

## 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 of 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 14096 (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 14096-2.

A CCD line scanner (class DB), a LASER scanner (class DB) and a drum scanner (class DS) 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

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**Further information**

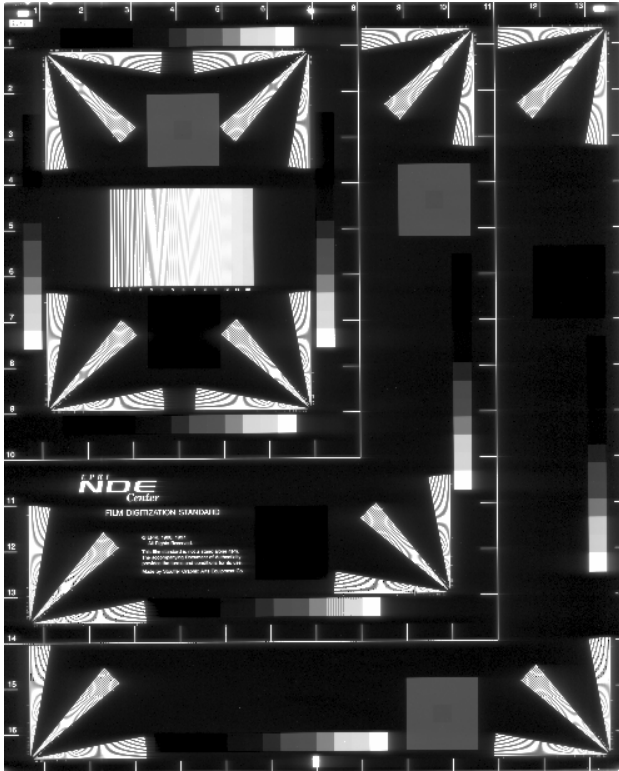


Fig. 1: Reference film according to EN 14096 and ASTM E 1937

The state of art in standard development for NDT film digitisation systems at CEN TC 138 WG1 and the standard prEN 14096 are available on-line via "http://trappist.kb.bam.de/CEN-NFD/". It is planned to have the final vote for this CEN standard prEN 14096 in 2001.

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]	$\geq 12$	$\geq 10$	$\geq 10$
Density contrast sensitivity $\Delta D_{CS}$ within $D_R$	$\leq 0,02$	$\leq 0,02$	$\leq 0,02$

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

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

Energy	Class DS		Class DB		Class DA	
	Pixel size $\mu m$	MTF 20 % lp/mm	Pixel size $\mu m$	MTF 20 % lp/mm	Pixel size $\mu m$	MTF 20 % lp/mm
$\leq 100$	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, $\geq 1MeV$	200	1,25	250	1	250	1

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

A similar standard draft for the classification of systems for NDT - industrial computed radiography with phosphor imaging plates is in preparation by CEN TC 138 WG1 (see "http://trappist.kb.bam.de/UA-CR").

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