

Method of

Measuring and defining the characteristics of anti-scatter grids used in X-ray equipment

[IEC title: Characteristics of anti-scatter grids used in X-ray
equipment]

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National foreword

This British Standard has been prepared under the direction of the Light Electrical Engineering Standards Committee.

It is identical with Publication 627:1978 “*Characteristics of anti-scatter grids used in X-ray equipment*”, published by the International Electrotechnical Commission (IEC).

Terminology and conventions. The text of the International Standard has been approved as suitable for publication, without deviation, as a British Standard. Some terminology and certain conventions are not identical with those used in British Standards.

Cross-reference. There is no British Standard equivalent for the ICRU Handbook 89 III C referred to in Appendix C for information purposes only. The handbook is obtainable from the International Commission on Radiation Units and Measurements, 7910 Woodmont Avenue, Washington DC, 20014, U.S.A.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 19 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

During the preparation of this standard a great number of systematic measurements have been made particularly in order to find out:

- the quantities influencing the accuracy of the measurement, and
- the variation of the characteristics of anti-scatter grids of the same type and specification.

While the first have led to satisfactory results on which the requirements of Clause 4 of this standard are based, the latter has shown that, at present, relatively wide manufacturing tolerances must be accepted in Sub-clause 5.3.

A future edition of this standard may restrict these tolerances.

The characteristics of anti-scatter grids cannot be measured with sufficient accuracy under normal conditions of use in medical X-ray equipment because this would involve the observation of a number of external influencing factors that cannot be adequately controlled or monitored.

Beyond the measuring arrangement according to Clause 4 of this standard and the appropriate performance of the X-ray generator to be used for the measurement, provisions must also be taken to exclude, or to compensate for, external influences, such as, for example, fluctuations of the supply voltage and frequency. This requires complete stability of the supply or corresponding measurements of all relevant quantities influencing the accuracy of the measurement during the test.

Therefore this standard is not intended to be applied for the determination of the characteristics of anti-scatter grids under conditions which must be expected in installations of X-ray equipment at the user's site outside special experimental set-ups with carefully controlled test conditions.

In addition, this standard is not intended to be applied for testing the manufacturing quality with respect to the homogeneity and mechanical performance over the entire effective area of an anti-scatter grid.

1 Scope

This standard deals with the definitions, determination and indication of characteristics of ANTI-SCATTER GRIDS used in X-RAY EQUIPMENT, in order to reduce the incidence of SCATTERED RADIATION, produced particularly in the body of the PATIENT, upon the X-RAY IMAGE RECEPTION AREA and thus to improve the contrast of the X-RAY PATTERN.

In this standard only LINEAR GRIDS are considered.

2 Terminology

2.1 Degree of requirements

In this standard the auxiliary verb

- “shall” implies that compliance with a requirement is mandatory for compliance with the standard
- “should” implies that compliance with a requirement is strongly recommended but is not mandatory for compliance with the standard
- “may” implies that compliance with a requirement is permitted to be accomplished in a particular manner, for compliance with the standard.

NOTE These definitions are under consideration.

2.2 Definitions

2.2.1

anti-scatter grid

a device to be placed before the X-RAY IMAGE RECEPTION AREA in order to reduce the incidence of SCATTERED RADIATION upon the X-RAY IMAGE RECEPTION AREA and thus improve the contrast of the X-RAY PATTERN

NOTE In accordance with this concept, terms such as “scattered ray grid”, “roentgen grid”, “diaphragm”, “bucky-grid”, “potter-bucky-grid”, “wafer grid”, shall not be used for the purposes of IEC documents.

2.2.2

linear grid

an ANTI-SCATTER GRID composed of high absorbing strips and low absorbing gaps which are parallel in their longitudinal direction

2.2.3

parallel grid

a LINEAR GRID where the planes of the absorbing strips are parallel to each other and perpendicular to the incident face

2.2.4

focussed grid

a LINEAR GRID where the planes of its absorbing strips converge to a line, at the FOCUSING DISTANCE. This line is parallel to the incident face of the LINEAR GRID

2.2.5

tapered grid

a LINEAR GRID in which the height of the absorbing strips decreases towards the edges perpendicularly and symmetrically to the CENTRAL LINE

2.2.6 Cross grid

An ANTI-SCATTER GRID consisting of two LINEAR GRIDS built together in such a way that the directions of their absorbing strips form an angle.

2.2.6.1

orthogonal cross grid

a CROSS GRID in which the directions of the absorbing strips form an angle of 90°

2.2.6.2

oblique cross grid

a CROSS GRID in which the directions of the absorbing strips form an angle other than 90°

2.2.7

stationary grid

an ANTI-SCATTER GRID used in such a way that it does not move in relation to the RADIATION BEAM

2.2.8

moving grid

an ANTI-SCATTER GRID used in an ACCESSORY that enables the ANTI-SCATTER GRID to be moved, when irradiated by a RADIATION BEAM, in order to avoid the imaging of the absorbing strips and the consequent loss of information

2.2.9 Geometric characteristics

2.2.9.1

strips per centimetre

Letter symbol: N Unit: cm^{-1}

the number of absorbing strips of a LINEAR GRID per centimetre

2.2.9.2

grid ratio

Letter symbol: r

the ratio between the height of the absorbing strips and the distance between the absorbing strips in the centre of a LINEAR GRID

2.2.9.3**focussing distance**

Letter symbol: f_0 Unit: cm

distance between the line into which the planes of the absorbing strips of a FOCUSED GRID converge and the incident face of the grid

for PARALLEL GRIDS the FOCUSING DISTANCE is infinite

NOTE Attention is drawn to the difference between “focussing distance”, “focal spot to grid distance” and “focal spot to film distance”.

2.2.9.4**application limits**

Letter symbol: f_1, f_2 Unit: cm

the lower, f_1 , and the upper, f_2 , limits of the distance from the FOCAL SPOT to the incident face of a FOCUSED GRID between which the obtained radiological information can generally be expected to be acceptable

2.2.9.5**central line**

on the outside of an ANTI-SCATTER GRID, a marked line on the incident face indicating:

on a PARALLEL GRID:

- the direction of the absorbing strips and
- the centre of the effective area;

on a FOCUSED GRID:

- the direction of the absorbing strips and
- the position of the strip perpendicular to the incident face;

on a CROSS GRID:

- the same indications for both directions of the absorbing strips.

2.2.10 Physical characteristics**2.2.10.1****transmission of primary radiation**

Letter symbol: T_p

the ratio between the INDICATED VALUE of PRIMARY RADIATION with an ANTI-SCATTER GRID placed in a specified beam of radiation and that with the ANTI-SCATTER GRID taken out of the beam under specific measuring conditions

2.2.10.2**transmission of scattered radiation**

Letter symbol: T_s

the ratio between the INDICATED VALUE of SCATTERED RADIATION with an ANTI-SCATTER GRID placed in a specified beam of radiation and that with the ANTI-SCATTER GRID taken out of the beam under specific measuring conditions

2.2.10.3**transmission of total radiation**

Letter symbol: T_t

the ratio between the INDICATED VALUE of the total radiation with an ANTI-SCATTER GRID placed in a specified beam of radiation and that with the ANTI-SCATTER GRID taken out of the beam under specific measuring conditions

2.2.10.4**selectivity**

Letter symbol: Σ

a relative improvement of the proportion PRIMARY RADIATION with respect to SCATTERED RADIATION expressed by the ratio between the TRANSMISSION OF PRIMARY RADIATION and the TRANSMISSION OF SCATTERED RADIATION determined under specific measuring conditions

2.2.10.5**contrast improvement ratio**

Letter symbol: K

a relative improvement of the proportion PRIMARY RADIATION with respect to total radiation expressed by the ratio between the TRANSMISSION OF PRIMARY RADIATION and the TRANSMISSION OF TOTAL RADIATION determined under specific measuring conditions

2.2.10.6**grid exposure factor**

Letter symbol: B

the ratio between the INDICATED VALUE of the total radiation without an ANTI-SCATTER GRID in a specified beam of radiation and that with the ANTI-SCATTER GRID placed in the beam under specific measuring conditions

2.2.11 Other terms**2.2.11.1****decentring of a focussed grid**

the distance between:

- the position of the FOCAL SPOT of an X-RAY TUBE and
- the plane through the CENTRAL LINE of a FOCUSED GRID and perpendicular to the incident face of the FOCUSED GRID.

2.2.11.2**defocussing of a focussed grid**

the difference between:

- the distance from the FOCAL SPOT of an X-RAY TUBE to the incident face of a FOCUSED GRID and
- the FOCUSING DISTANCE of that FOCUSED GRID.

2.3 Further definitions

Definitions of terms used in, but not defined in, this standard are given in Appendix B.

3 Structure

ANTI-SCATTER GRIDS usually consist of strips of high-absorbing material of thickness d and height h arranged at regular distances D from each other. The height h of the strips is either constant over the effective area of the ANTI-SCATTER GRID or decreases in TAPERED GRIDS from the highest strip – with the height h_0 – to the edges.

The interspace between the strips is usually filled with low absorbing material, and the active volume may be surrounded by a frame and covered by material to protect against mechanical damage, and to ensure the necessary rigidity of the device.

The geometrical relation of STRIPS PER CENTIMETRE, N , is:

$$N = \frac{1}{d + D}$$