

STN	Rozmery, značenie a skúšanie uhlíkových kefiiek a rozmery držiakov kefiiek pre elektrické stroje	STN EN IEC 60136 35 0802
------------	---	--

Dimensions, marking and testing of carbon brushes and dimensions of brush-holders for electrical machinery

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 08/24

Obsahuje: EN IEC 60136:2024, IEC 60136:2024

139000



Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2024
Slovenská technická norma a technická normalizačná informácia je chránená zákonom č. 60/2018 Z. z. o technickej normalizácii v znení neskorších predpisov.

EUROPEAN STANDARD

EN IEC 60136

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2024

ICS 29.160.10

English Version

**Dimensions, marking and testing of carbon brushes and
dimensions of brush-holders for electrical machinery
(IEC 60136:2024)**

Dimensions, marquages et essais des balais et dimensions
des porte-balais pour machines électriques
(IEC 60136:2024)

Abmessungen, Kennzeichnung und Prüfung von
Kohlebürsten und Abmessungen von Bürstenhaltern für
elektrische Maschinen
(IEC 60136:2024)

This European Standard was approved by CENELEC on 2024-06-12. CENELEC 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 CEN-CENELEC Management Centre or to any CENELEC 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 CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 60136:2024 (E)**European foreword**

The text of document 2/2180/FDIS, future edition 3 of IEC 60136, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60136:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-03-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-06-12

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60136:2024 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60773:2021 NOTE Approved as EN IEC 60773:2021 (not modified)

ISO 3611 NOTE Approved as EN ISO 3611

ISO 13102:2012 NOTE Approved as EN ISO 13102:2012 (not modified)

ISO 13385-1:2019 NOTE Approved as EN ISO 13385-1:2019 (not modified)

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60276	2018	Carbon brushes, brush holders, commutators and slip-rings - Definitions and nomenclature	EN IEC 60276	2019
IEC 60560	-	Definitions and terminology of brush-holders for electrical machines	-	-
ISO 129-1	-	Technical product documentation (TPD) - Presentation of dimensions and tolerances - Part 1: General principles	EN ISO 129-1	-
ISO 197-1	1983	Copper and copper alloys - Terms and definitions - Part 1: Materials	-	-
ISO 286-2	2010	Geometrical product specifications (GPS) - ISO code system for tolerances on linear sizes - Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts	EN ISO 286-2	2010



IEC 60136

Edition 3.0 2024-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Dimensions, marking and testing of carbon brushes and dimensions of brush-holders for electrical machinery

Dimensions, marquages et essais des balais et dimensions des porte-balais pour machines électriques

**THIS PUBLICATION IS COPYRIGHT PROTECTED****Copyright © 2024 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -**webstore.iec.ch/advsearchform**

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 60136

Edition 3.0 2024-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Dimensions, marking and testing of carbon brushes and dimensions of brush-holders for electrical machinery

Dimensions, marquages et essais des balais et dimensions des porte-balais pour machines électriques

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.160.10

ISBN 978-2-8322-8835-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	7
1 Scope.....	10
2 Normative references	10
3 Terms, definitions and symbols.....	11
3.1 Terms and definitions.....	11
3.2 Symbols.....	19
4 Units and marking.....	21
4.1 Units	21
4.2 Marking.....	21
4.2.1 Units.....	21
4.2.2 Additional marks on the brush.....	21
4.2.3 Additional marks for brush-holders	22
5 Principal dimensions and tolerances of brushes.....	22
5.1 Sequence	22
5.2 Standard dimensions	24
5.3 Tolerances on principal dimensions	24
5.3.1 General tolerances	24
5.3.2 Split brushes	25
5.3.3 Metal-graphite brushes	26
5.4 Recommended combinations of principal dimensions.....	26
5.4.1 Combination for t and a	26
5.4.2 Square brush.....	29
6 Complementary dimensions of brushes	30
6.1 Chamfers	30
6.1.1 Angle.....	30
6.1.2 Dimension	30
6.1.3 Non-reversing chamfer	31
6.2 Angles for contact and top bevels	32
6.2.1 Angles for contact bevel	32
6.2.2 Angles for top bevel.....	33
6.2.3 Combination of angles	34
6.3 Pressure area	34
6.4 Depth of insertion q_i of the flexible (shunt) in the brush.....	35
6.5 Residual material width adjacent to the flexible.....	36
6.6 Safe length of a worn brush r_m	37
7 Terminations of brushes: flexibles and terminals.....	38
7.1 Flexibles	38
7.1.1 General	38
7.1.2 Nominal area and maximum diameter of flexibles	39
7.1.3 Length of flexible	40
7.1.4 Flexible protection	40
7.2 Terminals.....	40
7.2.1 General	40
7.2.2 Axial spade terminals	41
7.2.3 Flag terminals.....	42
7.2.4 Double shoe terminals	43

7.2.5	Tubular terminals.....	44
7.2.6	Soldered terminals.....	45
7.2.7	Current capacity of terminals.....	46
8	Test procedures for determining physical properties of brushes.....	47
8.1	General.....	47
8.2	Measurement of electrical resistance of brush/flexible connection.....	47
8.2.1	General.....	47
8.2.2	Test equipment.....	48
8.2.3	Test procedure.....	50
8.2.4	Test procedure for method b) (mathematical).....	55
8.2.5	Calculation and report.....	56
8.3	Measurement of the pull strength of tamped or moulded connections.....	56
8.3.1	General.....	56
8.3.2	Principle.....	56
8.3.3	Test equipment.....	56
8.3.4	Test procedure.....	59
8.3.5	Calculation and report.....	59
9	Brush-holder dimensions and configuration.....	59
9.1	General.....	59
9.2	Dimensions of the inside of the brush-box.....	59
9.2.1	Main dimensions.....	59
9.2.2	Tolerances and clearances on brush-box t and a	59
9.2.3	Dimensions and tolerances on brush-box chamfer.....	60
9.3	Check of brush-box dimensions.....	61
9.3.1	General.....	61
9.3.2	Gauging of dimensions t and a	61
9.3.3	Gauging of chamfers.....	61
9.4	Serrations on fixing face of the brush-holder.....	61
9.4.1	General.....	61
9.4.2	Profile and dimensions of serrations.....	61
9.4.3	Location of serrations.....	62
9.5	Brush-holder mounting position.....	62
Annex A (normative)	Equivalent dimensions in inches.....	63
Annex B (normative)	Values of the principal dimensions of metal-graphite brushes.....	66
Annex C (informative)	Considerations relative to brush stability.....	67
C.1	General.....	67
C.2	Radial brush without top bevel angle operating in bidirectional rotation.....	68
C.3	Radial brush with top bevel angle operating in the forward direction.....	70
C.4	Radial brush with top bevel angle operating in the reverse direction.....	71
C.5	Trailing type brushes.....	72
C.6	Reaction type brush with top bevel angle.....	74
Annex D (informative)	Flexibles configuration.....	77
Annex E (informative)	Flexible location.....	78
Annex F (informative)	Recommended values of thickness for spade, flag and double shoe terminals.....	79
Annex G (informative)	Technical questionnaire for the definition of a carbon brush.....	80
Bibliography	82

Figure 1 – Examples of brush components.....	11
Figure 2 – Chamfer height	12
Figure 3 – Contact bevel angle α	12
Figure 4 – Top bevel angle β	13
Figure 5 – Pressure area width for commutator and for slip-ring	13
Figure 6 – Depth of insertion.....	14
Figure 7 – Residual material width	14
Figure 8 – Safe length of a worn brush	15
Figure 9 – Flexible dimensions l_S and d_S for different examples of brushes	16
Figure 10 – Definition of distance d_P for different types of brush connection	17
Figure 11 – Brush-holder box chamfer height.....	18
Figure 12 – Definition of serration location distance	19
Figure 13 – Safe remaining length mark for different brush designs	22
Figure 14 – Main dimensions for a wedge-edge brush.....	23
Figure 15 – Preferred orientation for anisotropic grades depending on the application	30
Figure 16 – Angle of chamfers	30
Figure 17 – Split brush.....	31
Figure 18 – Non-reversing chamfer height	31
Figure 19 – Sharp edge when a contact bevel angle α is applied	33
Figure 20 – Flat surface of edge when a top bevel angle β is applied.....	33
Figure 21 – Flexible configuration illustration	38
Figure 22 – Definition of shape and dimensions of axial spades terminals	41
Figure 23 – Definition of shape and dimensions of flag terminals	42
Figure 24 – Definition of shape and dimensions of double shoe terminals	43
Figure 25 – Definition of shape and dimensions of tubular terminals	44
Figure 26 – Definition of shape (example) and dimensions of formed spade terminal	45
Figure 27 – Definition of shape (examples) and dimensions of two types of pin terminals.....	46
Figure 28 – Examples of testing device for the measurement of the connection electrical resistance	48
Figure 29 – Example of contact probe for flexible.....	49
Figure 30 – Example of contact probe for brush	49
Figure 31 – Measurement of connection resistance for a moulded or tamped connection	51
Figure 32 – Measurement of connection resistance for a riveted connection	52
Figure 33 – Alternative method for the measurement of connection resistance in case of 2 rivets.....	53
Figure 34 – Connection with a metal top soldered or riveted to the block	54
Figure 35 – Iterated determination of location P of Probe 2.....	55
Figure 36 – Test equipment for the measurement of the pull out force	57
Figure 37 – Example of support device for brushes with inclined connection hole	58
Figure 38 – Profile of serrations – cross-sectional view.....	62
Figure C.1 – Illustration of rotational moments for a radial brush.....	69

Figure C.2 – Illustration of forces applied on a radial brush with top bevel angle operating in the forward rotation	70
Figure C.3 – Illustration of forces applied on a radial brush with top bevel angle operating in the reverse direction	72
Figure C.4 – Illustration of forces applied on a trailing brush with a top bevel angle operating in the forward direction	73
Figure C.5 – Illustration of forces applied on a reaction brush	75
Figure E.1 – Flexible location	78
Figure G.1 – Main dimensions	80
Figure G.2 – Brush operation	81
Table 1 – Symbols for each unit system	21
Table 2 – Standard dimensions of brush block	24
Table 3 – Tolerances on t , a and r	25
Table 4 – Recommended combination of t , a and r	27
Table 5 – Dimension of chamfer height c	31
Table 6 – Recommended values of non-reversing chamfer height	32
Table 7 – Preferred values for contact bevel angle α and top bevel angle β	33
Table 8 – Typical combination values for contact bevel angle α and top bevel angle β	34
Table 9 – Recommended minimum values of pressure area width w_p	35
Table 10 – Maximum values of depth of insertion q_i	35
Table 11 – Example of maximum values of q_i for an EG grade	36
Table 12 – Minimum width of residual material	37
Table 13 – Recommended nominal area for flexibles and their corresponding maximum diameter	39
Table 14 – Standard lengths of flexibles l_S and tolerances	40
Table 15 – Standard values of spades terminals dimensions	42
Table 16 – Standard values of flag terminals dimensions	43
Table 17 – Standard values of double shoe terminals dimensions	44
Table 18 – Standard values of tubular terminals dimensions	45
Table 19 – Standard values of formed spade terminals dimensions and tolerances	46
Table 20 – Minimum values of current capacity for terminals	47
Table 21 – Tolerances on brush box dimensions and clearances	60
Table 22 – Maximum value of the brush-box chamfer height c_H	60
Table A.1 – Standard dimensions and tolerances on brush dimensions $t \times a \times r$ in inch system	63
Table A.2 – Nominal and maximum dimensions of chamfer height c to be used in inch system	64
Table A.3 – Recommended minimum value of w_p to be used in inch system	64
Table A.4 – Maximum values of depth of insertion q_i	64
Table A.5 – Recommended nominal area for flexibles (shunts) and their corresponding maximum diameter	65
Table A.6 – Standard lengths of flexibles l_S and tolerances	65
Table B.1 – $t \times a \times r$ tolerances and clearance for metal graphite grades	66

Table C.1 – Overview of the different mechanical configurations (bevel angles) in operation	67
Table D.1 – Configuration of flexibles	77
Table F.1 – Recommended thickness for spade, flag and double shoe terminals corresponding to screws diameter.....	79
Table G.1 – Elements to be included in a form.....	80

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIMENSIONS, MARKING AND TESTING OF CARBON BRUSHES AND
DIMENSIONS OF BRUSH-HOLDERS FOR ELECTRICAL MACHINERY**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60136 has been prepared by IEC technical committee TC 2: Rotating machinery. It is an International Standard.

This third edition cancels and replaces the second edition published in 1986 and Amendment 1:1995. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

Title: modified.

Clause or subclause	Previous clause	Change
1	I-1	Clarification and extension of the scope.
2	None	New clause introduced.
3	None	New clause introduced.
4	I-4 and II-7.5	Addition of units and extension of marking.
5.1	I-2	Addition of cylindrical and wedge-shape brushes.
5.2	I-3	Distinction of dimensions between t , a and r .
6.1	II-7.1	Revision of the chamfer dimension table and addition of non-reversing chamfer.
6.2	II-7.2	Revision of angles dimensions and addition of typical combination of angles.
6.4	II-7.4	Clarification of the definition of the depth of insertion and modification of maximum values.
6.5	None	New subclause introducing the concept of residual material width.
7.1.2	II-8.7	Change of definition of flexibles area and diameter.
7.1.4	None	Addition of flexible protection.
7.2	II-8.1 to II-8.5	Clarification. Addition of other types of terminals.
8	Annex C	Clarification of the method of measurement of electrical resistance and addition of graphical method.
9.2 and 9.3	Clause A.3	Brush-holder: Separation of Dimensions and Control of brush box in two different subclauses.
Annex A	None	Compilation of tables with inches dimensions from the previous edition.
Annex B	None	Addition of recommended dimensions for metal-graphite grades.
Annex C	None	Explanation of stability of brushes (linked to 6.2).
Annex D	II-8.7	Addition of examples of configuration of flexibles.
Annex E	None	Addition of recommended standardization of flexibles' location
Annex F	Annex D and II-8.8	Link between the thickness of terminals and the screw diameter.
Annex G	Annex B	Simplification of the questionnaire, to include only elements defined in this document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
2/2180/FDIS	2/2189/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

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

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

DIMENSIONS, MARKING AND TESTING OF CARBON BRUSHES AND DIMENSIONS OF BRUSH-HOLDERS FOR ELECTRICAL MACHINERY

1 Scope

This document applies primarily to brushes and brush-holders for cylindrical commutators and slip rings for electrical rotating machines. Some clauses of this document may cover other configurations, such as flat commutators or plain disks.

It defines the dimensions of brushes and their components, together with their tolerances:

- dimensions of brush block (t , a , r),
- angles α and β ,
- chamfer,
- flexibles (shunts),
- standard terminals.

It also covers the conventional designation of principal dimensions, the marking of brushes and the testing methods for the qualification of brushes after their manufacturing (except the brush grade material, covered by IEC 60413).

And finally, it specifies dimensions of the brush-holders that are linked to brushes.

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 60276:2018, *Carbon brushes, brush holders, commutators and slip-rings – Definitions and nomenclature*

IEC 60560, *Definitions and terminology of brush-holders for electrical machines*

ISO 129-1, *Technical product documentation (TPD) – Presentation of dimensions and tolerances – Part 1: General principles*

ISO 197-1:1983, *Copper and copper alloys – Terms and definitions – Part 1: Materials*

ISO 286-2:2010, *Geometrical product specifications (GPS) – ISO code system for tolerances on linear sizes – Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN