

NEMA XR 29-2013
*Standard Attributes on CT Equipment Related
to Dose Optimization and Management*

Published by:

National Electrical Manufacturers Association
1300 North 17th Street
Rosslyn, Virginia 22209

www.nema.org

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FOREWORD

The first edition of this standard is intended to identify four key features of CT scanners which contribute to or help perform optimization and or management of doses of ionizing radiation while still enabling the system to deliver the diagnostic image quality needed by the physician.

This standard was developed by the CT Group of the X-Ray Imaging Section of the Medical Imaging & Technology Alliance (MITA), a division of NEMA. Inquiries, comments, and proposed or recommended revisions should be submitted to the X-Ray Imaging section by contacting:

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At the time of the approval of the standard, the CT group was composed of the following members:

GE Healthcare
Hitachi Medical Systems America, Inc.
Neusoft Medical Systems USA, Inc.
Neurologica
Philips Healthcare
Siemens Medical Solutions USA, Inc.
Toshiba America Medical Systems

At the time of the approval of the standard, the X-Ray Imaging section was composed of the following members:

Advanced Instrument Development Inc.
Agfa HealthCare
Aribex, Inc.
Bioptics, Inc.
Capintec, Inc.
CIRS
Eizo Nanao Corporation
EOS imaging
FUJIFILM Medical Systems U.S.A., Inc.
GE
GE Healthcare
Hitachi Medical Systems America, Inc.
Hologic Inc.
Konica Minolta Medical Imaging USA, Inc.
Median Technologies Inc.
Medtronic Navigation
NeuroLogica Corporation
Neusoft Medical Systems, USA, Inc.
Philips Healthcare
Shimadzu Medical Systems
Siemens Healthcare
The Phantom Laboratory
Toshiba America Medical Systems Inc.
Ziehm Imaging, Inc.

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Section 1 OVERVIEW

1.1 SCOPE

This standard identifies common computed tomography (CT) system (i.e. scanner) attributes that contribute to or help perform optimization/management of doses of ionizing radiation while still enabling the system to deliver the diagnostic image quality needed by the physician. The CT group, MITA and NEMA as a whole conveys its determination and commitment to help ensure that clinicians have the tools needed to manage the amount of radiation that is used.

1.2 RATIONALE

This standard is established to assist health care providers to ensure that patients undergoing CT exams undergo procedures that produce images that are of diagnostic quality while optimizing use of ionizing radiation. The features identified will assist healthcare provides to incorporate up-to-date dose-related features on the devices they utilize in order to maintain the established standard of care established by professional societies and regulatory agencies.

1.3 REFERENCES

1.3.1 Normative References

By reference herein the following normative documents are adopted, in whole, or in part as indicated in this standards publication.



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|--------------------|---|
| DICOM PS 3.16-2011 | <i>Content Mapping Resource</i> |
| DICOM PS 3.3-2011 | <i>Information Object Definitions</i> |
| NEMA XR-25-2010 | <i>Computed Tomography Dose Check</i> |
| NEMA XR 28-2013 | <i>Supplemental Requirements for User Information and System Function Related to Dose in CT (to be published)</i> |

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| IEC 60601-2-44 Ed. 3 and Ed. 3.1 | <i>Particular requirements for the basic safety and essential performance of X-ray equipment for computed tomography</i> |
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Section 2 DETAILED INFORMATION ON ATTRIBUTES

2.1 GENERAL

This standard identifies common computed tomography (CT) system (i.e. scanner) attributes that contribute to or help perform optimization and/or management of doses of ionizing radiation while still enabling the system to deliver the diagnostic image quality needed by the physician. These attributes include DICOM Dose Structured Reporting, incorporation of the features and functionality that conform to NEMA XR-25 *Computed Tomography Dose Check*, various forms of automatic exposure control, and reference pediatric and adult protocols.

2.2 DICOM RADIATION DOSE STRUCTURED REPORTING (RDSR)

The CT DICOM structured dose report enables capturing of post exam dose information in a standardized electronic format that can be included in the patient record. It is also the key to being able to monitor and track doses for establishment of diagnostic reference levels as well as facility dose management and quality assurance.

This information can be found in DICOM PS 3.3-2011 *Information Object Definition*.

2.3 DOSE CHECK FEATURE

The *Computed Tomography Dose Check* standard provides for features that notify and alert the CT equipment operators, generally technologists, that prepare and set scan parameters (the settings for a particular scan to be administered to a particular patient) prior to a scan. If the estimated dose index is above the value defined and set by the operating group, practice, or organization then a notification is sent to the operator so that person can check the (intended) dose.

This attribute is defined in NEMA XR-25 *Computed Tomography Dose Check* and is additionally defined in IEC 60601-2-44 Ed. 3.1, paragraph 203.107 "Safety measures against excessive X-RADIATION."

2.4 AUTOMATIC EXPOSURE CONTROL

Automatic exposure control (AEC) is an operational mode that tailors a CT system's radiation output to the specific body regions and parts being imaged in order to manage the radiation delivered to obtain the desired level of diagnostic quality.

Reference IEC 60601-2-44 Ed. 3.1, paragraph 203.106 "Control of RADIATION output" for AEC. Additionally, NEMA XR 28-2013 *Supplemental Requirements for User Information and System Function Related to Dose in CT* (to be published) contains a general explanation of AEC functionality that may be present on a CT system.

2.5 REFERENCE ADULT AND PEDIATRIC PROTOCOLS

A protocol is a set of scanning parameters (such as scan type(s): kV, mA, collimation, rotation speed, reconstruction algorithm, etc.) established to accomplish a particular clinical task (such as capturing an image of the abdomen). Protocols pre-loaded on a CT system that may be selected at the operator's discretion are called reference protocols. Manufacturers develop reference protocols through detailed knowledge of the system's specific performance characteristics and input from clinical collaborators.

Protocols may be in the format defined in NEMA XR 28-2013 (to be published).

Section 3

IMPLEMENTATION OF STANDARD ATTRIBUTES

3.1 MANAGING IMPLEMENTATION

The features identified will assist healthcare providers to incorporate up-to-date, dose-related features on the devices they utilize in order to maintain the established standard of care established by professional societies and regulatory agencies. Each of the attributes contributes to dose optimization and/or dose management. Even with such attributes on the equipment, clinicians must ensure that operators are trained and knowledgeable of the functions and operations of these attributes in addition to facilities' radiation management policies and procedures.

