SLOVENSKI STANDARD
SIST EN 12544-2:2001

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Neporušitveno preskušanje - Meritve in vrednotenje napetosti na rentgenski cevi - 2. del: Preverjanje konstantnosti z metodo debelega filtra

Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 2: Constancy check by the thick filter method

Zerstörungsfreie Prüfung - Messung und Auswertung der Röntgenröhrenspannung - Teil 2: Konstanzprüfung mit dem Dickfilter-Verfahren

Essais non destructifs - Mesurage et évaluation de la tension des tubes radiogenes - Partie 2: Contrôle de la constance selon la méthode du filtre épais

Ta slovenski standard je istoveten z: **EN 12544-2:2000**

ICS:

19.100	Neporušitveno preskušanje	Non-destructive testing

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Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 2: Constancy check by the thick filter method

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This European Standard was approved by CEN on 24 December 1999.

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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.

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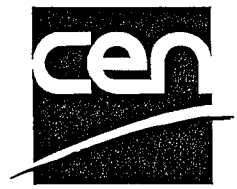

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 138, Non-destructive testing, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by August 2000, and conflicting national standards shall be withdrawn at the latest by August 2000.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.

In the framework of its scope, Technical Committee CEN/TC 138 entrusted CEN/TC 138/WG 1 "Ionizing Radiation" with preparing the following standard:

EN 12544-2, *Non-destructive testing - Measuremenent and evaluation of the X-ray tube voltage - Part 2: Constancy check by the thick filter method.*

EN 12544-2 is a part of series of European Standards; the other parts are the following:

EN 12544-1, *Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 1: Voltage divider method.*

EN 12544-3, *Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 3: Spectrometric method.*

Introduction

In order to cover the different requirements for the measurement of the X-ray tube voltage, three different methods are described in EN 12544-1 to EN 12544-3.

The voltage divider method (EN 12544-1) enables a direct and absolute measurement of the average high voltage of constant potential X-ray systems on the secondary side of the high voltage generator.

The thick filter method (EN 12544-2) describes a constancy check. This method is recommended for the regular stability check of an X-ray system.

The spectrometric method (EN 12544-3) is a procedure for non-invasive measurement of the X-ray tube voltage using the energy spectrum of the X-rays. This method can be applied for all X-ray systems and shall be applied whenever the voltage divider method is not applicable, e.g. in case of tank units where it is not possible to connect the voltage divider device.

1 Scope

This standard specifies a constancy check of a X-ray system where mainly the X-ray voltage is checked and also the tube current and the constitution of the target which can be changing due to ageing of the tube.

The thick filter method is based on a measurement of the dose rate behind a defined thick filter using defined distances between the X-ray tube, the filter and the measuring device.

This method is very sensitive to changes of the voltage, but it does not provide an absolute value for the X-ray tube voltage. Therefore, a reference value is needed and, it is recommended to find this reference, for example, within the acceptance test of the system.

The thick filter method is a rather simple technique and may be applied by the operator of an X-ray system to perform regularly a constancy check of the system.

The method can also be applied for consistency checks after changing components which may affect the X-ray tube voltage.

This method can be applied for all types of X-ray systems, i.e. for constant potential, half wave and impulse wave generators with a tube current larger than 1 mA.

2 Principle and equipment

The equipment to be used includes the following components, see Figure 1:

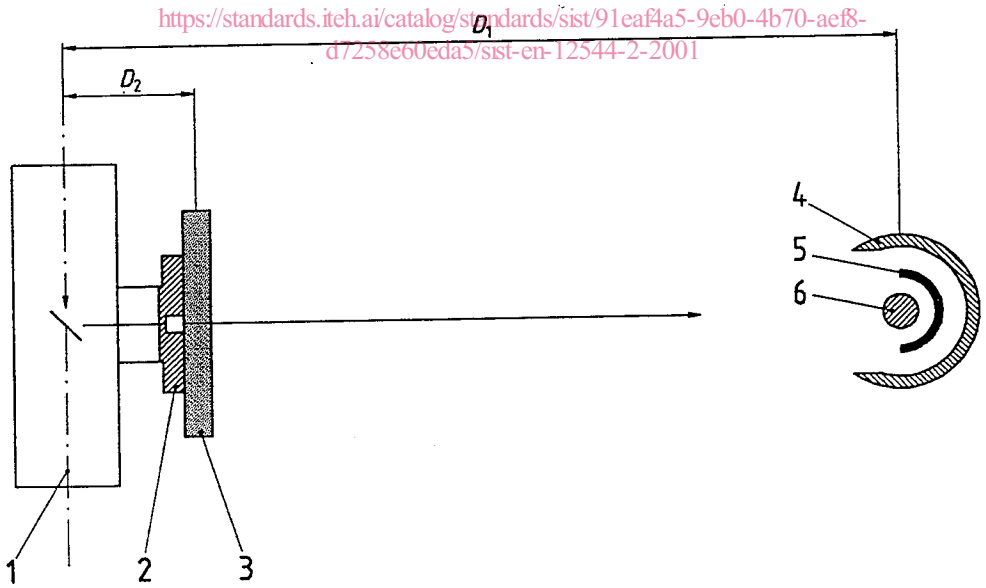
– the X-ray system;

– a specified collimator;

– a specified filter;

– suitable dose meter or dose rate meter;

– a film for the prove of good collimation and dose meter or dose rate meter adjustment.



Key

1 X-ray tube
2 collimator
3 thick filter
4 lead shield
5 film
6 dose meter

Figure 1 – Setup of the thick filter method

It is possible to apply any type of filter and distances. Two aspects are important:

– To obtain reproducible values, the collimator, the filter and the dose rate meter shall be identical and, the focus to filter distance D_2 and the focus to dose rate meter distance D_1 shall be fixed for the reference and all subsequent measurements.

– The filter material and thickness shall be selected according to Figure 2.

The requirements concerning the dose meter or dose rate meter are:

– The long term stability shall be 3 times better than the tolerance of the measured values. A regular stability check of the dose rate meter, using a radioactive source, is necessary.

– The device shall have adequate measuring ranges.

– The exposure time shall be selected to obtain values between 50 % and 100 % of the scale. Three or more measurements shall be taken and the results shall be averaged.

The diameter of the selected collimator shall be as small as possible. The area of homogeneous radiation intensity at the dose meter or dose rate meter shall be equal or less then 3 times of the size of the detection chamber of the dose meter. This shall be proven with a film exposure due to the requirement of exact adjustment. This radiograph marked with the date of measurement may be used for documentation. Figure 3 shows a typical radiograph of a dose meter which is well adjusted corresponding to Figure 1.

NOTE The results of the measurement arrangement are reliable if it provides the same value in horizontal and vertical adjustment.

Using the thick filter method, the measured values will change approximately 5 to 10 times faster (leverage factor) than the X-ray voltage changes. That means for example that 5 % of the X-ray tube voltage change corresponds to 25 % to 50 % of the measured dose rate.

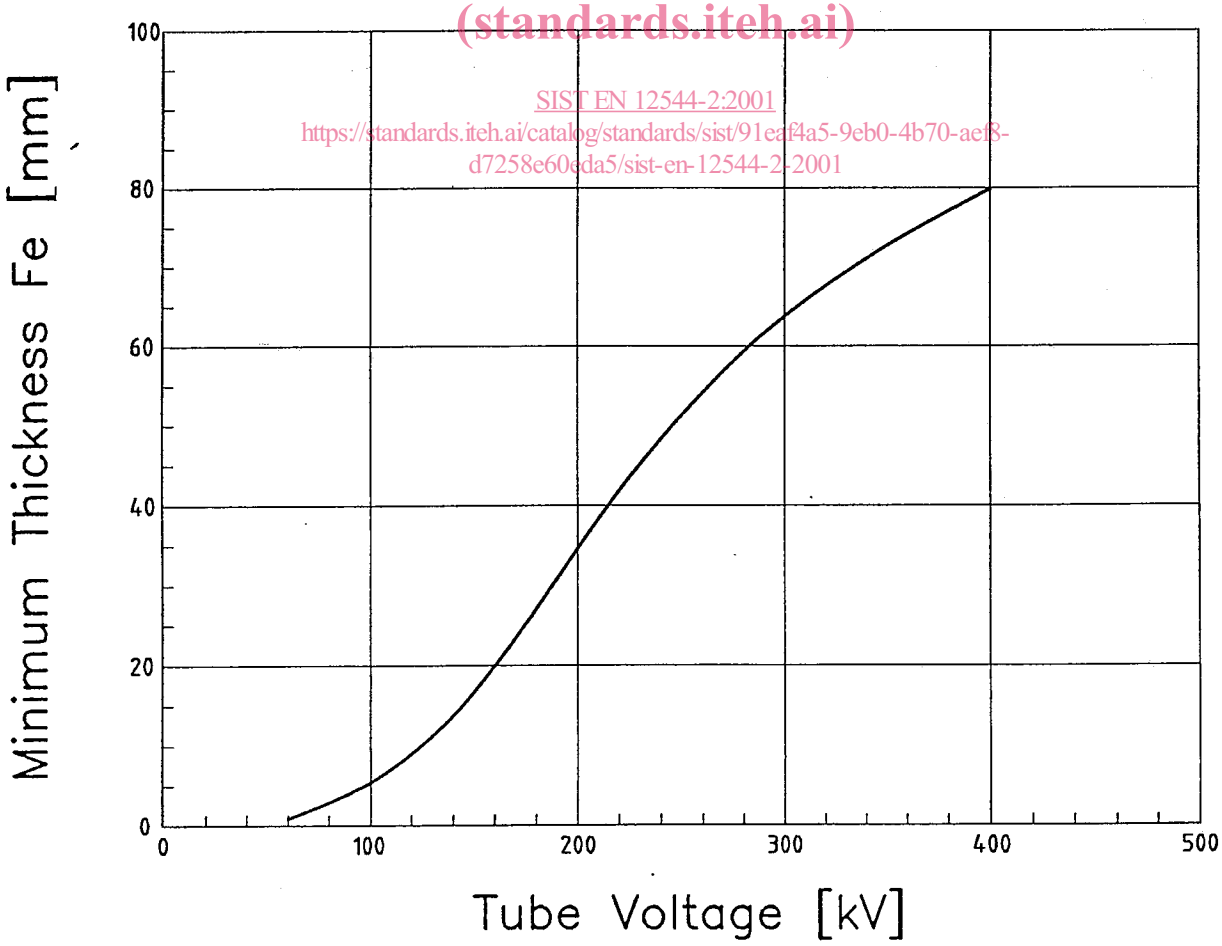


Figure 2 – Minimum filter thickness values

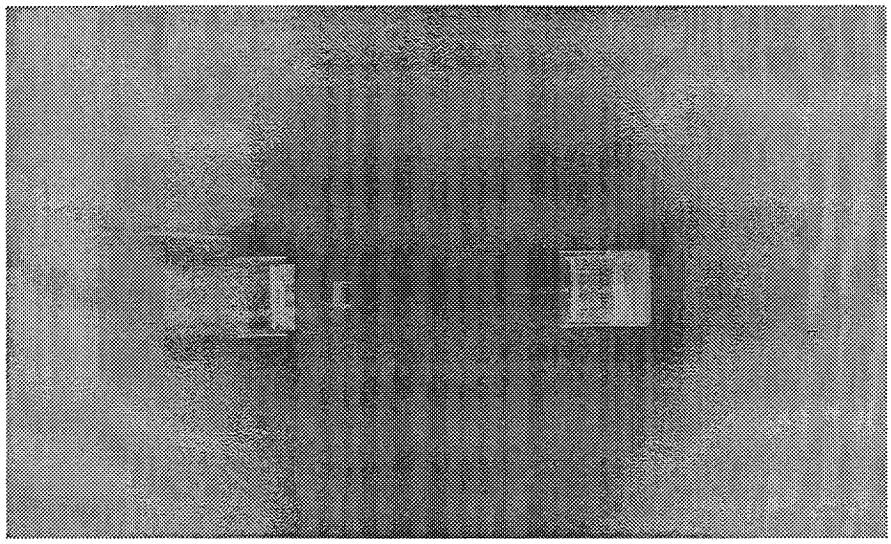


Figure 3 – Radiograph of the well-adjusted dose meter corresponding to Figure 1

3 Measurement

In order to carry out the constancy check of an X-ray system or the consistency check of an X-ray system to compare different components the dose rate is measured using a filter as given in Figure 2 or thicker.

3.1 Leverage factor

For the first application of the thick filter method the leverage factor L_v shall be determined corresponding to the selected setup. The dose value shall be measured at 100 % (D_{100}) and at 95 % (D_{95}) of the test voltage.

NOTE The leverage factor should be adjusted between 6 and 8. This is a compromise which considers limitations in exposure time. A high leverage factor is recommended for high accuracy of the method.

The leverage factor is calculated by equation (1)

$$L_v = (1 - D_{95} / D_{100}) / 0{,}05 \qquad (1)$$

3.2 Constancy check

The constancy test of the tube shall be repeated regularly at the given voltage. The arrangement corresponding to Figure 1 shall be used with the same collimator, thick filter (thickness and material) and the same calibrated dose meter for the constancy check. The constancy of the tube voltage is confirmed if the measured dose value or dose rate value has been reproduced within the required tolerance T (in %) which is calcualted by equation (2).

$$T = 100 \cdot | (D_{100measured} - D_{100nominal}) | / (D_{100nominal} \cdot L_v) \qquad (2)$$

Within the reference measurement all essential parameters (distances D1 and D2, filter material and thickness, type of dose meter or dose rate meter) shall be documented. The arrangement shall be identical for all subsequent measurements.

An example is given in Annex A.