

Determination of Image Quality Parameters for NDT Film Digitisation Systems and Digital Radiological Detectors

Key words

Non-destructive testing (NDT), radiographic testing, image quality, film digitisation, digital archiving and analysis of radiographs, radiological image detectors

Characteristics and items tested

Characterisation of transfer curve, signal to noise ratio and MTF based on a standard reference film or a standardised radiographic set-up according to EN 584-1. Result of this procedure is an assignment to a system class.

Uncertainty of results

The measured values, used for the assignment to a system class have an expanded measuring uncertainty of < 5 %.

Fields of application

Classification of film digitisation systems and other digital detectors for industrial radiographic testing in non-destructive testing (NDT)

Methodology and instrumentation

Based on a standard reference film according to ASTM E 1936 –37, ASME Section 5, Article 2, Appendix VI or EN ISO14096 (see fig. 1) the transfer curve, signal to noise ratio and MTF is determined. The film digitisation system in question will be classified according to EN ISO14096-2.

A CCD line scanner (class DB-7), a LASER scanner (class DS-9) and a drum scanner (class DS-50) are available in the laboratory as reference systems for NDT film digitisation. A reference implementation of the software for parameter calculation was realised.

Additionally a digital LASER film imager is available for the output of electronic reference images on film. It is used for production of reference catalogues, e.g. ISO 5817 "Reference radiographs for assessment of weld imperfections".

Qualification and quality assurance

Reference determination of image quality parameters for digital radiological detectors, NDT certification RT-3 according to EN 473, accreditation to DIN EN ISO IEC 17025:2005

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Further information

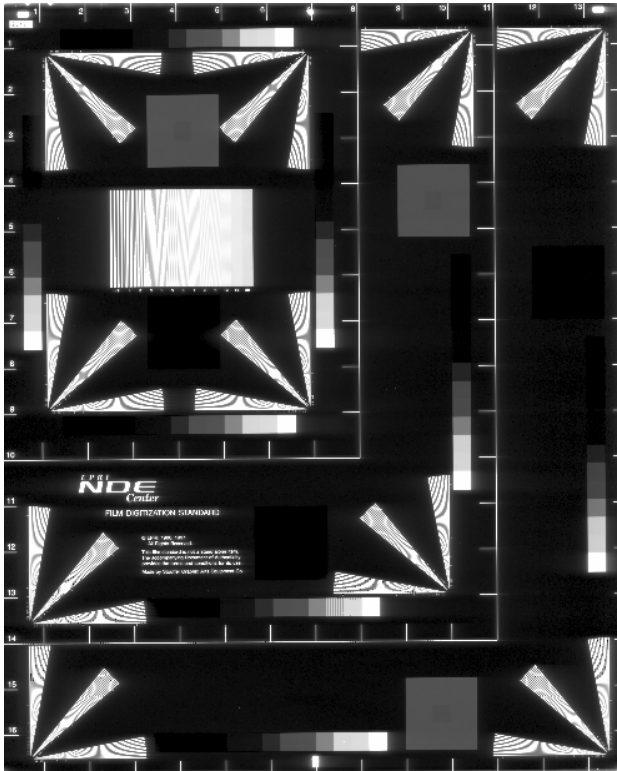


Fig. 1: Reference film according to EN 14096 and ASTM E 1937

All radiographic film digitisation systems shall be subdivided into 3 quality classes **DS**, **DB** and **DA** :

DS - the enhanced technique, which performs the digitisation with an insignificant reduction of signal-to-noise-ratio and spatial resolution.

Application field: digital archiving of films (digital storage).

DB - the enhanced technique, which permits some reduction of image quality.

Application field: digital analysis of films, films have to be archived.

DA - the basic technique, which permits some reduction of image quality and further reduced spatial resolution.

Application field: digital analysis of films, films have to be archived.

Parameter	Class DS	Class DB	Class DA
Density range* D_R	0.5 – 4.5	0.5 – 4.0	0.5 – 3.5
Digital resolution [bit]	≥ 12	≥ 10	≥ 10
Density contrast sensitivity ΔD_{CS} within D_R	≤ 0.02	≤ 0.02	≤ 0.02

*NOTE: This density range may be splitted into separate working ranges

EN 14096-2, table 1: Minimum density range of the radiographic digitisation system with a minimum density contrast sensitivity

Energy keV	Class DS		Class DB		Class DA	
	Pixel size μm	MTF 20 % lp/mm	Pixel size μm	MTF 20 % lp/mm	Pixel size μm	MTF 20 % lp/mm
≤ 100	15	16.7	50	5	70	3.6
>100 to 200	30	8.3	70	3.6	85	3
>200 to 450	60	4.2	85	3	100	2.5
Se-75,Ir-192	100	2.5	125	2	150	1.7
Co-60, $\geq 1\text{MeV}$	200	1.25	250	1	250	1

EN 14096-2, table 2: Minimum spatial resolution of film digitisation systems

Besides the characterisation of film digitisation equipment the digitisation of radiographs is possible in all system classes (DS, DB, DA).