SLOVENSKI STANDARD
SIST EN 60336:1998

01-september-1998

X-ray tube assemblies for medical diagnosis - Characteristics of focal spots (IEC 60336:1993)

X-ray tube assemblies for medical diagnosis - Characteristics of focal spots

Kennwerte von Brennflecken von Röntgenstrahlern für medizinische Diagnostik

Gaines équipées pour diagnostic médical - Caractéristiques des foyers

Ta slovenski standard je istoveten z: **EN 60336:1995**

ICS:

11.040.50 Radiografska oprema Radiographic equipment

SIST EN 60336:1998 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60336

April 1995

ICS 11.040.50

Supersedes HD 509 S1:1988

Descriptors: Electromedical equipment, X-ray tubes, radio-diagnosis, focal spots, properties

English version

X-ray tube assemblies for medical diagnosis
Characteristics of focal spots
(IEC 336:1993)

Gaines équipées pour diagnostic médical
Caractéristiques des foyers
(CEI 336:1993)

Kennwerte von Brennflecken von
Röntgenstrahlern für medizinische
Diagnostik
(IEC 336:1993)

This European Standard was approved by CENELEC on 1995-03-06. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 336:1993, prepared by SC 62B, Diagnostic imaging equipment, of IEC TC 62, Electrical equipment in medical practice, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60336 on 1995-03-06 without any modification.

This European Standard supersedes HD 509 S1:1988.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-03-15
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-03-15

For products which have complied with HD 509 S1:1988 before 1996-03-15, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1998-06-13.

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A, B and C are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 336:1993 was approved by CENELEC as a European Standard without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT EUROPEAN PUBLICATIONS

This European Standard incorporates by dated or 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.

NOTE : When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Date
417	1973	Graphical symbols for use on equipment Index, survey and compilation of the single sheets		
417G	1985	Seventh supplement	HD 243 S12*	1995
601-2-28	1993	Medical electrical equipment Part 2: Particular requirements for the safety of X-ray source assemblies and X-ray tube assemblies for medical diagnosis	EN 60601-2-28	1993
613	1989	Electrical, thermal and loading characteristics of rotating anode X-ray tubes for medical diagnosis	EN 60613	1990
788	1984	Medical radiology - Terminology	HD 501 S1	1988

* HD 243 S12 is based on IEC 417:1973 and its supplements A:1974 to M:1994

NORME INTERNATIONALE
INTERNATIONAL STANDARD

CEI
IEC
336

Troisième édition
Third edition
1993-08

Gaines équipées pour diagnostic médical – Caractéristiques des foyers

X-ray tube assemblies for medical diagnosis – Characteristics of focal spots

Bureau Central de la Commission Electrotechnique Internationale 3, rue de Varembé Genève, Suisse

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE W

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

Clause Page

SECTION 7: STAR PATTERN RESOLUTION LIMIT

SECTION 8: BLOOMING VALUE

Figures

Tables

Annexes

INTERNATIONAL ELECTROTECHNICAL COMMISSION

X-RAY TUBE ASSEMBLIES FOR MEDICAL DIAGNOSIS – CHARACTERISTICS OF FOCAL SPOTS

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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. The 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 the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

International Standard IEC 336 has been prepared by sub-committee 62B: Diagnostic imaging equipment, of IEC technical committee 62: Electrical equipment in medical practice.

This third edition cancels and replaces the second edition published in 1982 and constitutes a technical revision.

The text of this standard is based on the following documents:

Six Months' Rule	Reports on voting
62B(CO)68 62B(CO)78	62B(CO)73 62B(CO)85

Full information on the voting for the approval of this standard can be found in the reports on voting indicated in the above table.

Annexes A, B and C are for information only.

The terms employed in this standard which are defined in clause 2 and in IEC 788 are printed in small capitals.

INTRODUCTION

The first edition of International Standard IEC 336: 1970, *Measurement of the dimensions of focal spots of diagnostic X-ray tubes using a pinhole camera*, was based upon an earlier ICRU Recommendation and upon national standards and has become well established as a valuable means of determining the dimensions of FOCAL SPOTS.

Since its publication, X-RAY TUBE technology as well as the systematic investigation of imaging procedures has developed significantly. The method for the determination of the dimensions of a FOCAL SPOT based upon a FOCAL SPOT PINHOLE RADIOGRAM becomes very difficult for NOMINAL FOCAL SPOT VALUES smaller than 0,3 because the results are affected by factors, such as TRANSMISSION through the shielding of the diaphragm and the need for repeated IRRADIATIONS of the RADIOGRAPHIC FILM due to tube-loading considerations. Therefore, a new method, using a pair of FOCAL SPOT SLIT RADIOGRAMS, has been developed which will be applied over the entire range of usual NOMINAL FOCAL SPOT VALUES. It avoids former uncertainties in determining the dimensions of FOCAL SPOTS and gives valuable results even in cases of distorted FOCAL SPOTS. Furthermore, it provides basic data in the form of a pair of FOCAL SPOT SLIT RADIOGRAMS allowing determination of the imaging properties of the FOCAL SPOT in the form of a pair of one-dimensional MODULATION TRANSFER FUNCTIONS.

Thus, not only the method for the determination of the dimensions of FOCAL SPOTS but also that for the determination of the MODULATION TRANSFER FUNCTION will be based exclusively upon the use of the pair of FOCAL SPOT SLIT RADIOGRAMS for all NOMINAL FOCAL SPOT VALUES.

In addition, further methods are described in this standard for establishing FOCAL SPOT characteristics. These are in common use and will continue to have their place for use by manufacturers (FOCAL SPOT PINHOLE RADIOGRAMS) and in the field (FOCAL SPOT STAR RADIOGRAMS).

In its report in 1958 (see NBS handbook 78), ICRU recommended applying to the measured length of line FOCAL SPOTS a multiplier of 0,7. This correction factor was confirmed by ICRU in 1963 (see NBS handbook 89).

The same factor was incorporated in the first edition of IEC 336 and after very careful consideration, has been retained in this standard (see table 5). In this way, discrepancies between NOMINAL FOCAL SPOT VALUES according to the present standard and the dimensions of FOCAL SPOTS, well established through the application of the first and second edition of IEC 336, are avoided.

Maintaining the multiplier 0,7 for NOMINAL FOCAL SPOT VALUES of 0,3 and greater is justifiable due to the fact that these FOCAL SPOTS are almost exclusively designed for very high loads which cause the distribution in radiant intensity over the length to exhibit a pronounced peak with relatively shallow shoulders. This results in larger linear dimensions for the length of the FOCAL SPOT compared to the width even though the MODULATION TRANSFER FUNCTIONS for both width and length may be approximately equal.

FOCAL SPOTS in the range below 0,3 are normally designed for magnification techniques with a more rectangular distribution of the radiant intensity over both width and length. Here the MODULATION TRANSFER FUNCTIONS are comparatively equal so indicating the same

dimensions for width and length. Additionally, in the absence of any earlier standards there is no sound reason to perpetuate the factor of 0,7 for the new range.

For FOCAL SPOTS in X-RAY TUBE ASSEMBLIES specified for special applications, such as for RECONSTRUCTIVE TOMOGRAPHY, where different properties of the width and the length of a FOCAL SPOT are intended, the multiplier 0,7 will not be applied.

The production of FOCAL SPOT STAR RADIOGRAMS has been standardized because of their usefulness in making a simple assessment of the imaging properties of a system under field conditions by establishing the STAR PATTERN RESOLUTION LIMIT under those conditions (assuming the FOCAL SPOT has such a characteristic).

Within the scope of this standard it is not intended to recommend or require that a statement of these characteristics should be part of the specification of an X-RAY TUBE ASSEMBLY. The information to be given with an X-RAY TUBE ASSEMBLY is the subject of IEC 601-2-28. This requires the NOMINAL FOCAL SPOT VALUE and the one-dimensional MODULATION TRANSFER FUNCTION to be given in the ACCOMPANYING DOCUMENTS (see the following table).

Methods for evaluation of specific aspects characterizing the FOCAL SPOT

Information obtained				
By means of a	According to section	About	According to section	Used for evaluating compliance with requirements on the
Pair of FOCAL SPOT SLIT RADIOGRAMS [1]	2	Dimensions	5	Specified NOMINAL FOCAL SPOT VALUE
		Imaging properties	6	Specified pair of one-dimensional MODULATION TRANSFER FUNCTIONS
FOCAL SPOT PINHOLE RADIOGRAM	3	Orientation		
		Radiation intensity distribution		
		Symmetry		
FOCAL SPOT STAR RADIOGRAM [2]	4	STAR PATTERN RESOLUTION LIMIT	7	
		BLOOMING VALUE	8	
		Modification of FOCAL SPOT properties over the life time		

NOTES

1 A method for the determination of the r.m.s. value of the line spread function as a further characteristic of the FOCAL SPOT is under consideration.

The r.m.s. value can give valuable information as a single value about the properties of the FOCAL SPOT with respect to the total imaging process of a system.

2 The distribution of radiant intensity over a FOCAL SPOT does not always provide a point where the MODULATION TRANSFER FUNCTION will reach the spatial frequency axis. In this case, the method by means of a FOCAL SPOT STAR RADIOGRAM is not applicable.