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Quality Criteria for Scanning Systems

Frank J. EPPLE
Zeutschel GmbH

Quality Criteria for Scanning Systems

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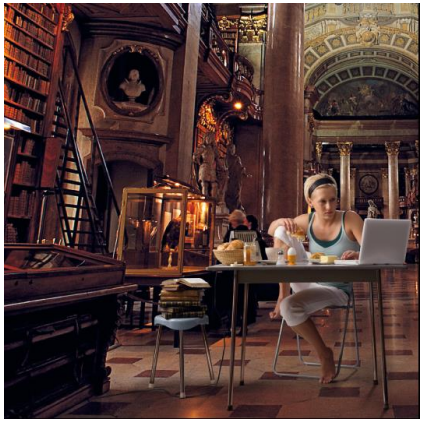

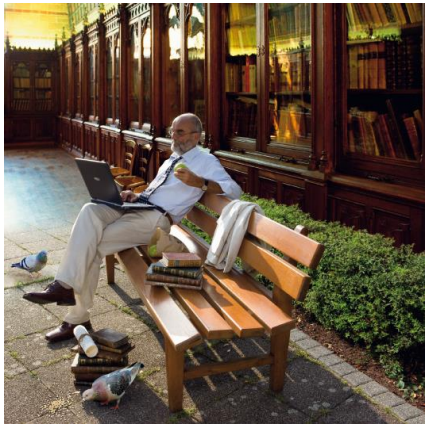

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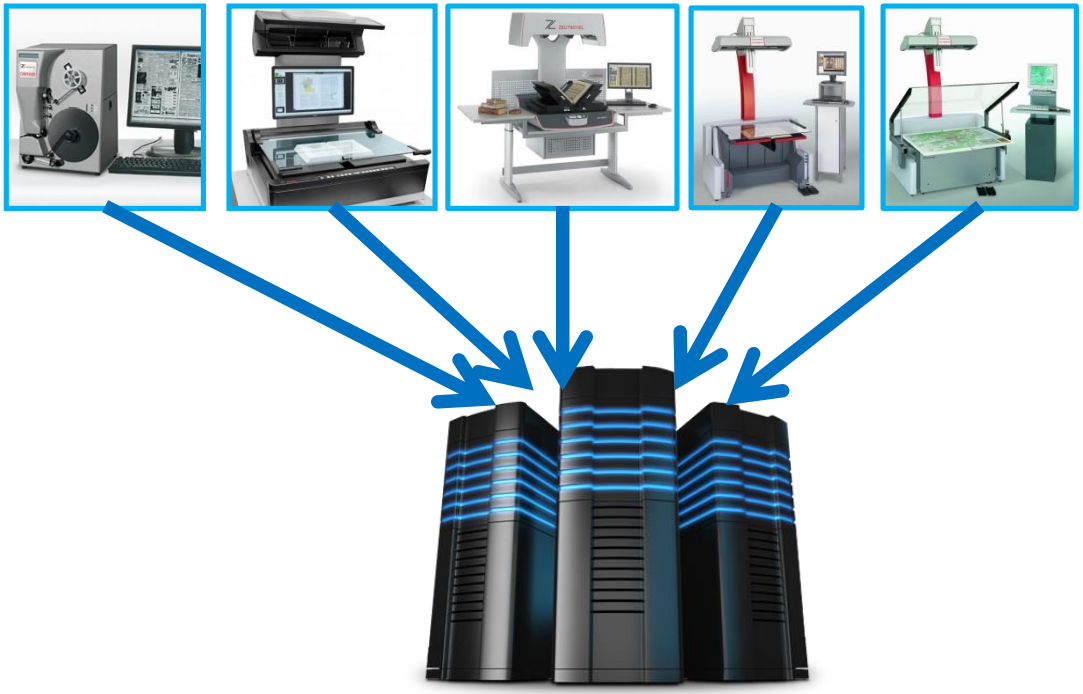

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For your written treasures,
choose the best only…

They deserve nothing else!

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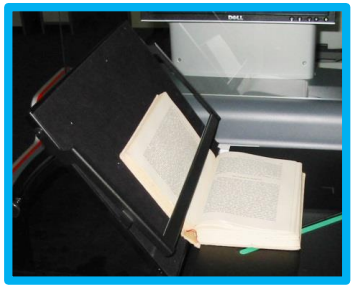

Make sure your documents will be handled most carefully during processing…

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Make sure your documents receive enough light for homogeneous scans, scan by scan…

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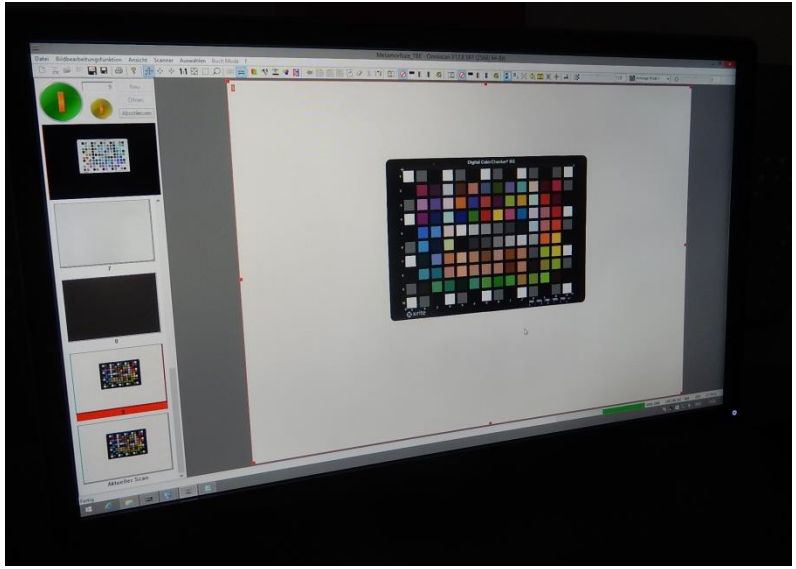

Make sure you get the right colours, not just coloured images…

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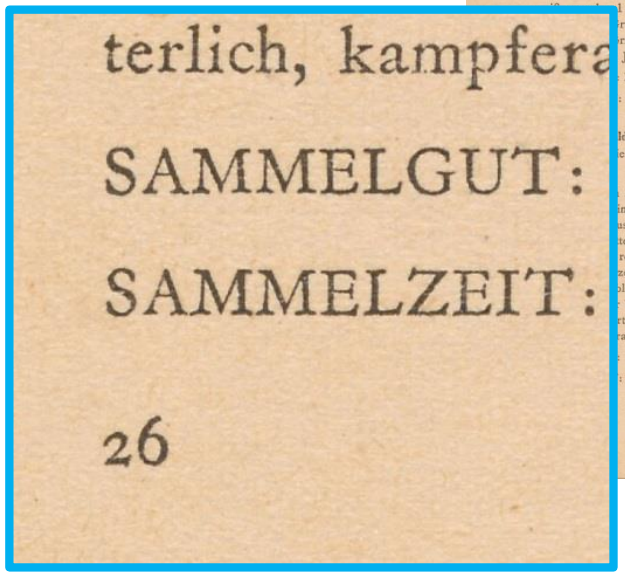
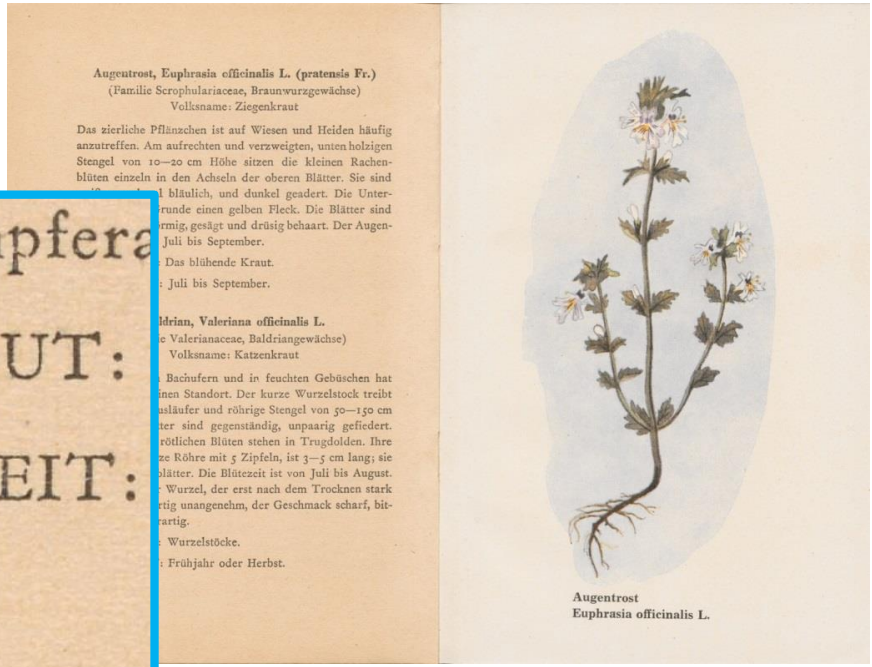
Make sure you can also catch fine details during scanning…





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Make sure you need to scan your valuable originals only once…

Heine_01_033.tif	Typ: TIF-Datei Abmessungen: 1358 x 2089	Größe: 8,75 MB
Heine_01_034.tif	Typ: TIF-Datei Abmessungen: 1358 x 2089	Größe: 8,75 MB
Heine_01_035.jpg	Typ: JPG-Datei Abmessungen: 1358 x 2089	Größe: 1,14 MB
Heine_01_036.jpg	Typ: JPG-Datei Abmessungen: 2581 x 4015	Größe: 1,29 MB
Heine_01_037.tif	Typ: TIF-Datei Abmessungen: 1358 x 2089	Größe: 347 KB
Heine_01_038.tif	Typ: TIF-Datei Abmessungen: 2581 x 4015	Größe: 1,23 MB
Heine_01_039.tif	Typ: TIF-Datei Abmessungen: 1357 x 2096	Größe: 8,77 MB
Heine_01_040.tif	Typ: TIF-Datei Abmessungen: 1357 x 2096	Größe: 8,77 MB
Heine_01_041.jpg	Typ: JPG-Datei Abmessungen: 1357 x 2096	Größe: 1,15 MB
Heine_01_042.jpg	Typ: JPG-Datei Abmessungen: 2581 x 4015	Größe: 1,31 MB
Heine_01_043.tif	Typ: TIF-Datei Abmessungen: 1357 x 2096	Größe: 348 KB

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Typical specifications in tenders

- Size of originals: dimensions, thickness;
- Resolution (“200 ppi”, “600 ppi”);
- Colour depth (b/w, grey scales, color;

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Typical specifications in tenders

- Scan speed (scan time or cycle time);
- File format(s): tif, jpg; pdf;

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Typical specifications in tenders

- Scan speed (scan time or cycle time);
- File format(s): tif, jpg; pdf;

… but often as not there is no measurable, hard data about image quality.

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This leaves the door open for free interpretation of the image quality:

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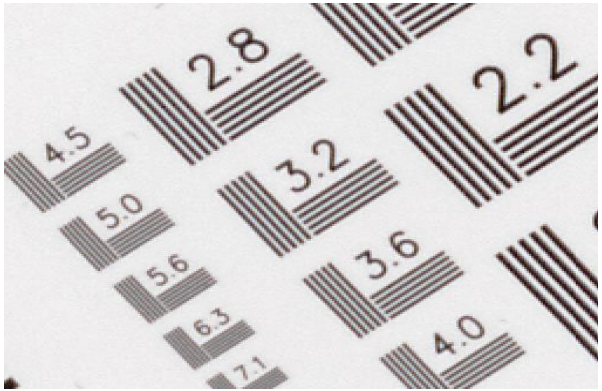
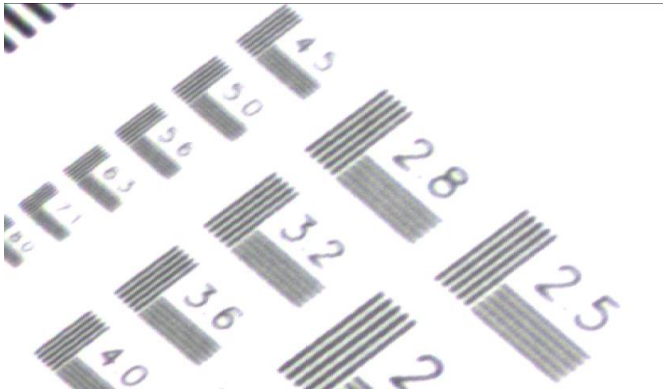
Both images may show 300 ppi
in the technical metadata:





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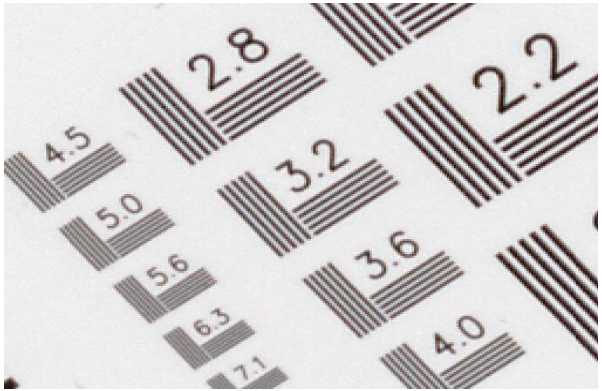
Both images may show 300 ppi in the technical metadata:

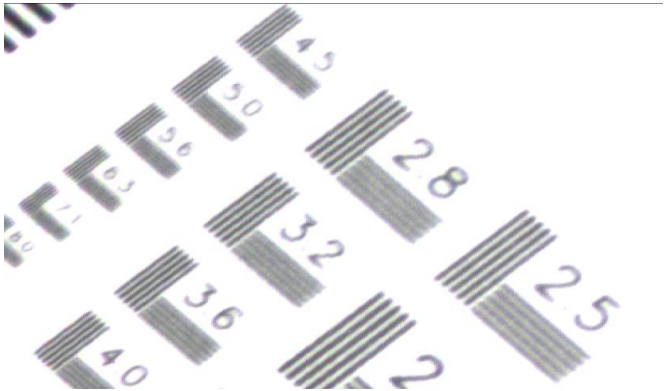
300 ppi scan resolution

300 ppi image resolution



127 ppi scan resolution

300 ppi image resolution



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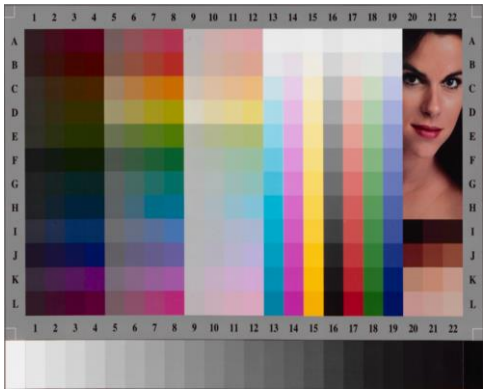
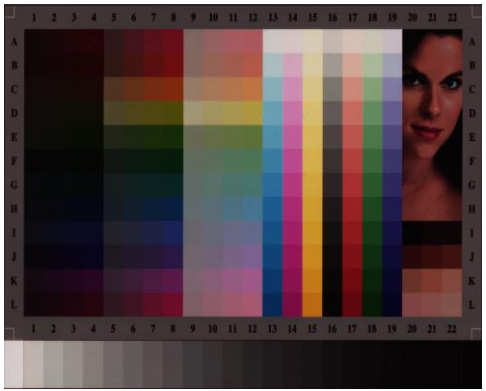
Both images are colour





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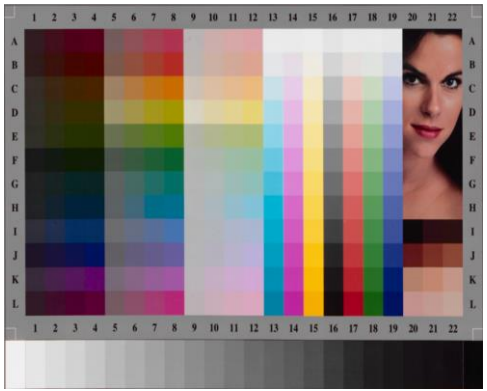
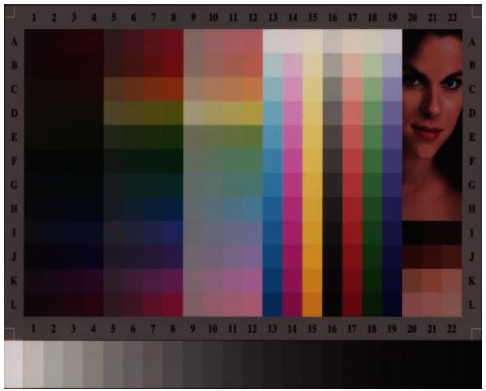
Both images are colour

But colour reproduction of the original is quite different!





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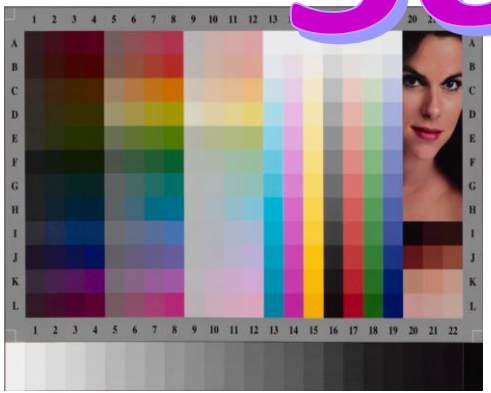
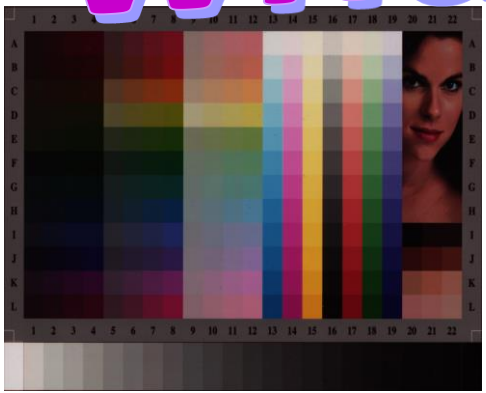
Both images are colour

But colour reproduction of the originals
quite different

So what???





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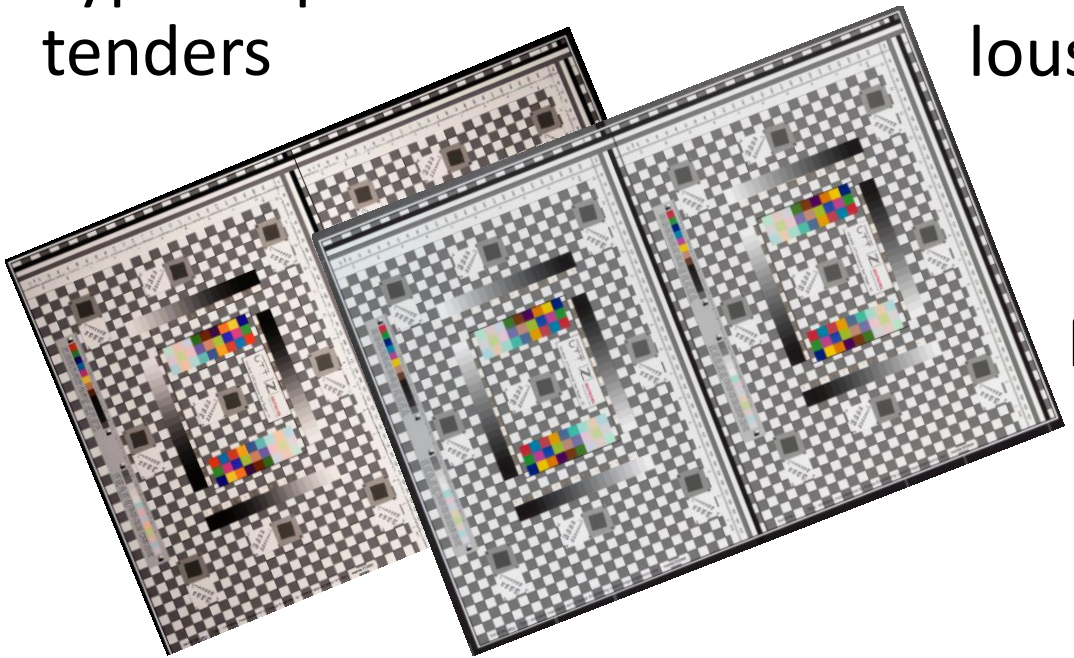
Typical specifications in tenders



The tenderer risks to get lousy results if image quality is not clearly defined.

Maybe this is okay for the cost controller.

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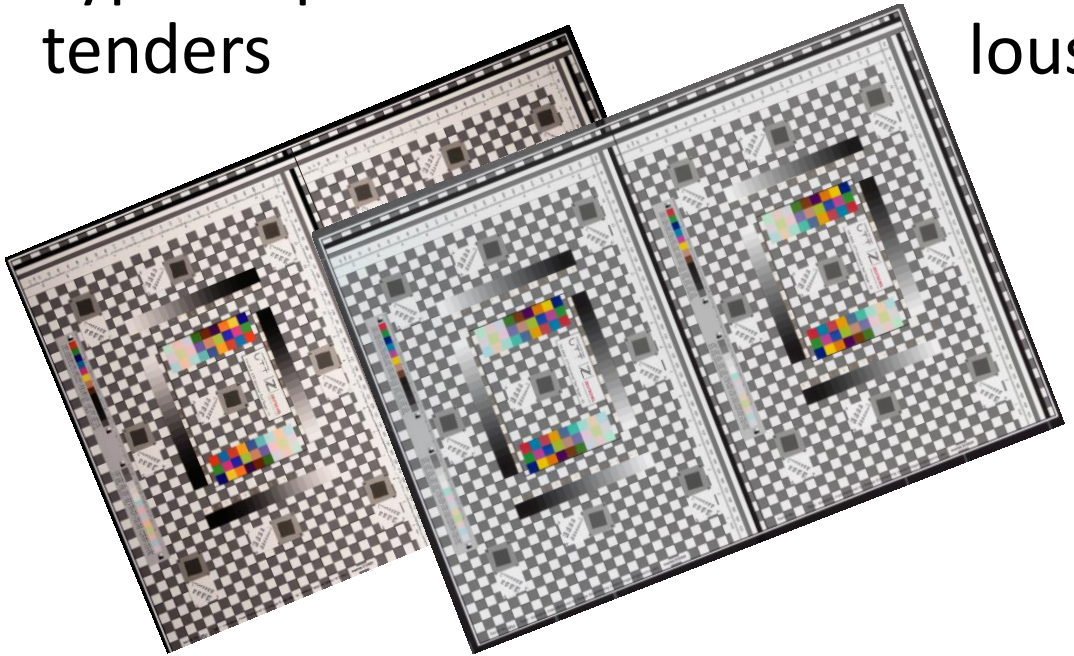
Typical specifications in tenders



The tenderer risks to get lousy results if image quality is not clearly defined.

But shouldn’t it be the objective of important digitization work to produce highest quality images?

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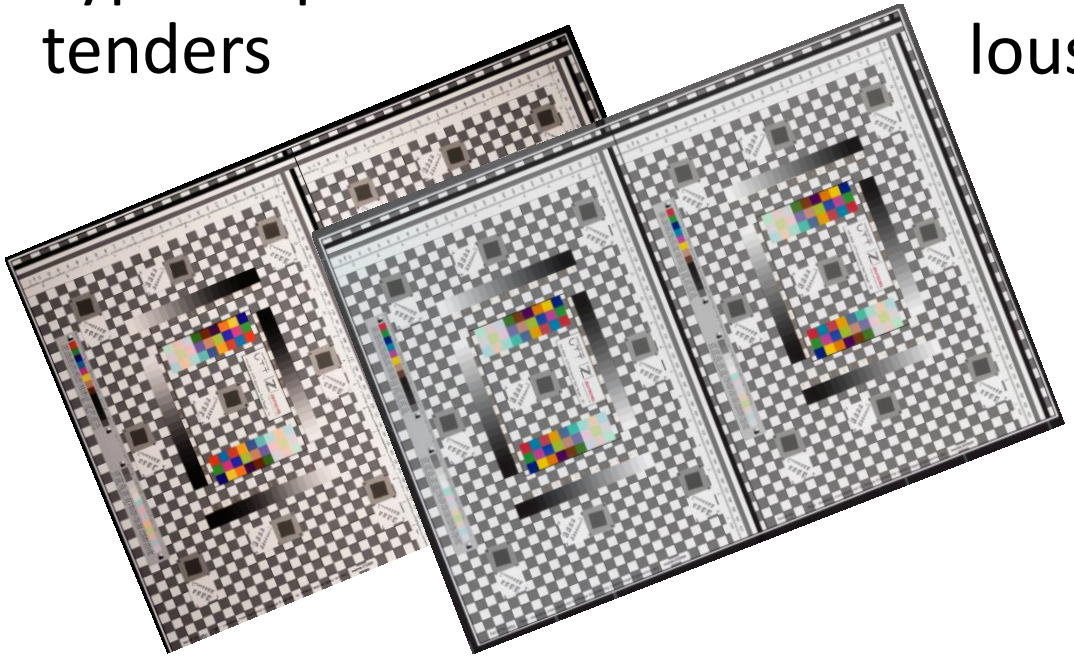
Typical specifications in tenders



The tenderer risks to get lousy results if image quality is not clearly defined.

How much will it cost to re-scan the whole project because the image quality is not sufficient?

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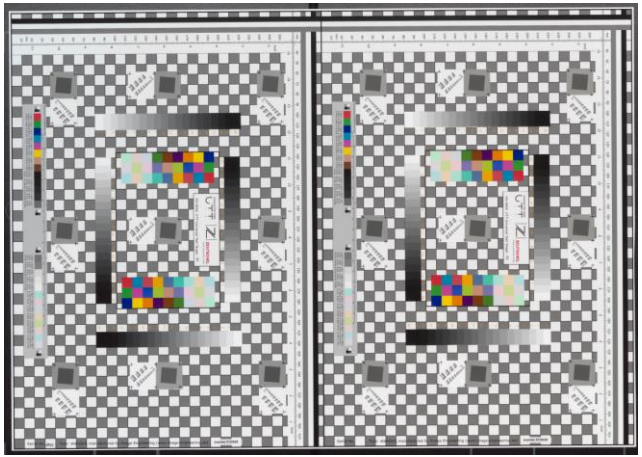
How define a project with quality in mind?



Tenders for digitization projects should specify more than just size of the documents, a colour mode and a resolution.

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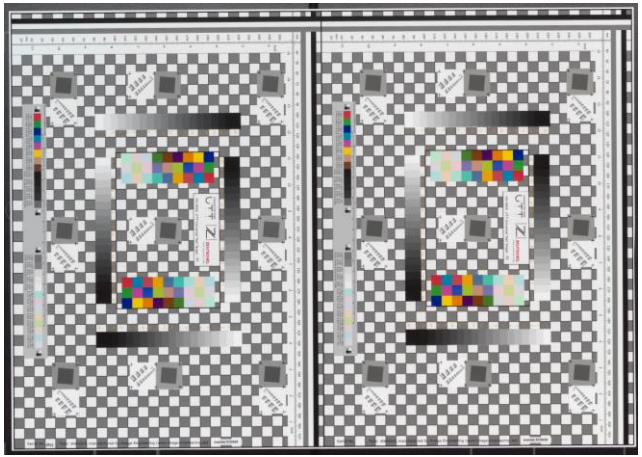
How tender with quality in mind?



Describe image quality very clearly, and with “measureable” criteria.

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You can check:

- Effective resolution;
- Geometry and distorsion;
- Color channel coverage;
- Image noise;

Measurable quality criteria

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You can check:

- Linearity;
- Dynamic range;
- Color reproduction;
- Homogeneity.

Measurable quality criteria

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Effective resolution:

Which details can you resolve with the scanner?

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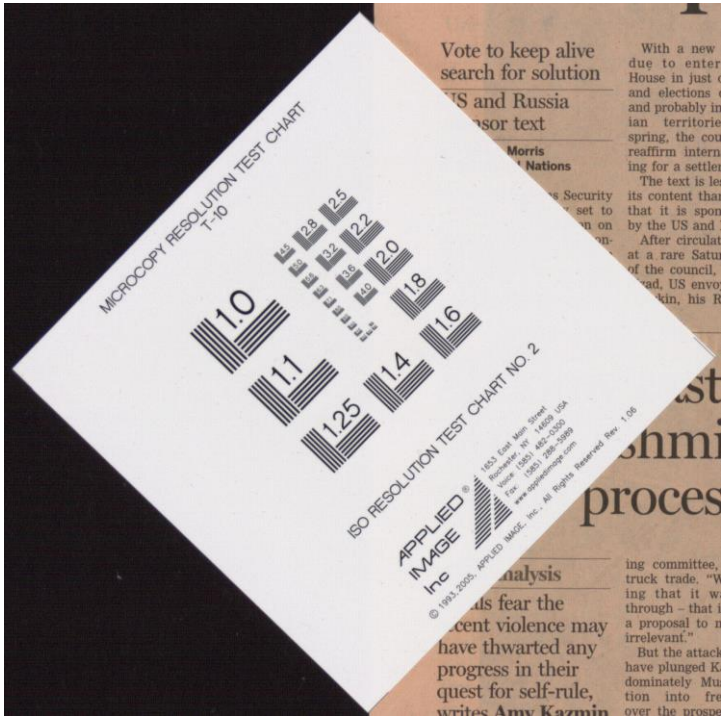
Effective resolution:

With the T10 test chart, you can optically verify how many line pairs per mm are resolved.



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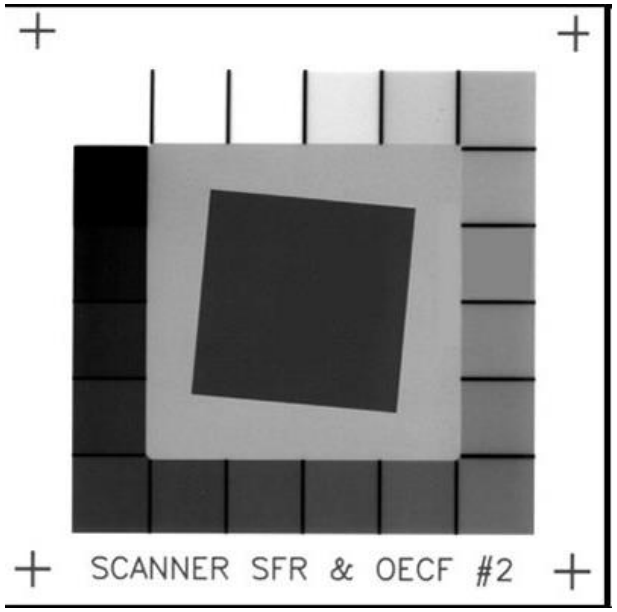
Effective resolution:

If we don‘t want to trust our eyes, the Modulated Transfer Function (MTF) can be measured with the “Slanted Edge“ test target (QA62) and software.



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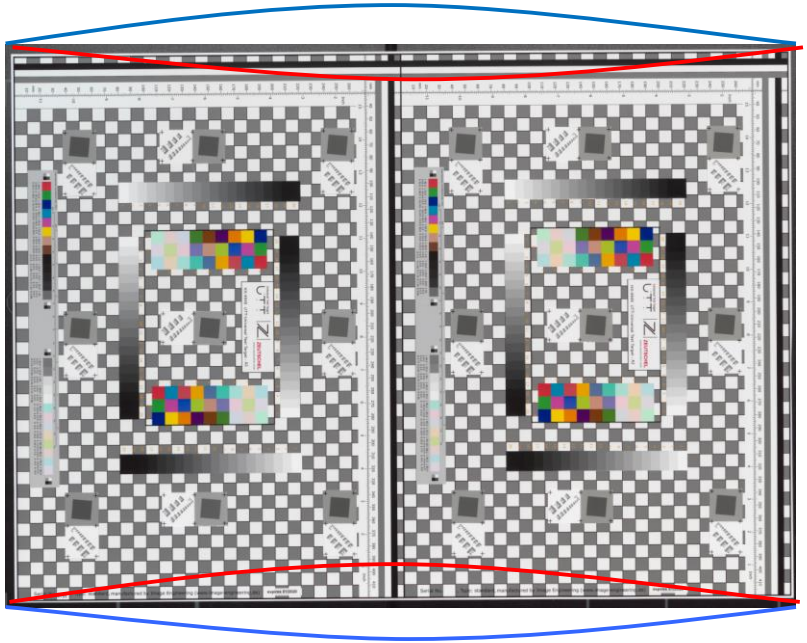
Geometry and distortion:

Make sure the square image remains a square and will not be distorted in any way!



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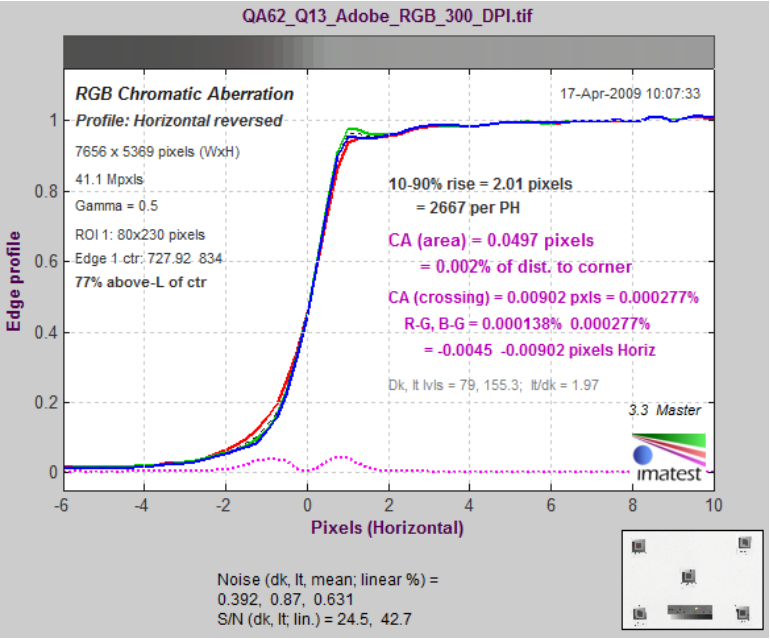
Colour channel coverage:

The colour channel sensors must be very finely tuned together for good image quality – there is a software measuring the deviation of colour channels .



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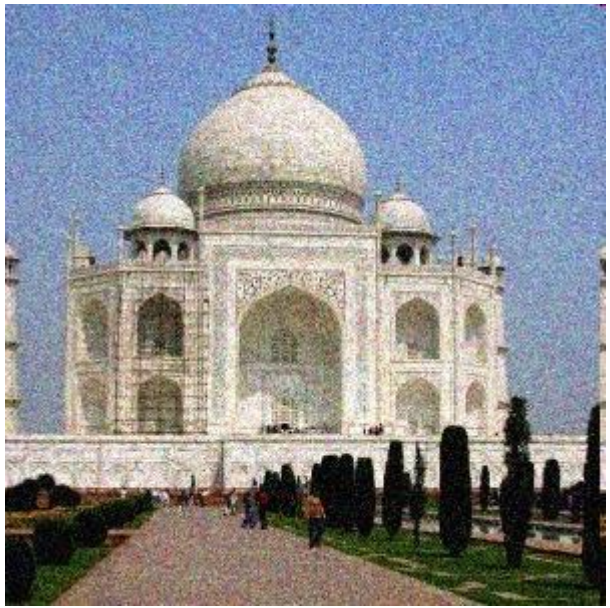

Image noise:

Noise in an image are pixels in the wrong colour in an image.

The image does not look well.

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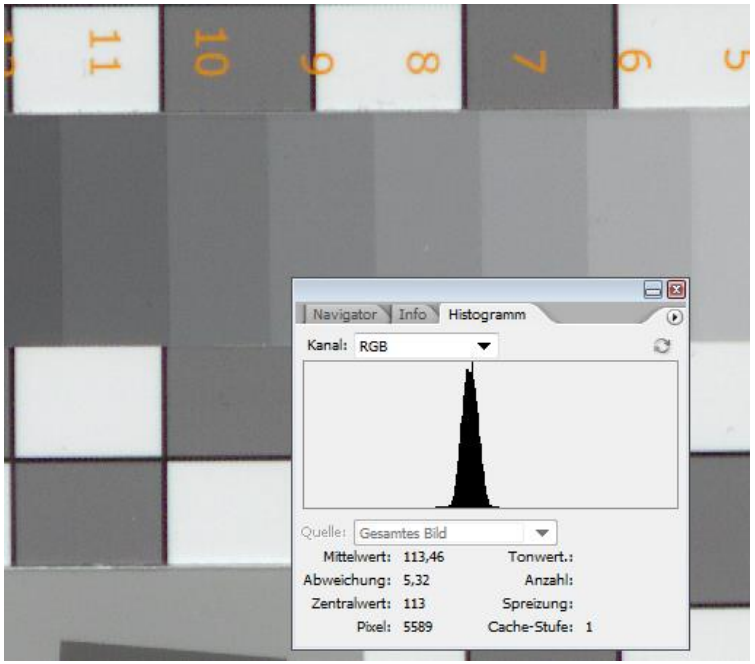

Image noise:

Typically noise is measured on the grey bar. Noise is the deviation from the central value measured.

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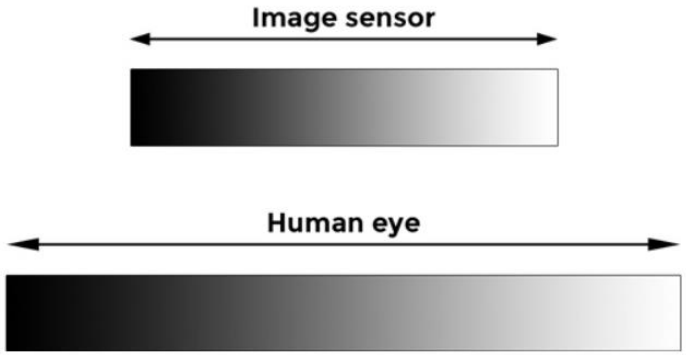

Dynamic range as perceived by human eye and image sensor

Dynamic range:

Dynamic range describes how well a system can reproduce brightness levels.

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Dynamic range:

Already you will notice a difference using your eyes.

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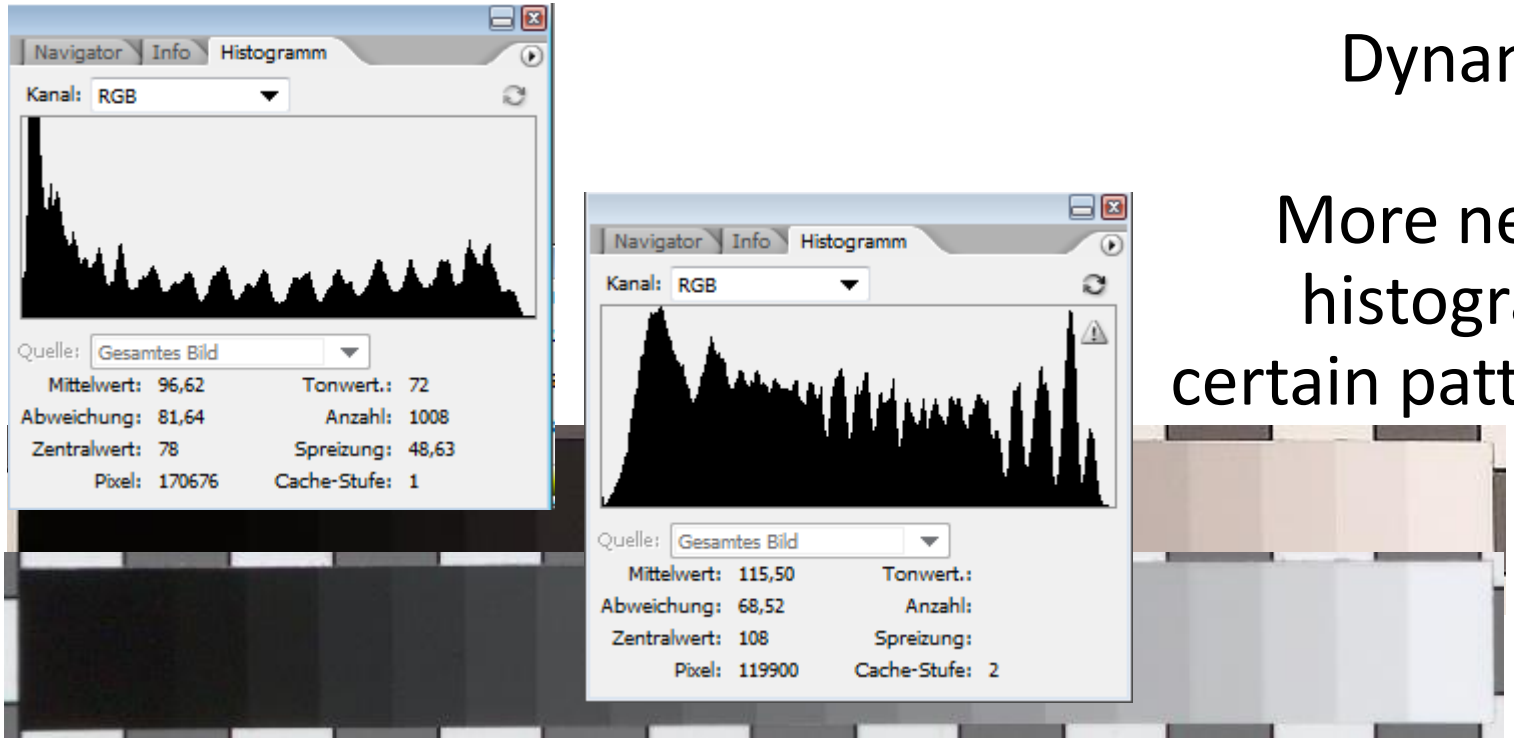

Dynamic range:

More neutral, the histogram shows certain patterns, too.

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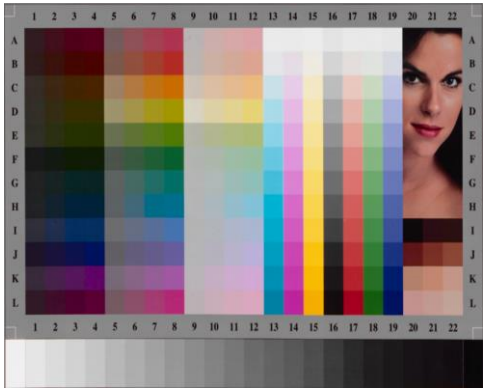

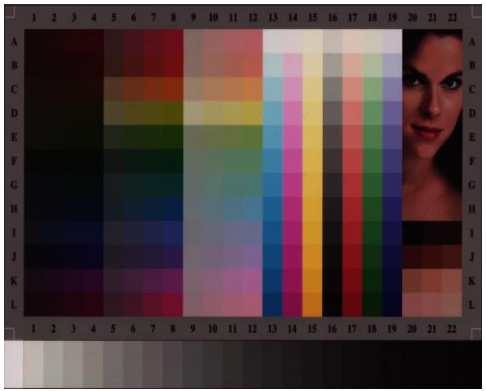

True colour reproduction:

If you are working in colour, colour reproduction should be as accurate as possible.

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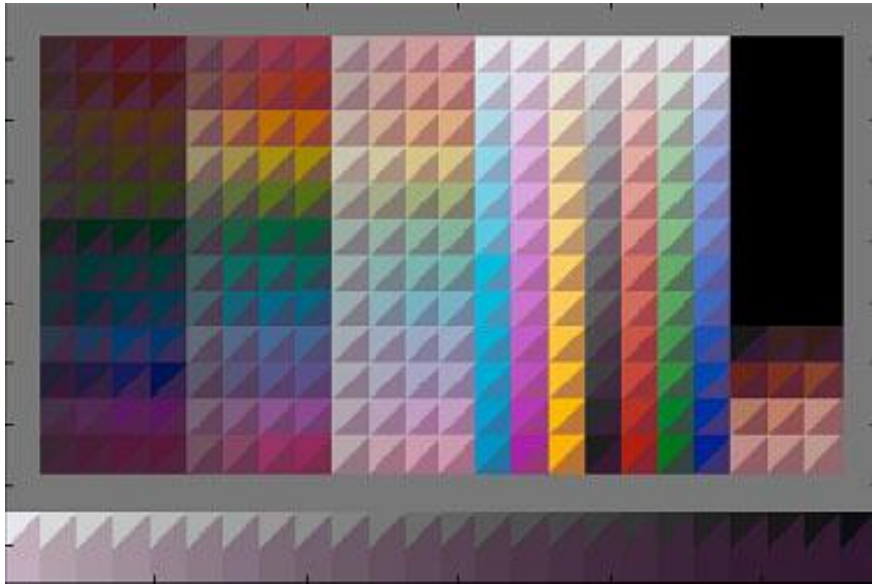

True colour reproduction:

Colour deviation can be measured as ΔE.
The smaller ΔE, the better.

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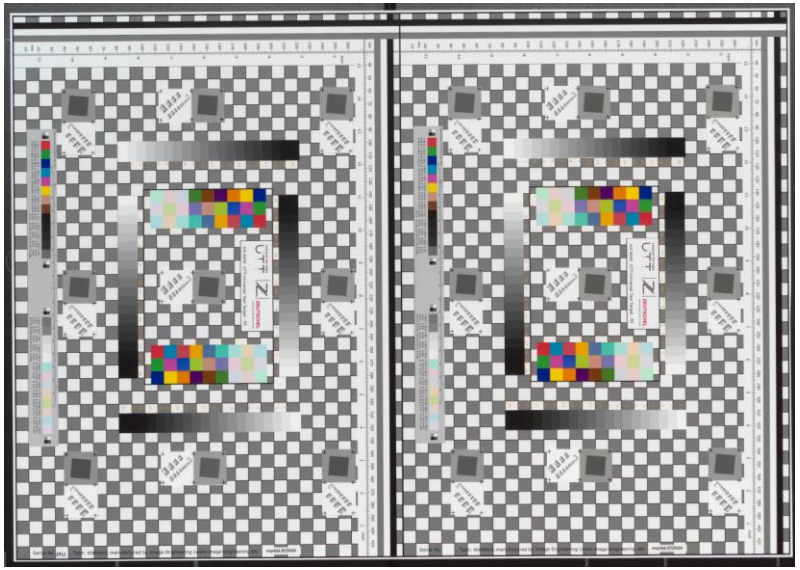
Homogeneous lighting:

Homogeneous lighting of the scan area can be checked on white background, or with the UTT chart.



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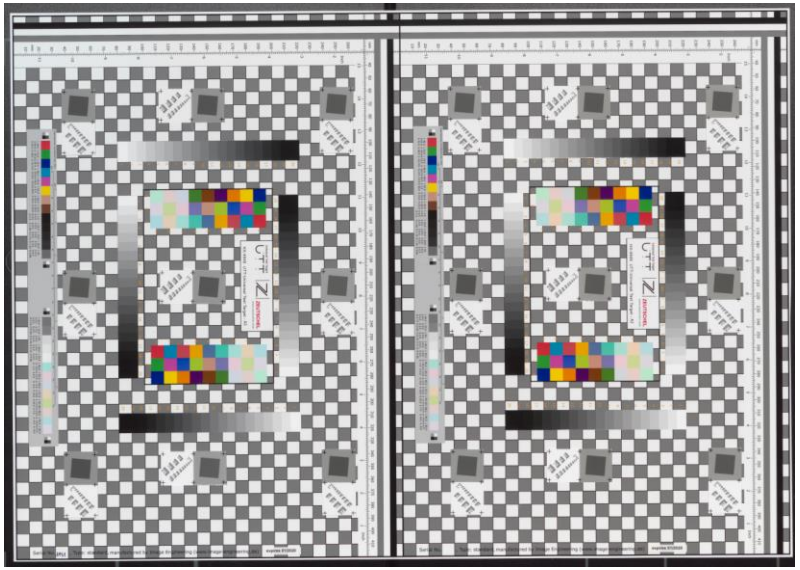
Homogeneous lighting:

The values sampled inside the white should be very close together (around 235 ± 8, also in the different color channels).



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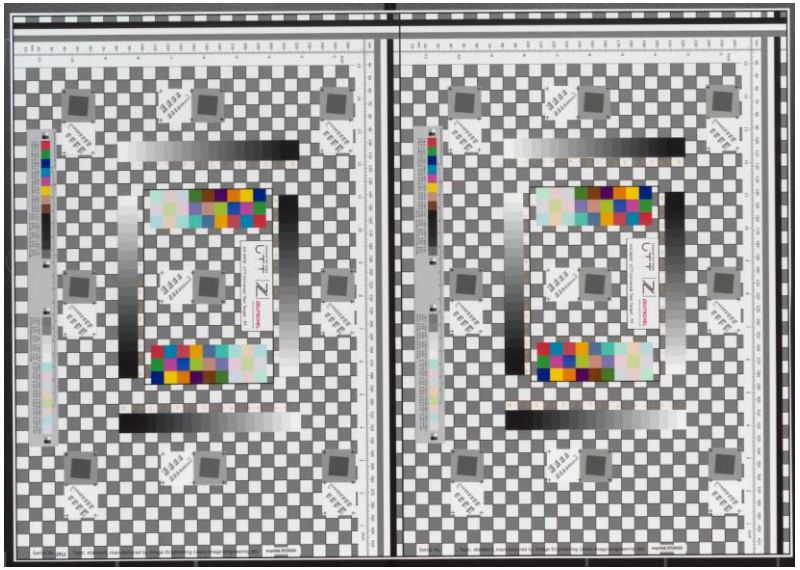
Targets and fields for measuring image quality are available in the Universal Test Target (UTT).



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What do you need?

It is absolutely up to your needs to define the quality standards you need in your project…

Exposure tolerance ΔL*	≤ 2	≤ 2	≤ 2
Exposure tolerance ΔE*	≤ 2,83	≤ 2,83	≤ 2,83
Gain Modulation in the high lights	0,8 - 1,08	0,8 - 1,08	0,8 - 1,08
Gain Modulation gray scale	0,10 - 2,00	0,60 - 1,40	0,60 - 1,40
Noise (Standard deviation); 8 bit	≤ 4	≤ 4	≤ 4
Illumination > A4 to A3	ΔL* 3 eciRGBv2: PV 8	ΔL* 3 eciRGBv2: PV 8	ΔL* 3 eciRGBv2: PV 8
Illumination > A3 to A2	ΔL* 4 eciRGBv2: PV 10 AdobeRGB (1998): PV 12	ΔL* 4 eciRGBv2: PV 10 AdobeRGB (1998): PV 12	ΔL* 4 eciRGBv2: PV 10

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What do you need?

If you need support to define your criteria, we are glad to help!

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Metamorfoze? FADGI?
ISO 19264-1?

These are existing standards in which image quality is set for digitization projects.

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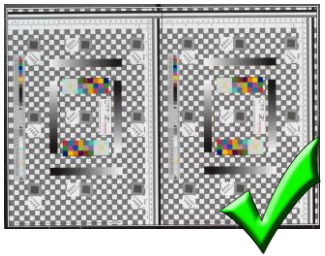
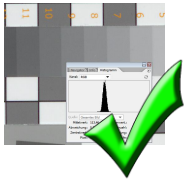
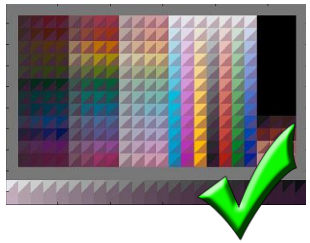
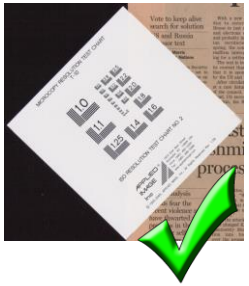
Metamorfoze? FADGI?
ISO 19264-1?

All these describe the image quality needed throughout a process, not the characteristic of a machine.









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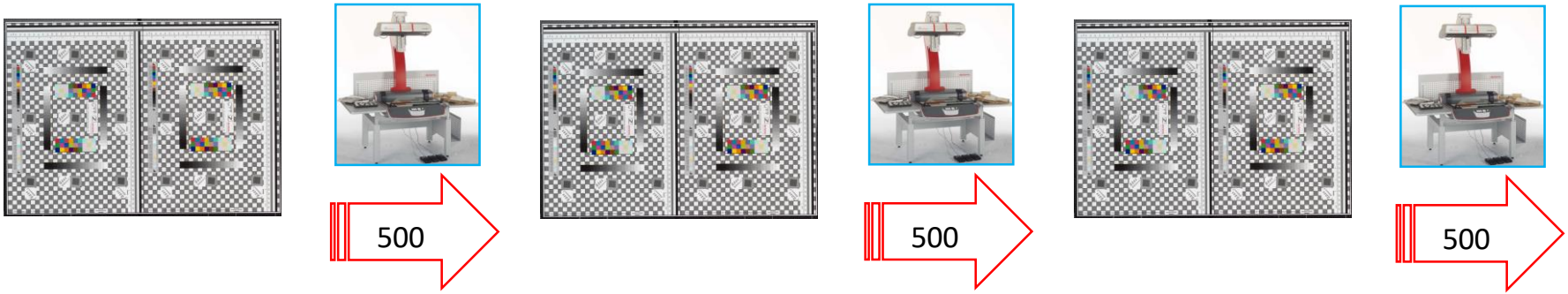
Metamorfoze? FADGI?
ISO 19264-1?

Typically, you need to test the image quality at the begin of daily work, and again after a certain number of scans.



Quality Criteria for Scanning Systems

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ISO 19264-1

This standard was developed by interested parties.
It has three quality levels,

Level A (excellent)
Level B (very good)
Level C (good)

Quality Criteria for Scanning Systems

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ISO 19264-1

Level A

Defines the best imaging practical today. Images created to level A represent the state of the art in image capture and are suitable for almost any use.

Quality Criteria for Scanning Systems

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Level B

defines a very good professional image capable of serving almost all use cases. This includes being suitable for OCR, for reprint on the best commercially available printers.

Quality Criteria for Scanning Systems

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Level C

is appropriate where there is no reasonable expectation of having the
ability to achieve level B or A performance. These images will have informational value only, and may or may not be suitable for OCR.

Quality Criteria for Scanning Systems

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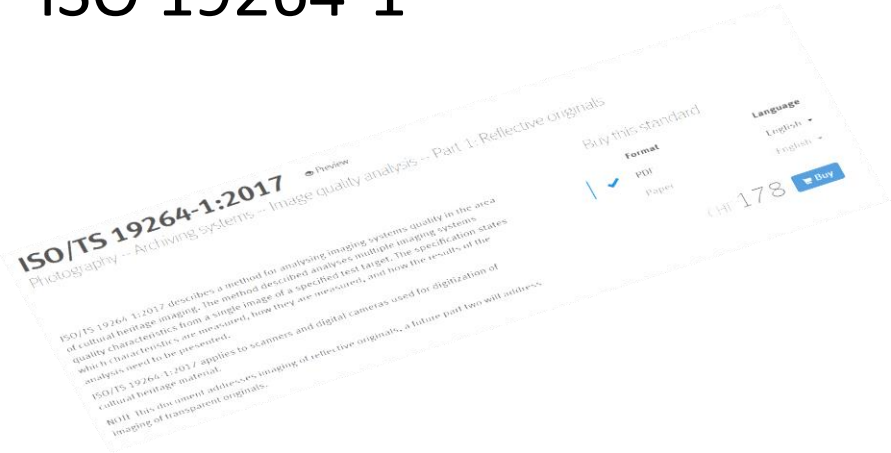

The full guidelines are described in the standard, also defining the tools and how values should be measured.

Quality Criteria for Scanning Systems

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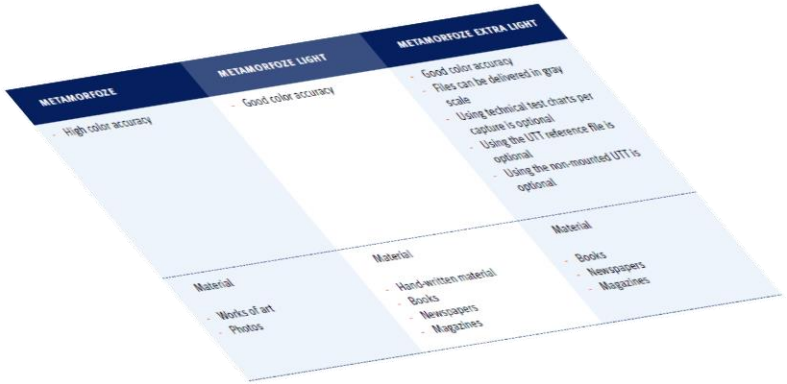
metamorfoze

Metamorfoze



METAMORFOZE	METAMORFOZE LIGHT	METAMORFOZE EXTRA LIGHT
High color accuracy	Good color accuracy	Good color accuracy Files can be delivered in gray scale Using technical test charts per capture is optional Using the UTT reference file is optional Using the non-mounted UTT is optional
Material Works of art Photos	Material Hand-written material Books Newspapers Magazines	Material Books Newspapers Magazines

M was developed by the Royal Dutch Library.

It has three quality levels,

Metamorfoze
Metamorfoze light
Metamorfoze extra light

Quality Criteria for Scanning Systems

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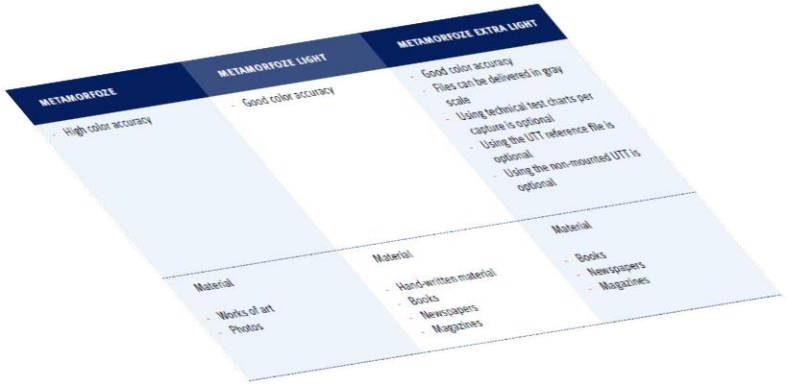
metamorfoze

Metamorfoze



METAMORFOZE	METAMORFOZE LIGHT	METAMORFOZE EXTRA LIGHT
High color accuracy	Good color accuracy	Good color accuracy Files can be delivered in gray scale Using technical test charts per capture is optional Using the UTT reference file is optional Using the non-mounted UTT is optional
Material Works of art Photos	Material Hand-written material Books Newspapers Magazines	Material Books Newspapers Magazines

M was developed by the Royal Dutch Library.

It has three quality levels,

Metamorfoze
Metamorfoze light
Metamorfoze extra light

Quality Criteria for Scanning Systems

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Metamorfoze

Metamorfoze

is intended for digitalizing originals that are considered works of art, such as letters with drawings or maps, photo collections and paintings.

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Metamorfoze

Metamorfoze light

is intended for digitalizing originals whereby color accuracy is slightly less significant, like books, newspapers, magazines and hand-written material.

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Metamorfoze

Metamorfoze extra light

is intended for digitalizing books, newspaper and magazines.

Solutions for Digitization Projects

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Metamorfoze

The full guidelines are decribed in the 44 pages of the Metamorfoze Preservation Imaging Guidelines

Quality Criteria for Scanning Systems

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FADGI

F are the Federal Agencies Digital Guidelines Initiative who published
Technical Guidelines for Digitizing Cultural Heritage Material
using a four star/level system.

Quality Criteria for Scanning Systems

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FADGI
****

4 star

define the best imaging practical today. Images created to a four star level represent the state of the art in image capture and are suitable for almost any use.

Quality Criteria for Scanning Systems

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FADGI
***
3 star

Three star imaging defines a very good professional image capable of serving almost all use cases.
This includes being suitable for OCR as well as for reprint on the best commercially available printers.

Quality Criteria for Scanning Systems

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FADGI
**
2 star

Two star imaging is appropriate where there is no reasonable expectation of having the capability of achieving three or four star performance. These images will have informational value only, and may or may not be suitable for OCR.

Quality Criteria for Scanning Systems

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FADGI
*
1 star

One star imaging should only be considered informational, in that images are not of a sufficient quality to be useful for optical character recognition or other information processing techniques.
One star imaging is appropriate for applications where the intent is to provide a reference to
locate the original, or the intent is textual only with
no repurposing of the content.

Quality Criteria for Scanning Systems

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Metamorfoze? FADGI?
ISO 19264-1?

What level do we talk about?

Quality Criteria for Scanning Systems

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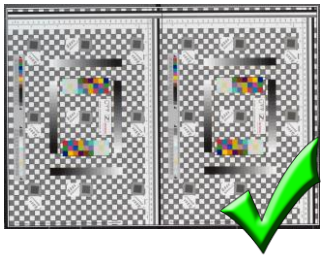
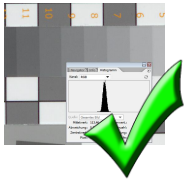
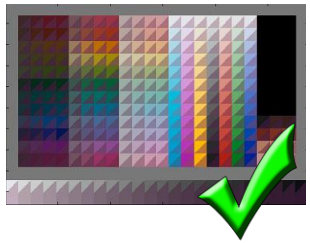
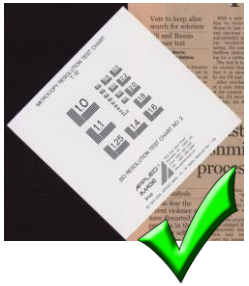
Metamorfoze? FADGI?
ISO 19264-1?

All these describe the image quality needed throughout a process, not the characteristic of a machine.









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What do you need?

It is absolutely up to your needs to define the quality standards you need in your project…

Exposure tolerance ΔL*	≤ 2	≤ 2	≤ 2
Exposure tolerance ΔE*	≤ 2,83	≤ 2,83	≤ 2,83
Gain Modulation in the high lights	0,8 - 1,08	0,8 - 1,08	0,8 - 1,08
Gain Modulation gray scale	0,10 - 2,00	0,60 - 1,40	0,60 - 1,40
Noise (Standard deviation); 8 bit	≤ 4	≤ 4	≤ 4
Illumination > A4 to A3	ΔL* 3 eciRGBv2: PV 8	ΔL* 3 eciRGBv2: PV 8	ΔL* 3 eciRGBv2: PV 8
Illumination > A3 to A2	ΔL* 4 eciRGBv2: PV 10 AdobeRGB (1998): PV 12	ΔL* 4 eciRGBv2: PV 10 AdobeRGB (1998): PV 12	ΔL* 4 eciRGBv2: PV 10

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What do you need?

If you need support to define your criteria, we are glad to help!