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GUIDE

Electrotechnical equipment – Temperatures of touchable hot surfaces

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROTECHNICAL EQUIPMENT – TEMPERATURES OF TOUCHABLE HOT SURFACES

FOREWORD

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This first edition of IEC Guide 117 has been prepared in accordance with ISO/IEC Directives, Part 1, Annex A, by the IEC Advisory Committee on Safety (ACOS). This is a non-mandatory guide in accordance with SMB Decision 136/8.

This Guide is based on CENELEC Guide 29.

The text of this IEC Guide is based on the following documents:

Four months' vote	Report on voting
C/1619/DV	C/1636/RV

Full information on the voting for the approval of this Guide 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.

INTRODUCTION

This Guide was initially prepared by CENELEC BTTF 120-1, Surface temperatures, and was approved by the CENELEC Technical Board as CENELEC Guide 29.

The CENELEC guide has been modified to take into account IEC document preparation procedures and those comments received from National Committees and Technical Committees.

ELECTROTECHNICAL EQUIPMENT – TEMPERATURES OF TOUCHABLE HOT SURFACES

1 Scope

This IEC Guide provides guidance for assessing the risk, to any person, of a burn from contact with hot touchable surfaces of electrotechnical equipment. This Guide establishes surface temperature limits, where such limits are required, and describes the maximum contact periods with a hot surface that any person may be subjected to without being exposed to a risk of burn. Curves of maximum temperatures versus contact times are described for different types of material with different types of surfaces.

These temperature limit values shall be taken into consideration by technical committees in determining surface temperature limits in product standards. In making this determination, consideration should be given to:

– the likelihood of contact with the heated part;
– the size and thermal capacity of the heated part;
– the expertise of the persons and their knowledge and experience relative to the temperatures likely to be encountered in operating or servicing the product;
– the provision of adequate cautions or warnings; and
– other similar factors taking into account the task analysis specified in 4.3.

It is ultimately the responsibility of the technical committee to establish the acceptable temperature limits (which may be higher) that may apply to touchable surfaces of products under their scope. Manufacturers may also use these temperature limit values to assist in their risk assessment if no relevant product standard exists.

It is not within the scope of this Guide to set temperature limits for the following zones or surfaces:

– hot functional surfaces;
– adjacent surfaces;
– handles or control knobs, including keypads, keyboards and the like, that a user needs to touch to operate or adjust the equipment;
– surfaces not likely to be touched.

It is outside of the scope of this Guide to specify protective measures. It is the task of manufacturers and also of standardisation groups to decide upon protective measures appropriate to the intended use of a product. Protective means, if needed, should be provided together with the equipment.

NOTE Although not specified in this Guide, examples of protective measures that may be taken are given in Clause 5 and Annex D. One example of several possible protective measures is the limitation of the surface temperature below the burn threshold. To achieve this, surface temperature limit values may be established at or below the burn threshold in the product standard. It is then the task of the manufacturer of the product to apply technical solutions in order to comply with the established limit values.

2 Normative references

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

ISO 13732-1:2006, *Ergonomics of the thermal environment – Methods for the assessment of human responses to contact with surfaces – Part 1: Hot surfaces*

3 Terms and definitions

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

3.1
adjacent surface
surface adjacent to a hot functional surface

NOTE The adjacent surface and the hot functional surface normally consist of the same piece of material, or are in direct thermal contact, and have similar thermal properties. The adjacent surface is not heated intentionally during use of the product. However, as it is adjacent to the hot functional surface and may become hot through conduction, its temperature will be in the range between the hot functional surface and a touchable surface.

3.2
arm's reach
either the distance measured from the floor to the fingertips of a person fully extended in the vertical direction or, for any other direction, one-third of that distance

3.3
burn threshold
surface temperature defining the boundary between no burn and a superficial partial thickness burn caused by contact of the skin with a hot surface for a specified contact period

3.4
contact period
duration of contact with the surface

3.5
hot functional surface
surface that is intentionally heated by an internal heat source and that has to be hot to carry out the function for which the equipment is intended to be used

NOTE 1 For example, curling tongs or the soleplate of an iron or the heater of a copy machine.

NOTE 2 Some equipment has hot surfaces as a consequence of how they generate their output, (for example, lamps within a luminaire or the heater of a copy machine), and these surfaces are considered, in terms of their treatment, as equivalent to a hot functional surface.

3.6
skin temperature
temperature at a depth of 80 µm below the surface of the skin, measured in degrees Celsius

3.7
surface temperature
temperature of a surface, measured in degrees Celsius, at an ambient temperature of 25^{-5}_{+0} °C.

3.8
thermal inertia
product of the density, thermal conductivity and specific thermal capacity of material

3.9
touchable surfaces (in some standards, accessible surfaces or accessible parts)

surfaces defined as touchable (or accessible) in the end-product standard, taking into account the intended installation of the equipment and surfaces within arm's reach, other than:

– hot functional surfaces;
– adjacent surfaces; and
– handles or control knobs, including keypads, keyboards and the like, that a user needs to touch to operate or adjust the equipment

NOTE 1 See Figure 1 for examples of the types of surfaces that may be encountered.

NOTE 2 The equipment has to be installed according to the manufacturer's instructions. This means that an oven intended for building-in should be installed according to the manufacturer's instructions before identification of the touchable surfaces.

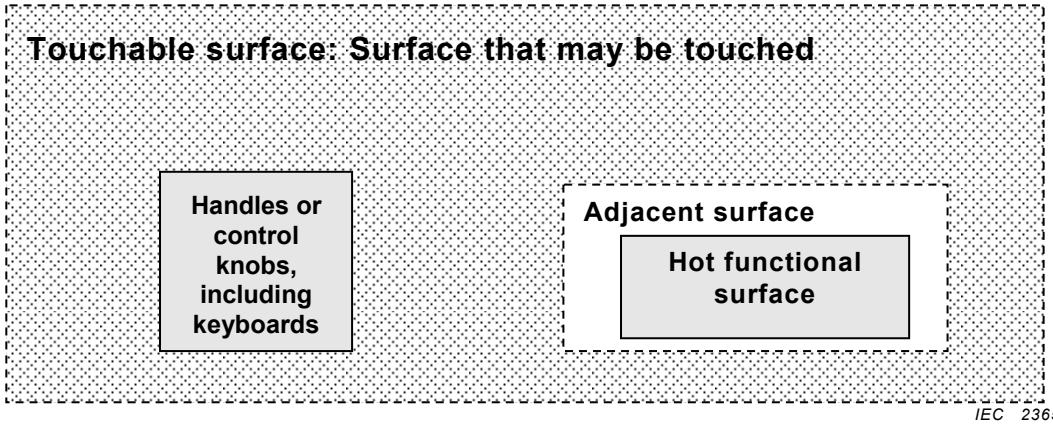


Figure 1 – Identification of the touchable parts of equipment (cross-hatched area)

4 Assessment of the risk of burning

4.1 General

Normally it is sufficient to follow the product standard. The manufacturer only needs to carry out a risk assessment if the product standard does not take account of the temperatures of surfaces likely to be touched, or if no relevant product standard exists.

4.2 Procedure

The different types of surfaces or zones shall be identified according to 4.3.

To assess the risk of a cutaneous burn from surfaces likely to be touched, the steps described in 4.4 to 4.8 shall be carried out for surfaces identified in 4.3.5.

4.3 Identification of surfaces

4.3.1 General

All surfaces of a product shall be classified according to 4.3.2 to 4.3.5.

4.3.2 Identification of hot functional surfaces

Hot functional surfaces shall be identified when the equipment is installed as for normal use.

4.3.3 Identification of adjacent surfaces

Adjacent surfaces shall be identified.

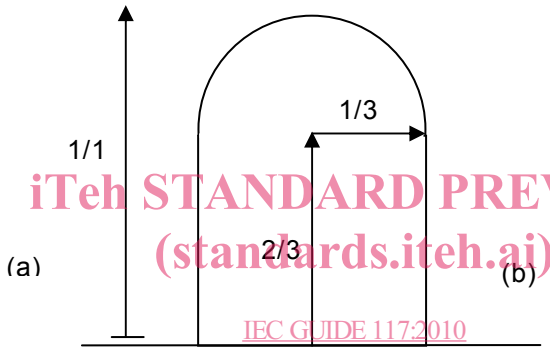
4.3.4 Identification of handles or control knobs including keypads, keyboards and the like

Handles or control knobs, including keypads, keyboards and the like that a user needs to touch to operate or adjust the equipment shall be identified.

4.3.5 Identification of touchable surfaces

All necessary information concerning the touchable surfaces of the equipment, including the following, shall be gathered:

– classification of surface temperatures as hot, moderate or cold;
– material and texture of the surfaces;
– all normal operating conditions of the equipment including the setting that results in maximum temperatures of the touchable surfaces;
– the probability of contact, taking into account the arm's reach of a person as shown in Figure 2 and Table 1.



The distance is interpreted as either a fully stretched person (a) or a person reaching for an item (b)

Figure 2 – Arm's reach

The worst case of either (a) or (b) shall be used.

Table 1 gives guidance on arm's reach for different age groups.

Table 1 – Arm's reach

Age Years	**Arm's reach in the vertical direction (see (a) of Figure 2), measured from the floor** m
Children less than 2 years	1,00
Children from 2 years to less than 6 years	1,50
Children from 6 years to less than 14 years	1,80
Adult	2,30
NOTE The values in this table are average values and are based on the data in CEN/TR 13387.	

If the equipment is installed out of reach, it is not considered touchable.

4.4 Task analysis

All necessary information concerning the use of the product shall be collected. By means of analysis or observation, the activities and tasks involved in using the product shall be described. Attention shall be paid to the means of possible contact with hot touchable surfaces and to which types of persons the contact may happen. From the task analysis, the following information is obtained:

– the touchable surfaces that may be touched unintentionally,
– the users, or other persons, who will likely touch or may touch the surfaces unintentionally,
– the range of operation of the product,
– the probability of touching a touchable surface,
– statistical data on relevant incidents, if available, and
– the normal operation setting of the temperature of the product.

4.5 Measurement of the surface temperatures

The surface temperatures shall be measured on touchable surfaces.

The measurement shall be carried out under normal operating conditions of the product that will result in the maximum surface temperature of touchable surfaces. The chosen operating conditions shall reflect the manufacturer's intended use of the product while excluding extreme usage patterns, deliberate misuse or unauthorised modifications of the product or its operating parameters.

If a technical committee has a specified temperature measurement method, that method shall be used. Otherwise the measurement of the surface temperature should be carried out by means of an electrical thermometer with a contact sensor made of metal having insignificant heat capacity. The accuracy of the instrument shall be at least ± 1 °C in the range up to 50 °C and at least ± 2 °C in the range above 50 °C.

NOTE The data in Annex A is based on measurement methods described in ISO 13732-1:2006.

4.6 Choice of applicable burn threshold

Based on the identification of the touchable surfaces in 4.3.5 and the task analysis in 4.4, and by taking account of the surface material and texture, the applicable burn threshold may be chosen using the data in Annex A, if available.

NOTE 1 Annex A provides data and curves for some types of materials under smooth surface conditions, and including some coating treatments. Further study may be necessary to determine burn thresholds for materials or textures not covered in Annex A.

The contact period to be used for selecting the burn threshold shall be according to Clause 6, and shall take into consideration the different groups of persons that are likely to come into contact with the surface.

NOTE 2 It should be noted that the surface temperature limit values are based on temperatures taken of a large mass at the point of contact, and with very high stored thermal energy. The document does not consider thin materials or those having low stored thermal energy. For these materials, the stored energy and thermal conductivity will need to be taken into account, not just the temperature as can be done for a large mass at the point of contact.

4.7 Comparison between surface temperature and burn threshold

Compare the measured surface temperatures with the applicable burn thresholds:

– if the surface temperature is above the burn threshold, there is potential for cutaneous injury after contact with the hot surface;