



Handläggande organ

Standardiseringsgruppen STG

Fastställd

2000-06-30

Utgåva

1

Sida

1 (1+21)

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Ergonomics of the thermal environment – Temperatures of touchable hot surfaces – Guidance for establishing surface temperature limit values in production standards with the aid of EN 563

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Swedish Standards corresponding to documents referred to in this Standard are listed in "Catalogue of Swedish Standards", issued by SIS. The Catalogue lists, with reference number and year of Swedish approval, International and European Standards approved as Swedish Standards as well as other Swedish Standards.

Termiskt klimat – Temperaturer på berörbara varma ytor – Vägledning för att sätta gränsvärden för ytemperaturer i produktionsstandarder med hjälp av EN 563

Europastandarden EN 13202:2000 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 13202:2000.

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ICS 13.180

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Prisgrupp Q

Tryckt i september 2000

EUROPEAN STANDARD

EN 13202

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2000

ICS 13.180

English version

Ergonomics of the thermal environment - Temperatures of touchable hot surfaces - Guidance for establishing surface temperature limit values in production standards with the aid of EN 563

Ergonomie des environnements thermiques -
Températures des surfaces tangibles chaudes - Lignes
directrices pour la fixation de valeurs limites de température
de surface dans les normes de produit à l'aide de l'EN 563

Ergonomie der thermischen Umwelt - Temperaturen
berührbarer heißer Oberflächen - Leitfaden zur Festlegung
der Temperaturgrenzwerte von Oberflächen in
Produktnormen unter Anwendung von EN 563

This European Standard was approved by CEN on 9 April 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2000, and conflicting national standards shall be withdrawn at the latest by November 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Products with built-in engines or other heat-sources often show hot surfaces. If such a surface is touched by the unprotected skin, burning of the skin may occur. To avoid skin burning protective measures should be applied, especially in cases, when the user of the product is not aware of the risk of burning. So it is essential to assess the risk of burning when using a product with a built-in heat source and to apply protective measures if necessary.

The assessment of a risk of burning and the application of protective measures hold as well for existing products as for products which will be produced in future. For a lot of products with built-in heat-sources European standards have been prepared, are under preparation or will be prepared in future. It is reasonable to include safety requirements in these standards concerning the assessment of a burning risk and the application of protective measures.

This standard will help users of existing products to assess the burning risk and to select appropriate protective measures. It will also serve standardisation committees to include safety aspects concerning hot surfaces in standards. Surface temperature limit values are already specified in a lot of existing standards. But often the specified values differ from each other, sometimes where the applications of the products are similar. From a scientific point of view there is no reason to specify different surface temperature limit values for the same surfaces and similar application of products. The surface temperature above which burning occurs when a hot surface is touched does not depend on the type of product. It depends mainly on the material and the texture of the surface and on the period of contact with the hot surface (see Introduction of EN 563:1994). So it is desirable to harmonise surface temperature limit values in all product standards. It can be done with the aid of this standard by using EN 563. In EN 563 burn thresholds are specified when a hot surface is touched. The specified values are based on scientific research and are valid for surfaces of all kinds of products, even though the scope of EN 563:1994 is limited to machinery.

It is not the intention of this document to obligatory specify surface temperature limit values for all standards. The technical committees and working groups preparing product standards know the specific use of a product. On this background they should decide if protective measures against burning should be specified in a product standard and if so which are appropriate. One of several possible protective measures is the limitation of the surface temperature. This document aims to guide technical committees and working groups to recognise burning risks and to establish appropriate temperature limit values if it is necessary and possible to specify such limit values.

This document also aims at providing information which is not contained in EN 563. In EN 563 no burn thresholds are specified for contact periods below 1. The texture of the surface is not described in detail in EN 563 but more in a general way. Burn thresholds in EN 563 are specified for healthy adults only and not for other people like children, elder or physically disabled people. This document does not change EN 563. But it will provide useful additional information in order to assess the risk of burning and to set surface temperature limit values in a wider field of application.

The nature of the additional information given in this document is different from the information given in EN 563. The information given in EN 563 is based on scientific research. The additional information provided by this document is based on mathematical calculation and reasonable conclusion. So e.g. the burn thresholds for a contact period of 0,5 s are calculated by extrapolation of the burn threshold curves of EN 563.

1 Scope

This standard specifies methods for the assessment of the risk of burning when a hot surface is touched by unprotected skin.

This document also describes how surface temperature limit values can be established in product standards with the aid of EN 563.

The guidance is for establishing temperature limit values in all fields, where surface temperature limit values are required. Its field of application is not restricted to the safety of machinery. It is applicable for all kinds of products where hot surfaces cause a risk of burning. It applies as well for electrically powered products as for all other products.

This document applies to hot surfaces of products which may be touched by healthy adults, children, elderly and physically disabled people. It also applies to products used in any environment, e.g. workplaces, the home etc..

This document does not set surface temperature limit values. It provides guidance to Technical Committees to carry out assessments of the risk of burning and to establish appropriate surface temperature limit values if necessary. It also provides hints about the necessity and the possibility of the establishment of limit values.

It is the responsibility of Technical Committees which prepare standards for products to assess if the setting of surface temperature limit values is necessary and to set those limit values if need be.

This document also provides the possibility of harmonising surface temperature limit values in standards for all kind of products. For different products with the same risk of burning it is reasonable to establish identical limit values.

This document also provides additional information which is not contained in EN 563. This includes burn thresholds for contact periods below 1 s, burn thresholds for different textures of material and the assessment of burning risks for people other than healthy adults.

This document does not deal with the problem of feeling pain when a hot surface is touched.

NOTE: If protection against pain is necessary reference is made to other appropriate sources, see Annex A in EN 563:1994.

The following limitations in the scope of EN 563:1994 also apply to this document:

- thermal capacity
- maximum area of the skin when in contact with a hot surface
- contact which could result in burns of vital areas of the face
- healthy skin.

2 Normative references

This European Standard incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 563:1994
Safety of machinery - Temperatures of touchable surfaces - Ergonomics data to establish temperature limit values for hot surfaces

EN 71-1
Safety of toys - Part 1: Mechanical and physical properties

EN 1050
Safety of machinery - Principles for risk assessment

IEC 61032
Testing equipment and testing methods - Test probes to verify protection by enclosures

3 Terms and definitions

For the purposes of this European Standard the terms and definitions of EN 563 apply as well as the following:

3.1

touchable surface

a surface of a product which can be touched by a person's skin.

4 Assessment of the risk of burning

4.1 Procedure

To assess the risk of burning by products with hot surfaces the steps described in 4.2 to 4.7 shall be carried out.

4.2 Identification of touchable hot surfaces

All necessary information concerning the touchable hot surfaces of the **product** shall be gathered. This to include the products attributes:

- accessibility (touchability) of the surfaces
- rough estimation of surfaces temperatures (hot, moderate, cold)
- material and texture of the surfaces
- all operating conditions of the product including the worst case.

NOTE: If more specific information is needed to determine the accessibility of the surface of a product, reference is made to other appropriate standards like:

IEC 61032, EN 71-1, etc..

4.3 Task analysis

All necessary information concerning the **use** of the product shall be collected. By analysis or observation describe the activities and tasks involved in using the product. Particular attention shall be paid to possible intentional and unintentional contact with hot surfaces and to which persons (users of the product and others) it may occur. The likely nature of the contact (probability and contact period) shall also be identified. From the task analysis the following information is obtained:

- surfaces which are or may be touched
- intentional or unintentional touching
- probability of unintentional touching
- frequency of intentional touching
- duration of contact with surfaces
- persons who contact or may contact surfaces (users and non-users)
- range of operation of the product.

4.4 Measurement of the surface temperatures

The surface temperatures shall be measured on that part or those parts of the product where contact of the skin with the surface can occur.

The measurement shall be carried out under the normal operating conditions of the product. The extreme end of the range of the normal operating conditions shall be included so as to provide maximum surface temperatures.

The measurement shall be carried out in accordance with 5.2 of EN 563:1994.

4.5 Choice of applicable burn threshold

Determine from the identification of the hot surfaces, see 4.2, and from the task analysis, see 4.3, all necessary factors for the choice of the applicable burn threshold:

- surface material
- surface texture
- contact period.

Then select from 4.2 of EN 563:1994 the applicable burn threshold. Details of the selection of the applicable burn threshold are specified in clause 7 of this standard.

4.6 Comparison and conclusion

Compare the measured surface temperatures with the applicable burn thresholds. The conclusions are:

- If the surface temperature is above the burn threshold, cutaneous injury upon contact with the hot surface is to be expected.
- If the temperature lies below the burn threshold, the skin will not normally suffer injury.
- If the measured surface temperature lies inside the burn threshold spreads of figures 2 to 6 of EN 563:1994 or inside the burn threshold spreads of tables B.1 and B.2 of this document cutaneous injury may or may not occur. This corresponds to the remaining uncertainty of the burn threshold specification.

Repeat the comparison for all touchable hot surfaces of the product.

4.7 Result of the risk assessment

Estimate from task analysis, see 4.3, the probability of touching a part of the surface of the product which has a temperature higher the burn threshold.

Assess the risk of burning for those parts of the product with surface temperatures higher than the burn thresholds. Hints for the risk assessment are given in 6.2 of EN 563:1994 and in EN 1050.

As result the risk of burning is determined in terms of:

- exceeding or falling short of the burn threshold for all parts of the surface of the product
- probability of contact
- duration of contact
- degree of possible injuries of the people involved.

5 Application of protective measures

If the risk assessment shows that there is a risk of burning it has to be decided whether protective measures are necessary and if so which protective measures are appropriate. In order to reduce or to eliminate burning risks protective measures can be applied to existing products and can also be specified in standards for products which are to be produced in future. In general engineering, organisational and personal protective measures can be applied. If it is necessary to apply protective measures at all and if so which specific measures are appropriate depends on the context in which a product will be used. It is out of the scope of this document to specify protective measures. It is the task of manufacturers and also of standardisation groups to decide upon appropriate protective measures regarding the intended use of a product. In 6.2 of EN 563:1994 a guidance is given to estimate the necessity of the application of protective measures. Annex C of EN 563:1994 contains examples for suitable protective measures and their priority.

One of several possible protective measures is the reduction of the surface temperature below the burn threshold. To achieve this surface temperature limit values can be established at or below the burn threshold in a 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.

Reduction of surface temperatures and establishing of limit values is applicable only for those parts of a product which are not deliberately heated as an integral part of the functioning of the product. In cases where surfaces of the product have to be hot and accessible to carry out the intended operation of the product other appropriate protective measures have to be applied (e.g.: Operating surfaces of an electrical hob, of a product, etc.).

NOTE: Even if it is not possible to reduce the surface temperature below the burn threshold it may be reasonable to limit the surface temperature to a higher level. Reasons for that may be to reduce the burning risk even if it can not be avoided totally. There may also be technical reasons to limit the temperature e.g. to prevent the destruction of the product by too high temperatures.

6 Need for establishing surface temperature limit values and selection method

6.1 Procedure

If a standardisation group has to decide whether surface temperature limit values in a product standard are needed and which are appropriate the steps described in 6.2 to 6.4 shall be carried out. The procedure can also be used by manufacturers who want to limit a products surface temperature in order to avoid a risk of burning.

NOTE: A flow chart in Annex D is given for application of this process.

6.2 Determination of the risk of burning

First of all a determination of the risk of burning shall be carried out. The aim of the risk assessment is the identification of a possible burning risk in connection with the use of the product for which a standard is to be prepared.

The determination of the risk of burning can be done in accordance with clause 4 using samples of the product for which the standard is to be prepared. Alternatively the experts of the standardisation group have to decide on the background of a task analysis and on their experience, if the product may show touchable hot surfaces and if there is a risk of burning.

6.3 Choice of appropriate protective measures

If the risk assessment shows that there is a risk of burning a decision has to be taken if it is necessary to apply protective measures and which are appropriate (see clause 5).

6.4 Introducing surface temperature limit values into standards

If the standardisation group decides to introduce surface temperature limit values into the product standard the appropriate values can be taken from EN 563. Details of the method of selection of the appropriate surface temperature limit values are specified in clause 8 of this document.

7 Burn thresholds

7.1 General

To select the applicable burn threshold the procedure described in 5.3 of EN 563:1994 shall be carried out with the amendments and exceptions described in 7.2 to 7.4 of this document.

7.2 Determination of the contact period

7.2.1 General

For the selection of appropriate contact periods see 5.3.2 and table B.1 of EN 563:1994 apply in general. In order to give standardisation groups more flexibility additional values for different situations are provided.

After the assessment whether a contact with a hot surface may occur unintentionally or intentionally, a distinction shall be made based upon who may come into contact with the hot surface:

- healthy adults
- children
- elderly people
- people with physical disabilities.

7.2.2 Unintentional contact

Healthy adults

For healthy adults 5.3.2 and annex B of EN 563:1994 apply. In addition a minimum contact period of 0,5 s may be selected in the following case:

- touching a hot surface and fastest possible withdrawal following pain sensation without restriction of movement (see annex A).

Children

For children 5.3.2 and annex B of EN 563:1994 apply. If touching a hot surface and an extended reaction time due to their age is to be expected, at least 4 s shall be selected.

Until 24 months children do not have reflexes which are quick enough to remove their hands from what burns them. They do not always have the ability to get away from hot surfaces therefore. The contact period can be up to 15 s for very young children.

Elderly people

For elderly people 5.3.2 and annex B of EN 563:1994 apply. If the product is used mainly by elderly people 1 s shall be selected as the minimum contact period. If touching a hot surface and extended reaction time due to their age is to be expected, at least 4 s shall be selected.

People with physical disabilities

If people with physical disabilities may come in contact with hot surfaces special considerations shall be made by the standardisation group taking into account the nature of disability and the use of the product. The standardisation group has to decide if table B.1 of EN 563:1994 is applicable or if longer contact periods have to be selected.

7.2.3 Intentional contact

In general 5.3.2 and annex B of EN 563:1994 apply for healthy adults, children, elderly people and people with physical disabilities. Standardisation groups shall consider if the product is to be used by groups of people other than healthy adults where the task may take longer time than specified in table B.1 of EN 563:1994 . In that case the contact periods shall be modified accordingly.

If products are specifically made for people with physical disabilities then the nature of disability shall be considered in detail and expert medical advice shall be taken.

7.3 Selection of the burn threshold

5.3.3 of EN 563:1994 applies to healthy adults, elderly people and people with physical disabilities in general.

If burn thresholds for a contact period of 0,5 s are to be selected (see 7.2.2) they shall be taken from annex B of this document.

When a product can be touched by children a value towards the lower end of the burn threshold spreads in figures 2 to 6 of EN 563:1994 shall be selected for contact periods between 1 s and 10 s . For products specifically for children the values on the lower end of the spreads are recommended. For contact periods between 10 s and 1 min an interpolation shall be made between the lower end in the spread for a contact period of 10 s and the burn threshold for 1 min. For contact periods of 1 min and longer table 1 of EN 563:1994 applies also to children.

7.4 Texture of the surface

The texture of the surface will affect the nature of the contact. For rough surfaces values more towards the upper end of the burn threshold spreads (figures 2 to 6 of EN 563:1994 and

annex B) could be taken and for smooth surfaces values more towards the lower end of the spreads could be taken.