

ICS 19.100
CCS N78



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/Z 41476.3-2022

Non-destructive testing instruments - Radiation protection rules for the technical application of X-ray equipment up to 1MV - Part 3: Formulas and diagrams for the calculation of radiation protection for X-ray equipment up to 450kV

无损检测仪器 1MV以下X射线设备的辐射防护规则 第3部分：450kV以下X射线设备辐射防护的计算公式和图表

Issued on: April 15, 2022

Implemented on: April 15, 2022

**Issued by: State Administration for Market Regulation;
Standardization Administration of China**

Table of Contents

- 1 Scope
- 2 Normative references
- 3 Terms and Definitions
- 4 Calculation of main parameters

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part

1. Structure and Drafting Rules of Standardization Documents" drafted. This document is part 3 of GB /Z 41476 "Rules for Radiation Protection of X-ray Equipment Below 1MV for Nondestructive Testing Instruments". GB /Z 41476 has published the following parts.

- 1. General safety technical requirements;
- 2. Technical requirements for protection;
- 3. Calculation formulas and charts for radiation protection of X-ray equipment below 450kV;
- 4. Calculation of the control area. Please note that some content of this document may be patented. The issuing agency of this document assumes no responsibility for identifying patents. This document is proposed by China Machinery Industry Federation. This document is under the jurisdiction of the National Standardization Technical Committee of Testing Machines (SAC/TC122). This document is drafted by: Suzhou CTI Testing Technology Co., Ltd., Liaoning Advanced Equipment Manufacturing Base Construction Engineering Center, Shenzhen Guoji Instrument Co., Ltd., Edson (Xiamen) Electronics Co., Ltd., Institute of Applied Electronics, Chinese Academy of Engineering Physics, Guangdong Zhengye Branch Technology Co., Ltd., Shanghai Yinghua Testing Technology Co., Ltd., General Electric Testing and Control Technology (Shanghai) Co., Ltd., Dandong Nondestructive Testing Testing Equipment Co., Ltd., Shanghai Chaoqun Nondestructive Testing Equipment Co., Ltd., Bohai Shipyard Group Co., Ltd., Liaoning Instrument Research Institute Co., Ltd. any company. The main drafters of this document. Zeng Xiaohu, Xu Haigeng, Zhu Ping, Lin Junming, Chen Hao, Sheng Zhoulin, Kong Fanqin, Li Bo, Dong Diangang, Fu Yan, Liu Chunwei, Wang Lin.

X-rays are electromagnetic waves with extremely short wavelengths and high energy, and their wavelengths are shorter than those of visible light. As five routine detection methods One, X-ray detection has been widely used in industrial non-destructive testing. Because of its strong penetration, it will cause certain damage to the body of the inspector. The safety

protection problem in this X-ray inspection has received extensive attention. GB /Z 41476 aims to establish protection requirements for X-ray equipment below 1MV And personnel safety protection rules, it is proposed to be composed of 4 parts.

1.General safety technical requirements. The purpose is to give the dose limit for personnel in the operation of X-ray equipment below 1MV, Equipment usage requirements, etc.

2.Technical requirements for protection. The purpose is to provide effective, Reliable radiation protection measures.

3.Calculation formulas and charts for radiation protection of X-ray equipment below 450kV. The purpose is to give 450kV to The calculation formulas and related charts of the main technical indicators of X-ray equipment protection are listed below, which is convenient for the analysis of relevant data in the process of X-ray protection. calculate.

4.Calculation of the control area. The purpose is to provide a calculation method for the control area of X-ray equipment below 1MV, and for the third Some content is further supplemented. Non-destructive testing equipment for X-ray equipment below 1MV
Radiation Protection Regulations Part

3.Below 450kV Calculation formulas and charts for radiation protection of X-ray equipment

1 Scope

GB/Z 41476.3-2022 is the Chinese national standard on non-destructive testing instruments - radiation protection rules for the technical application of x-ray equipment up to 1mv - part 3: formulas and diagrams for the calculation of radiation protection for x-ray equipment up to 450kv, in the field of testing. The /Z suffix marks it as a guiding technical document: it does not prescribe requirements that can be certified against, but sets out the technique, the method or the state of the art that the standards bodies recommend following. It was issued on 15 April 2022 by the State Administration for Market Regulation; Standardization Administration of China. As a guiding technical document it carries no separate date of entry into force: it applies from publication. Classification: ICS 19.100, CCS N78. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This document describes the main radiation protection involved in the production, commissioning and operation of X-ray non-destructive testing equipment below 450kV Calculation formulas and charts of parameters, and calculation methods of protective layer of fixed working equipment. This document applies to safety protection during the production, commissioning and operation of X-ray non-destructive testing equipment below 450kV, and also applies to basic Safety protection for X-ray equipment with tungsten anode target.

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, dated citations documents, only the version corresponding to that date applies to this document; for undated references, the latest edition (including all amendments) applies to this document. GB /Z 41476.1-2022 Radiation protection rules for X-ray equipment below 1MV of non-destructive testing instruments Part

1.General Safety technical requirements GB /Z 41476.4-2022 Radiation protection rules for X-ray equipment below 1MV of non-destructive testing instruments Part

3 Terms and Definitions

There are no terms and definitions that need to be defined in this document.

4 Calculation of main parameters

4.1 General rules The measured working voltage in this document adopts a constant DC voltage; when a rectifier circuit without a constant DC voltage is used, the highest tube voltage. The radiation protection distance can be obtained by calculation, and its change is related to the thickness of the material. The parameters required for the calculation are as follows:

--- For fixed X-ray equipment, relevant necessary parameters (rated tube voltage, tube current, beam angle, radiation leakage agent) should be given. amount), the protective distance of the radioactive source, the thickness of the protective material, and the above parameters should not exceed the specified radiation dose limit;

--- For mobile X-ray equipment, relevant necessary parameters (rated tube voltage, tube current, beam angle, radiation leakage agent) should be given. The maximum radiation dose rate in the control area does not exceed $40\mu\text{Sv/h}$.

Note. The radiation protection distance of X-ray equipment exceeding the rated tube voltage should be consulted with the manufacturer and supplier. The radiation protection distances are relative to DC voltages and can also be applied to AC voltages. When calculating the radiation protection distance of fixed equipment, the maximum value of the relevant working parameters of the X-ray equipment (the maximum value at the maximum tube voltage) should be used. maximum tube current). For the calculation of the radiation protection distance of mobile X-ray equipment, the actual working parameters of the equipment (tube current and tube power) should be used. pressure). Other sources of ionizing radiation also need to be considered when calculating the protective distance.