INTERNATIONAL STANDARD

**ISO 19232-5**

Third edition
2018-08

# Non-destructive testing — Image quality of radiographs —

## Part 5: Determination of the image unsharpness and basic spatial resolution value using duplex wire-type image quality indicators

*Essais non destructifs — Qualité d'image des radiogrammes —*

*Partie 5: Détermination de l'indice de flou de l'image et de la résolution spatiale de base à l'aide d'indicateurs de qualité d'image duplex à fils*

Reference number
ISO 19232-5:2018(E)

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Published in Switzerland

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 5, *Radiation methods.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This third edition cancels and replaces the second edition (ISO 19232-5:2013), which has been technically revised. The main changes compared to the previous edition are as follows:

— new high definition duplex IQI;

— extended description of usage;

— extended table with basic spatial resolution and linepairs/mm;

— evaluation of duplex wire-type IQI by visual evaluation and evaluation with profile function in digital images.

A list of all parts in the ISO 19232 series can be found on the ISO website.


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# Non-destructive testing — Image quality of radiographs —

# Part 5: Determination of the image unsharpness and basic spatial resolution value using duplex wire-type image quality indicators

## 1 Scope

This document specifies a method of determining the total image unsharpness and basic spatial resolution of radiographs and radioscopic images. The IQI with up to 13 wire pairs can be used effectively with tube voltages up to 600 kV. The IQI with more than 13 wire pairs can be used effectively at tube voltages lower than 225 kV. When using source voltages in the megavolt range, it is possible that the results are not be completely satisfactory.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5576, *Non-destructive testing — Industrial X-ray and gamma-ray radiology — Vocabulary*

ISO/IEC 17050-1, *Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5576 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1**
**duplex wire-type image quality indicator**
**duplex wire-type IQI**
image quality indicator specifically designed to assess the total image unsharpness and basic spatial image resolution of a radiograph or a digital image and composed of a series of pairs of wire elements made of high density metal

**3.2**
**total image unsharpness value**
$U_T$
smallest number of the duplex wire pair which is not sufficiently separable and corresponds to wire diameter plus wire spacing

Note 1 to entry: The corresponding unsharpness values are given in Table 1.

Note 2 to entry: $U_T$ can be $U_T^{visual}$, $U_T^{20\%}$ or i$U_T^{20\%}$.

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**3.3**
**total image unsharpness value determined visually**
$U_T^{visual}$
smallest number of the duplex wire pair, which is visually not separable in a film radiograph on a viewing station or on a monitor image

**3.4**
**total image unsharpness value determined from a profile function in a digital image**
$U_T^{20\%}$
smallest number of the duplex wire pair, which is not separable or separable by a profile function with less than 20 % modulation depth in a linearized profile

**3.5**
**interpolated total image unsharpness value**
$iU_T^{20\%}$
smallest number of the duplex wire pair which is separable, determined from a profile function in a digital image by interpolation from a linearized profile function and obtained by interpolation to 20 % modulation depth from neighbour element modulations

**3.6**
**basic spatial resolution**
$SR_b$
smallest geometrical detail which can be resolved and half of the measured unsharpness in a digital image or radiograph

Note 1 to entry: $SR_b$ can be $SR_b^{image}$ or $SR_b^{detector}$.

**3.7**
**basic spatial detector resolution value**
$SR_b^{detector}$
smallest geometrical detail, which can be resolved with a digital detector at magnification equal to one and corresponds to half of the measured detector unsharpness, $U_T^{visual}$ or $U_T^{20\%}$, in a digital image and corresponds to the effective pixel size and is determined from the smallest number of the duplex wire pair, which is not separable by visual inspection or from the smallest number of the duplex wire pair with less than 20 % modulation depth in a linearized profile, measured with the IQI on the detector without object

Note 1 to entry: For this measurement, the duplex wire IQI is placed directly on the digital detector array or imaging plate.

**3.8**
**basic spatial image resolution value**
$SR_b^{image}$
smallest geometrical detail, which can be resolved in a digital image at magnification >1 and corresponds to half of the measured image unsharpness, $U_T^{visual}$ or $U_T^{20\%}$, in a digital image and corresponds to the effective pixel size of the magnified image and is determined from the smallest number of the duplex wire pair, which is not separable by visual inspection or from the smallest number of the duplex wire pair with less than 20 % modulation depth in a linearized profile

**3.9**
**interpolated basic spatial image resolution value**
$iSR_b^{image}$
smallest geometrical detail, which can be resolved in a digital image at magnification >1 and corresponds to half of the measured image unsharpness, $iU_T^{20\%}$, in a digital image and corresponds to the interpolated effective pixel size of the magnified image and is determined from a profile function in a digital image by interpolation from a linearized profile function and obtained by interpolation to 20 % modulation depth from neighbour element modulations

Note 1 to entry: For measurement of $iSR_b^{detector}$, the duplex wire IQI is placed directly on the digital detector array or imaging plate and $iSR_b^{detector}$ is equal to $iSR_b^{image}$.


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**3.10**
**linepair per mm value**
lp/mm
duplex wire pair values or interpolated values corresponding to $1/U_T$, where $U_T$ can be $U_T^{visual}$, $U_T^{20\%}$ or $iU_T^{20\%}$

Note 1 to entry: The corresponding values are given in Table 1.

# 4 Specification of duplex wire-type IQI

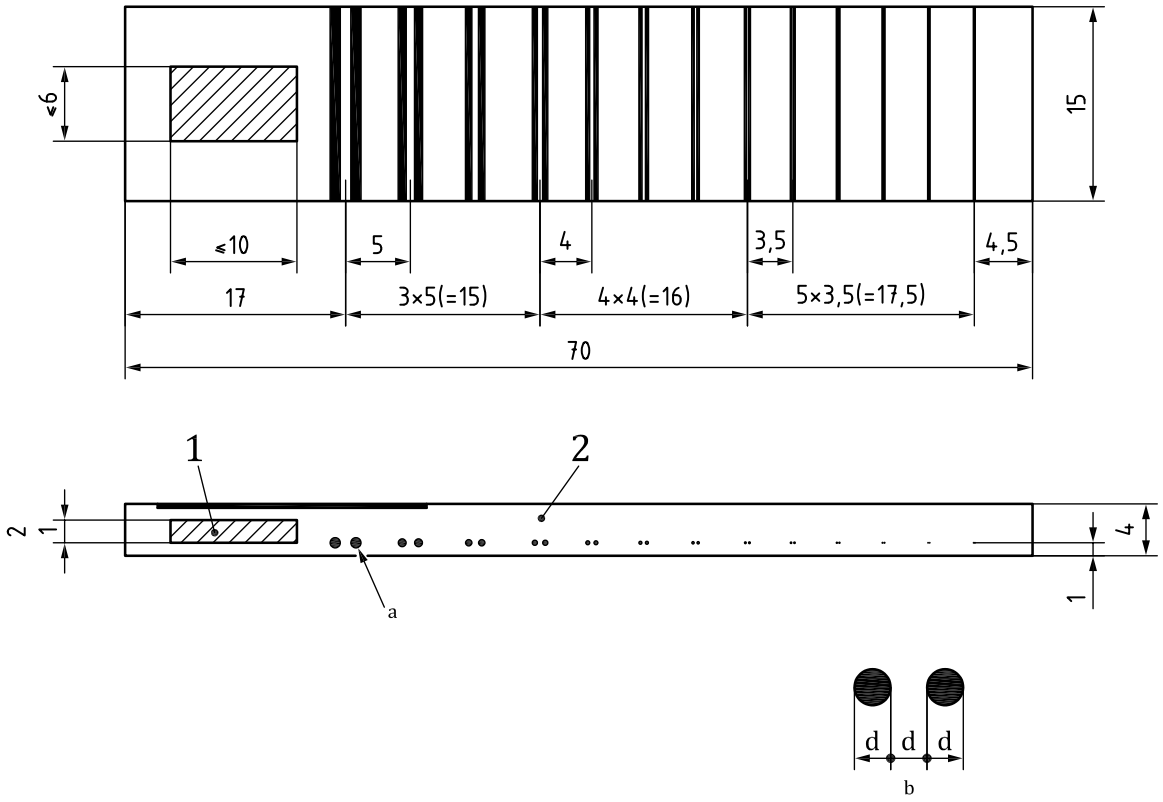
## 4.1 Dimensions, manufacture, and marking

### 4.1.1 Dimensions and material

The standard duplex wire-type IQI shall consist of a series of 13 elements placed in a transparent rigid plastic holder. Each element shall consist of a pair of wires of circular section. The elements D1 to D3 are of tungsten, the others of platinum.

The dimensions shall be in accordance with Figure 1.

Dimensions in millimetres




**Key**

1 space for identification marking
2 rigid plastic mounting
*d* wire diameter (equals spacing between the wires)
a Wire diameter, *d*, equals spacing between the wires.
b Enlarged view of each wire pair (element).

**Figure 1 — Duplex wire-type IQI**

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