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Test Standard for Determination of the Limiting Spatial Resolution of X-Ray Image Intensifier Systems

NEMA

ELECTRICAL MANUFACTURERS ASSOCIATION 2101 L STREET, N.W., WASHINGTON, D.C. 20037

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NEMA XR 11-1987

XR 11

Test Standard for Determination of the Limiting Spatial Resolution of X-Ray Image Intensifier Systems

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FOREWORD

This NEMA Standards Publication is one of a series of test standards developed by the X-ray Imaging Products Section and the medical diagnostic imaging industry for the measurement of performance characteristics governing the image quality of X-ray image intensifier (XRII) systems. These test standards are intended for the use of equipment manufacturers, prospective purchasers, and users alike. Manufacturers may find these standards useful in establishing standard test conditions for the determination of system performance specifications. Prospective equipment purchasers may benefit from these standards as the employment of standard test conditions and methods enables meaningful comparisons to be made of NEMA-referenced, competitive, equipment performance specifications. Users may also benefit from these standards through a better appreciation of the performance capabilities of X-ray image intensifier systems. It must be recognized, however, that not all test standards lend themselves to measurement at the installation site. Some test standards require instrumentation better suited to factory measurements while others require facilities of an instrumentation laboratory to assure stable test conditions necessary for reliable measurements.

Characterizing the parameters that govern image quality is a non-trivial task. The assessment of image quality lies in the eye of the beholder and so is a somewhat subjective measure influenced by the spatial, temporal, contrast, and noise characteristics of the image. Historically, many techniques have been developed employing varying degrees of sophistication to establish subjective and objective measures of these parameters. The NEMA X-ray Image Intensifier Systems Subcommittee has identified a set of parameters as key image quality performance characteristics of X-ray image intensifier systems and intends to prepare a set of NEMA Standards Publications for the following parameters:

Image Signal Uniformity,
Contrast,
Distortion,
Detective Quantum Efficiency (DQE),
Visible Field Size,
Modulation Transfer Function (MTF),
Noise Power Spectrum,
Limiting Spatial Resolution,
Signal to Noise Ratio.

This NEMA Standards Publication has been prepared by the X-ray Imaging Products Section of NEMA which periodically reviews it for any revisions necessary to keep it up to date with advancing technology. Comments or proposed revisions are welcomed and should be submitted to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

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PURPOSE

The procedures in this standard determine the highest spatial frequency of a bar pattern test object that can be resolved by visual observation of the image of the test object produced by an X-ray image intensifier (XRII) system under a given set of test conditions. The standard is intended as a means of determining the limiting spatial resolution (LSR) of a system set up according to the specifications of the system designer or manufacturer, and specifies the determination of the LSR at the central axis of the imaging system and the minimum LSR at a radius specified by the manufacturer or system designer.

The LSR is a subjective measure of the highest spatial frequency that is resolvable by the experienced observer throughout the region of measurement. While it is generally acknowledged that a system's resolving capability is best measured in terms of its modulation transfer function (MTF), which is both more definitive and more objective than the LSR, the LSR test, although subjective, is much simpler to perform. Since both techniques are widely used and find broad application, they are deemed worthy of coverage as separate NEMA Standards Publications.

Each stage of the imaging chain introduces an MTF loss. These losses are generally greater in areas away from the central axis of the imaging system than near the central axis causing the system resolution to be spatially (primarily radially) variant. The LSR also depends on the radiation contrast of the test object (a set of parallel, equidistant, lead bars described in 3.1), and the contrast is dependent on the energy spectrum of the radiation. Since the thickness of the lead foil in the test object is only 0.05 to 0.1 mm, radiation less penetrating than the standard, 7 mm aluminum half-value-layer radiation of the International Commission on Radiological Units and Measurements (ICRU) is required to assure adequate contrast of the pattern.

SCOPE

This document is the test standard for the determination of the limiting spatial resolution (LSR) of X-ray image intensifier (XRII) systems. These systems include optical viewing systems, video systems, photofluorographic film recording systems, and cine film recording and projection systems.

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TEST STANDARD FOR DETERMINATION OF THE LIMITING SPATIAL RESOLUTION OF X-RAY IMAGE INTENSIFIER SYSTEMS

Section 1

REFERENCED STANDARDS

Below is a complete listing of the titles and publication numbers of all publications referenced in full or in part, in this Standards Publication. The mailing address of each referenced organization is also provided.

I

The Aluminum Association
818 Connecticut Avenue, N.W.
Washington, D.C. 20006

ASD-1 1979 — *Aluminum Standards and Data*

II

International Commission on Radiological Units and Measurements
7910 Woodmont Avenue
Washington, D.C. 20014

10f — *Methods of Evaluating Radiological Equipment and Materials*

III

National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

XR 5-1984 — *Measurement of Dimensions and Properties of Focal Spots of Diagnostic X-Ray Tubes*

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Section 2
DEFINITIONS

2.1 ALUMINUM EQUIVALENT

The thickness of aluminum (type 1100 alloy) affording the same attenuation, under specified conditions, as the material in question.

NEMA Standard 3-11-1987.

2.2 AUTOMATIC BRIGHTNESS CONTROL

A device that automatically controls the brightness at a preselected location in the output of the XRII by control of one or more of the factors (e.g., X-ray tube current and voltage) influencing the electrical energy supplied to the X-ray tube.

NEMA Standard 3-11-1987.

2.3 AUTOMATIC EXPOSURE CONTROL

A device that automatically controls one or more of the technique factors in order to obtain at a preselected location(s) a desired quantity of radiation.

NEMA Standard 3-11-1987.

2.4 CENTRAL AXIS OF THE IMAGING SYSTEM

The line perpendicular to the XRII entrance plane passing through the geometric center of the output image of the XRII system.

NEMA Standard 3-11-1987.

2.5 CENTRAL AXIS OF THE X-RAY FIELD

The line perpendicular to the XRII entrance plane passing through the geometric center of the X-ray tube focal spot.

NEMA Standard 3-11-1987.

2.6 CENTRAL LIMITING SPATIAL RESOLUTION

The limiting spatial resolution determined at, or as near as possible to, the central axis of the imaging system.

NEMA Standard 3-11-1987.

2.7 COMPOSITE VIDEO SIGNAL

The video signal resulting from the combination of the image signal with the blanking and synchronization (sync) signals.

NEMA Standard 3-11-1987.

2.8 ENTRANCE FIELD SIZE

The diameter of the field in the entrance plane of the XRII system that, under specific conditions, is used for the transmission of information contained in the X-ray beam regarding objects through which the beam has passed.

NEMA Standard 3-11-1987.

2.9 ENTRANCE PLANE OF THE XRII SYSTEM

For an XRII in its housing, the plane perpendicular to the axis of the XRII and grazing the part of the XRII, including its housing, that protrudes most in the direction of the radiation source.

NEMA Standard 3-11-1987.

2.10 GEOMETRIC MAGNIFICATION

Magnification of an object in the X-ray field attributable to the relative distances of the object and the entrance plane of the XRII system from the X-ray tube focal spot.

NEMA Standard 3-11-1987.

2.11 HALF VALUE LAYER

The thickness of a specified material required to decrease the exposure rate of a beam of X-rays to one-half its initial value. For the purpose of this definition, the solid angle of the radiation beam is deemed to be as small as possible so that the quantity of scattered radiation included in the beam is minimized.

NEMA Standard 3-11-1987.

2.12 KILOVOLTS PEAK (kVp)

The maximum potential difference in kilovolts, applied, during an exposure, between the anode and cathode of an X-ray tube.

NEMA Standard 3-11-1987.

2.13 LIMITING SPATIAL RESOLUTION (LSR)

For an XRII system, the highest spatial frequency bar pattern that an experienced observer can visually resolve. A bar pattern (of the type described in 3.1) is deemed to be resolved if the observer can visually distinguish the complete pattern of two lead bars and three spaces, with the assistance of optical magnification, in the output image of the XRII system. The LSR determined by experienced observers is generally 5 to 10 percent higher than that determined by inexperienced observers.

NEMA Standard 3-11-1987.

2.14 MULTIPLE FIELD XRII SYSTEM

An XRII system incorporating an XRII having more than one, discretely selectable, entrance field size.

NEMA Standard 3-11-1987.

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2.15 OFF-AXIS LIMITING SPATIAL RESOLUTION

The lowest value of the LSR, either radial or tangential, determined in any quadrant of the output image of the XRII system at specific radii measured from the central axis of the imaging system and referred to the entrance plane of the XRII system. The radii are to be specified by the system manufacturer. Specification of an off-axis LSR provides a means of establishing the system response to optical and electron-optical aberrations.

NEMA Standard 3-11-1987.

2.16 OUTPUT IMAGE OF THE XRII SYSTEM

The image produced by the XRII system that is visually perceivable by a human observer. Output images of specific channels of the system are:

a. The processed photofluorographic film frame;
b. The processed cine frames observed on the projection screen when projected at a rate of 60 frames per second using the manufacturer's recommended projector systeme
c. The television monitor display screen;
d. The XRII output screen as relayed to the observer by the optical viewing system.

NEMA Standard 3-11-1987.

2.17 RADIAL LIMITING SPATIAL RESOLUTION

The LSR determined with the bars of the test object perpendicular to the radius from the central axis of the imaging system to the position of the test object.

NEMA Standard 3-11-1987.

2.18 RADIATION QUALITY

The characteristic of ionizing radiation determined by the spectral distribution of a radiation quantity with respect to radiation energy.

NEMA Standard 3-11-1987.

2.19 SOURCE TO ENTRANCE PLANE DISTANCE (SED)

The distance from the focal spot of the X-ray tube to the entrance plane of the XRII system measured along the central axis of the X-ray field.

NEMA Standard 3-11-1987.

2.20 TANGENTIAL LIMITING SPATIAL RESOLUTION

The LSR determined with the bars of the test object parallel to the radius from the central axis of the imaging system to the position of the test object.

NEMA Standard 3-11-1987.

2.21 TOTAL FILTRATION

The filtration, expressed in aluminum (Al) equivalent, due to all of the X-ray attenuating materials that are interposed between the X-ray tube focal spot and the X-ray beam entrance plane of the object being imaged.

NEMA Standard 3-11-1987.

2.22 X-RAY IMAGE INTENSIFIER (XRII) SYSTEM

That portion of an X-ray imaging system consisting of the XRII with its housing and the subsequent components of the imaging chain responsible for transmitting and displaying the detected X-ray pattern.

NEMA Standard 3-11-1987.

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Section 3
TEST EQUIPMENT

3.1 RESOLUTION TEST OBJECT

The test object includes several pairs of orthogonal square wave patterns at several spatial frequencies. Each member of a pattern pair consists of three equidistant, parallel spaces separating two bars. A bar and space are of equal width and constitute a line pair. Spatial frequency is measured in terms of line pairs per mm (1p/mm). An example of a suitable test pattern is shown in Figure 3-1.

The test object is formed from 0.1 mm thick lead foil for spatial frequencies less than 5 1p/mm and from 0.05 mm thick lead foil for frequencies greater than or equal to 5 1p/mm. The length of the bar shall be at least ten times its width. The test object is encased between thin protective covers having low X-ray absorption.

For test objects containing frequencies less than or equal to 5 1p/mm, the increment between frequencies shall not exceed 0.2 1p/mm. For objects containing frequencies greater than 5 1p/mm, the frequency increment shall not exceed 0.4 1p/mm. When the determination of LSR is made, there shall be present on the test object at least one square wave pattern of a frequency one increment higher than the LSR and one square wave pattern of a frequency one increment lower than the LSR. It is necessary that the spatial frequencies of a test object be determined by measurement rather than by reference to the nominal values provided with the pattern.

NEMA Standard 3-11-1987.

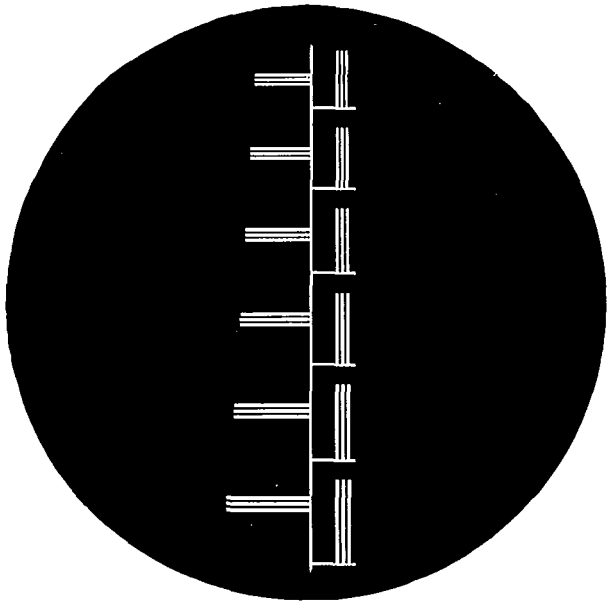

Figure 3-1
EXAMPLE OF A TEST OBJECT SUITABLE FOR THE DETERMINATION OF LIMITING SPATIAL RESOLUTION

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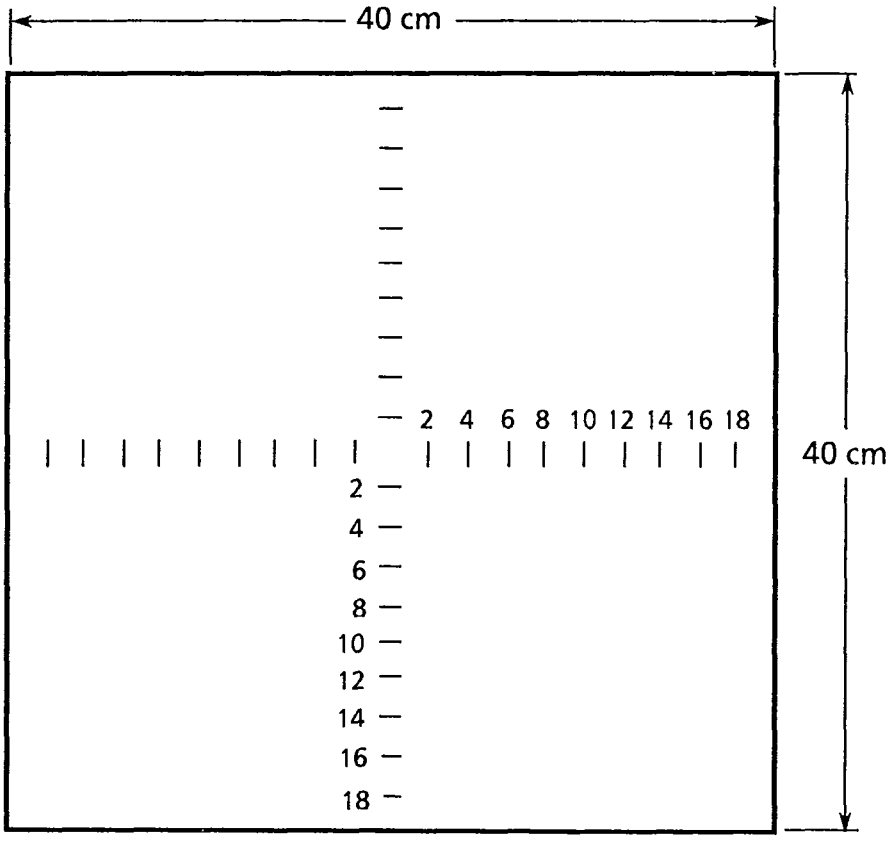
3.2 IMAGE POSITION CALIBRATION TEMPLATE

An image position calibration template, such as that shown in Figure 3-2, is used to locate the central axis of the imaging system and the radii of off-axis positions at which the LSR is determined. The template consists of a thin, radiolucent panel imprinted with radio-opaque demarkations to provide orthogonal axes along which distance measurements are made. The interval between the demarkations shall not exceed 2 cm. The overall size of the template shall equal or exceed the maximum entrance field size of the XRII system.

NEMA Standard 3-11-1987.



NOTE: Overall dimensions can be adjusted to accommodate variations in the maximum entrance field size among imaging systems

Figure 3-2
IMAGE POSITION CALIBRATION TEMPLATE

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Section 4
PROCEDURE

4.1 STANDARD SYSTEM TEST CONDITIONS

The system is to be set up according to the specifications of the manufacturer. During the test, except where explicitly permitted, no changes shall be made of the system calibration. This includes, but is not limited to, the focus of the XRII, lenses, and video camera, and the aperture of any lens. LSR must be determined at center and off-axis, in the radial and tangential directions, and for each entrance field size with a single system configuration.

It is recognized that under some conditions, it will be necessary to remove a grid or disassemble a window covering to satisfy the test conditions. Deviations from the standard test shall be permitted only where it is impractical to meet those conditions. Such deviations must be explicitly stated in the Statement of Compliance.

NEMA Standard 3-11-1987.

4.1.1 LSR Test Conditions

The following standard LSR test conditions are mandatory on equipment where they can be realized.

a. *Radiation Source.* The focal spot size recommended by the system manufacturer shall be used for the resolution test. If this is other than a NEMA Standard 0.6 mm (NEMA Standards Publication XR 5-1984) then the NEMA equivalent focal spot employed shall be indicated in the Statement of Compliance (5.0).

NEMA Standard 3-11-1987.

b. *Total Filtration.* The total filtration shall be 2.5 mm Al equivalent. The LSR shall be determined with no additional filtration between the X-ray tube and the test pattern (other than such filtration as the system may impose, e.g., tabletop, spot film window, etc.).

NEMA Standard 3-11-1987.

c. *Radiation Energy Spectrum.* The LSR determination shall be made at 50 kVp or the minimum kVp of the system's X-ray generator if this latter value exceeds 50 kVp. The kVp at which the determination is made shall be included in the Statement of Compliance (5.0).

NEMA Standard 3-11-1987.

d. *Collimator Aperture.* The collimator aperture shall be in correspondence with the entrance field size image. The maximum entrance field size shall be implied. If less than the maximum field is imaged, e.g., due to overframing (displaying less than the entire entrance field area in the output of the XRII system) or by selection of a reduced field size of a multiple field XRII, then the actual field size imaged, referred to the entrance plane, shall be stated in the Statement of Compliance (5.0).

NEMA Standard 3-11-1987.

4.1.2 Source to Entrance Plane Distance (SED)

The standard SED shall be 100 $\pm$ 1 cm. Equipment of fixed SED or equipment whose adjustment range does not span the standard SED shall be tested at the spacing recommended by the manufacturer, and such spacing shall be reported with the Statement of Compliance (5.0).

NEMA Standard 3-11-1987.

4.1.3 Alignment

The central axis of the X-ray field shall be colinear with the central axis of the imaging system. The displacement of these two axes shall not exceed 2 percent of the SED in the entrance plane of the XRII.

NEMA Standard 3-11-1987.

4.1.4 Position of the Resolution Test Object

If the entrance plane of the XRII is accessible, the test object shall be positioned directly in the entrance plane. If the entrance plane is inaccessible, the test object shall be placed as close to the entrance plane as possible, e.g., directly on the antiscatter grid, tabletop, etc., and the distance between the test pattern and the XRII entrance plane shall be stated. The resulting geometric magnification of the test object shall be stated for the central axis of the X-ray field, and the LSR so determined shall be corrected for geometric magnification disregarding any effects of a finite focal spot. In order to avoid interference, the bars of the test object shall be oriented at an angle of 45 degrees with respect to the TV raster lines or the lines of an unremovable grid.

For the determination of central and off-axis LSR, the resolution test object shall be located in the entrance plane of the XRII system with the aid of an image position calibration template such as that described in 3.2. The template shall be positioned in the entrance plane of the XRII system and centered in the output image of the XRII system using the demarkations along the template's axes.

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4.1.5 Antiscatter Grid

The antiscatter grid shall be removed since the LSR is determined without a scattering object interposed between the radiation source and the XRII entrance plane (except for relatively X-ray transparent objects such as the tabletop and automatic exposure control detectors). If removal is not feasible, the LSR shall be determined with the grid left in place, and the grid characteristics, i.e., grid ratio, lines per cm or inch, interspace material, and cover material, shall be stated in the Statement of Compliance (5.0).

NEMA Standard 3-11-1987.

4.1.6 Exposure Recording and Processing Conditions

Since the radiation is not attenuated by a patient or a patient-equivalent phantom during the determination of the LSR, the automatic brightness control or automatic exposure control of the equipment can be expected to cause an over-exposure at the radiation energy spectrum required. In such an event, the exposure rate or exposure per frame shall be adjusted manually in order to obtain the manufacturer's prescribed video signal or the proper density of the test film. Systems with fixed or variable optical apertures shall employ the aperture required when the system is calibrated to the manufacturer's criteria. The film recording materials and development processing employed in the determination of the LSR of filming systems shall be those recommended by the system manufacturer for conventional clinical applications. A series of test exposures over a range of densities shall be taken at the beginning of the determination, and the exposure that shows the test pattern optimally resolved shall be used.

NEMA Standard 3-11-1987.

4.1.6.1 XRII Photofluorographic System

The camera shall be set for single exposures.

NEMA Standard 3-11-1987.

4.1.6.2 XRII Cine System

Cine film shall be projected at 60 frames per second employing the system manufacturer's recommended projection system.

NEMA Standard 3-11-1987.

4.1.6.3 XRII Video System

The exposure rate shall be adjusted to achieve the manufacturer's recommended composite video signal level at the TV monitor input. The brightness and contrast controls of the TV monitor the room illumination, and the viewing distance shall be adjusted to obtain the best overall discernibility of the test object.

NEMA Standard 3-11-1987.

4.1.6.4 XRII Optical Viewing System

The exposure rate shall be adjusted so that the resolution of the test object is not limited by insufficient brightness. The room illumination shall be adjusted to obtain the best overall discernibility of the test object.

NEMA Standard 3-11-1987.

4.2 DETERMINATION OF THE LSR

The LSR shall be determined at the central axis of the imaging system and at off-axis locations in the four quadrants of the image at one or more specific radii, referred to the entrance plane of the XRII system, as specified by the system manufacturer.

NEMA Standard 3-11-1987.

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Section 5
STATEMENT OF COMPLIANCE

If a manufacturer desires to state his product is in compliance with this NEMA Standard, the statement of compliance shall include the following information:

XRII system type identification,
Image field size,
kVp,
Central LSR in the system output image,
Off-Axis LSR in the system output image,
Entrance plane radius for Off-Axis LSR value.

The Off-Axis LSR at the corresponding entrance plane radius shall be stated as the single value determined to be the minimum of all of the respective radial and tangential resolution determinations in the four quadrants of the system output image. Average or typical values shall not be used in the determination.

Compliance with this Standard shall be stated as "Limiting Spatial Resolution per NEMA Standard XR 11-1987."

It is recommended that the following tabular format for the presentation of the required date be used.

LIMITING SPATIAL RESOLUTION PER NEMA STANDARD 1987[1]

XRII System	kVp	Imaged Field Size[2] (mm)	Central LSR (1p/mm)	Off-Axis LSR (1p/mm)	Off-Axis Radius[2] (mm)
Optical					
Video					
___ mm Cine[3]					
___ mm Photo-fluorographic[3]					

[1]Deviations from the standard test conditions of 4.1 shall be listed, e.g.,
Spatial resolution at other than the specified radiation quality: state the kVp and filtration used.
Determination with the Resolution Test Object out of the entrance plane of the XRII system: state the distance of the object from the entrance plane and the geometric magnification factor employed.
Grid not removable: state grid characteristics, i.e., ratio, line frequency, interspace material, and cover material.
Determination at non-standard SED: state the SED used.

[2]Referred to the entrance plane of the XRII system.

[3]Nominal camera frame size designation, e.g., 35 mm or 105 mm.

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X-RAY IMAGING PRODUCTS SECTION
OF THE
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

MEMBER COMPANIES

ADAC Laboratories
Milpitas, CA 95035

Advanced Instrument Development, Inc.
Melrose Park, IL 60160

Belmont Equipment Corp.
Somerset, NJ 08873

Bennett X-Ray Corp.
Copiague, NY 11726

Canon U.S.A., Inc.
Jericho, NY 11753-1679

Capintec, Inc.
Pittsburgh, PA 15238

Continental X-Ray Corp.
Broadview, IL 60153

Dimensional Medicine, Inc.
Minnitonka, MN 55343

Dornier Medical Systems, Inc.
Marietta, GA 30067

Eastman Kodak Co.
Kodak Apparatus Div.
Rochester, NY 14650

EIMAC
Div. of Varian
Salt Lake City, UT 84104

Elema-Schonander, Inc.
Schaumburg, IL 60173-3887

Elscint, Inc.
Boston, MA 02215

Eureka X-Ray Tube Co.
Chicago, IL 60641

Fischer Imaging Corp.
Denver, CO 80241

Gammex, Inc.
Milwaukee, WI 53226

General Electric Co.
Medical Systems Group
Milwaukee, WI 53201

Hewlett-Packard Co.
Medical Products Group
McMinnville, OR 97128

Imatron, Inc.
South San Francisco, CA 94080

Keystone X-Ray, Inc.
Neptune Township, NJ 07753

Liebel Flarsheim Co.
Cincinnati, OH 45215

Lixi, Inc.
Downers Grove, IL 60515

The Machlett Laboratories, Inc.
Stamford, CT 06907

Medicor USA Ltd.
Columbus, OH 43212

MEICOR
Pleasanton, CA 94566

J. Morita U.S.A., Inc.
Tustin, CA 92680

Nuclear Associates
Div. of Victoreen, Inc.
Carle Place, NY 11514

Oldelft Corp. of America
Fairfax, VA 22031

Philips Medical Systems, Inc.
Shelton, CT 06484

Picker International, Inc.
Highland Heights, OH 44143

Dunlee, Inc.
Bellwood, IL 60104

Siemens Medical Systems, Inc.
Iselin, NJ 08830

Thomson-CGR Medical Corp.
Columbia, MD 21046

Thomson-CSF Electron Tubes
Dover, NJ 07801

3 M
Imaging Systems Div.
St. Paul, MN 55144

Toshiba Medical Systems
Tustin, CA 92680

Transworld X-Ray Corp.
Charlotte, NC 28224

Universal/Allied Imaging, Inc.
Chicago, IL 60651

Xerox Medical Systems
Pasadena, CA 91107

XRE Corp.
Littleton, MA 01460

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NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status, are set forth in certain clauses of the NEMA Bylaws, which are quoted below:

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

(Bylaw—Art. V, Sec. 1)

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process, or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment, and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

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