60 – 69	1,8	1,9	2,2	1,7 – 2,3
Women	50 – 59	1,5	1,6	1,9	1,4 – 2,0
	60 – 69	1,5	1,7	1,9	1,4 – 2,0

NOTE 14 Reproduced from GREIL, H., VOIGT, A., and SCHEFFLER, C. *Optimierung der ergonomischen Eigenschaften von Produkten für ältere Arbeitnehmerinnen und Arbeitnehmer – Anthropometrie*, 2008 with the permission of Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Dortmund.

Figure A.8 – "Projective" distal forefinger joint's width

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