



Image Preparation for Print Output

according to
Standards
of ISO TC 130 and
ISO/IEC JTC1 SC28

6. BAM-DIN Workshop
Image Technology

December 3rd 2007
BAM Berlin

J. Thomas Schmelzer



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Introduction Image Preparation for Print Output

according to Standards of ISO TC 130 and ISO/IEC JTC1 SC28

This presentation looks into the possibilities of adapting methods and tools derived from standards of ISO TC 130 (graphic technology) for controlling and processing colour in workflows for ISO/IEC JTC1 SC28 (office equipment).

ISO 12467-2 / AMD1 and profiles derived from the respective characterization data (FOGRA 27L and 39L) are compared for evaluation. The first order of precedence considers:

- homogeneity of colour ramps
- results of colour separated ramps using different rendering intents
- visible differences in appearance of colours
- colour differences of basic colours
- the definition of blue
- results of colour separations of real colour images
- the possibility of perceiving colour differences in several RGB colour-spaces

Also: Summary & Details and Situation & Future Tasks

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Work Areas

ISO TC 130

Graphic Technology

- international consensus
- develops standards for printing industry
- defines its own standards for work-conditions, i.e. specified viewing conditions (darkened rooms)

ISO/IEC JTC1 SC28

Office Equipment

- international consensus
- develops standards for office output
- follows recommendations from governments and organizations releasing standards for office environments, i.e. building codes, ergonomics and health

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COLOUR the common frontier

ISO TC 130

Graphic Technology

- traditional committee for colour printing (offset)
- deals with the most completely described colour technology - offset printing
- offset printing has been in practice for more than 100 years

ISO/IEC JTC1 SC28

Office Equipment

- is the relative new player in the area of colour
- works with a variety of different technologies – InkJet, Colour Laser, Thermaltransfer, etc
- technology is developing fast; about 25 years of application

Digital technology makes colour available and affordable for professional, office, home office and private users.
Preparing the future needs a closer look at the present situation.

ISO 12647-2 & AMD1

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ISO Standard 12647-2 is a mature standard defining controls for colour output in offset-printing, etc.

ISO12647-2 Amendment (AMD1) published 2007, is used in this presentation

- in the comparison with ISO 12647-2
- to show effects in the preparation of images for the output and
- to identify potential problems

A part of ISO 12647-2 is based on colour characterization data released by FOGRA (27L / 39L). ICC-profiles based on these characterization data have been published by eci and these are part of this comparison.

What is the difference?

A look at the well accepted control tool (UGRA/FOGRA Medienkeil) shows first differences in colour output between these versions of ISO 12647-2 and the derived ICC profiles ISO Coated (eci) and ISO Coated v2 eci. Both are intended to describe the same kind of offset-print, both produced with the same inks and settings.

UGRA/FOGRA-Medienkeil v2

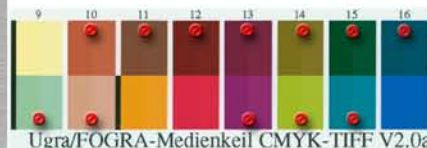
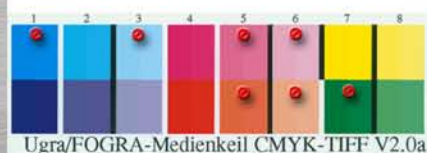
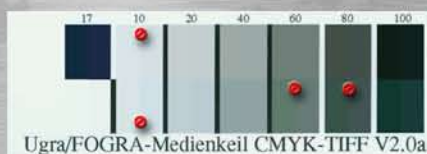
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Comparing the outputs of the UGRA/FOGRA-Medienkeil v2 with profiles derived from FOGRA 27L / 39L show, that the very greenish impression of the output colours compared to the black fields has been reduced.

By visual comparison 23 out of 32 testcolours look different, although the standards for the simulated offset colours and offset printing did not change.

Comparing data

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To make differences visible, the colour values of the respective characterization charts 27L (ISO 12467-2 / ISO Coated eci) and 39L (ISO 12467-2 AMD1/ ISO Coated v2 eci) are compared.

Black over 80% is not neutral anymore and shows a redish cast.

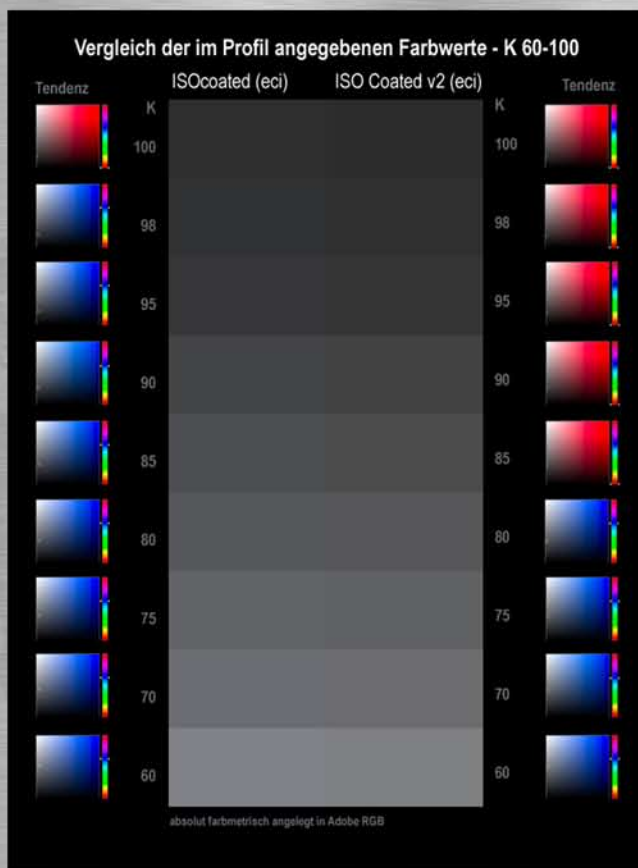


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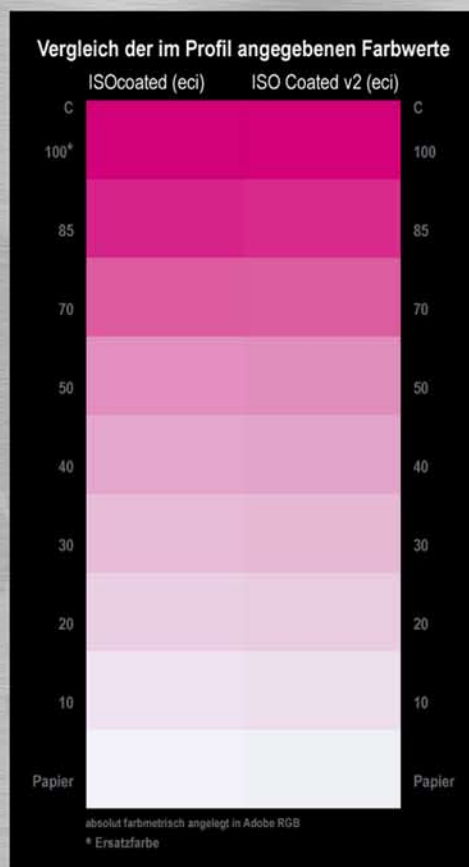
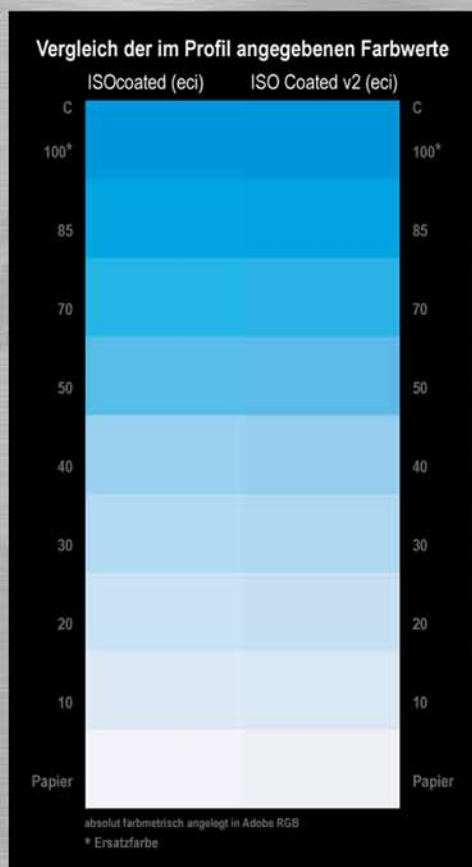


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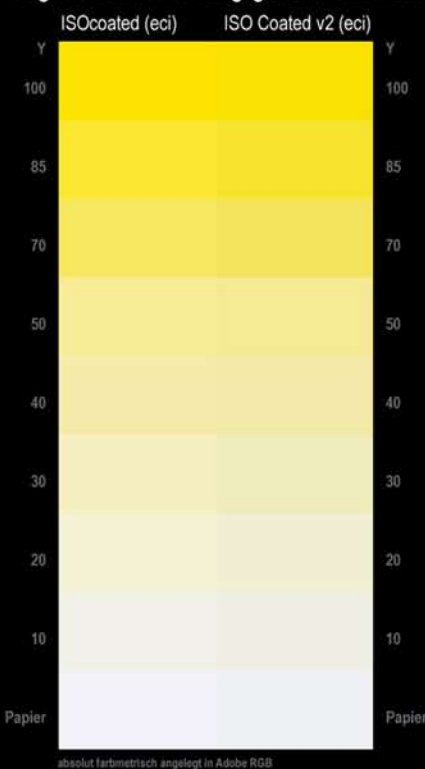
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Vergleich der im Profil angegebenen Farbwerte



Vergleich der im Profil angegebenen Farbwerte

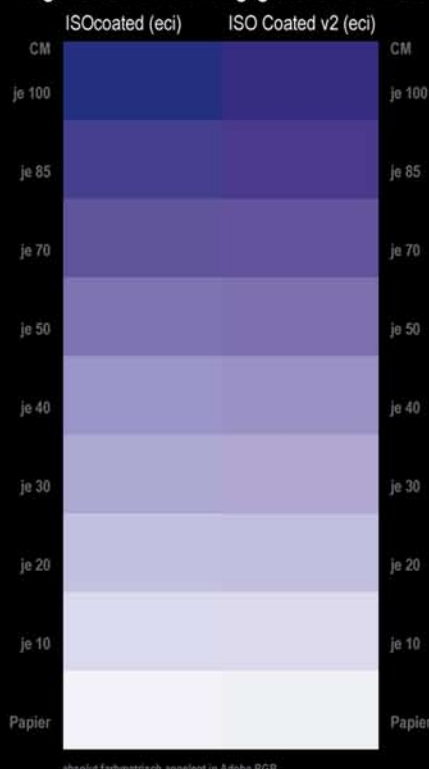


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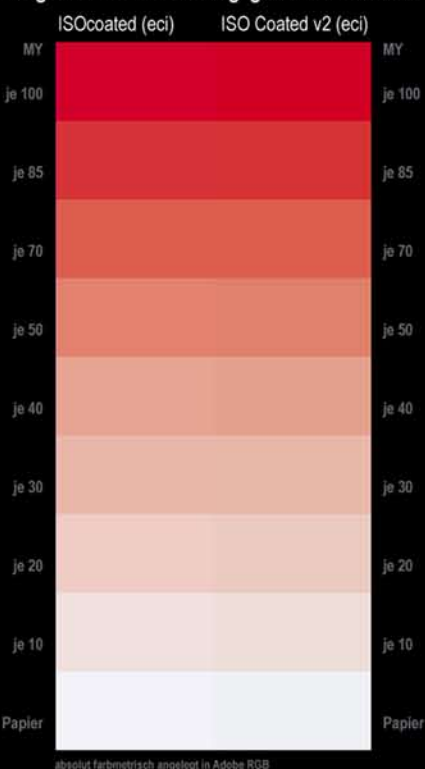
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Vergleich der im Profil angegebenen Farbwerte



Vergleich der im Profil angegebenen Farbwerte

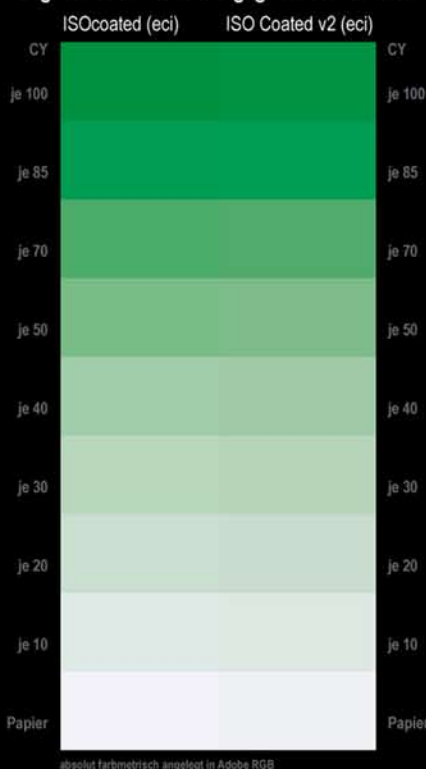


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Observations of concern

All colours of ISO coated v2 eci (FOGRA 39L) look darker, as if the same originals of ISO coated eci (27L) have been used, but either the paper has aged or the lamp of the measuring device has lost some of its power.

Changes identified

- Black (K) has become more redish in patches over 80%
- Cyan (C) has generally become less than 1 dE darker
- Magenta (M) shows the same effects as Cyan except the 85% and 100% patches got brighter
- Yellow (Y) has generally become less than 1 dE darker
- Blue (CM) patches over 50% have become more redish
- Red (MY / overprint of Magenta and Yellow) does not reflect the brighter patches of the Magenta
- Green (CY / overprint of Cyan and Yellow) changed to less yellowish in patches over 70% and turned brighter, this change is not according to the behaviour of the single colours

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Colour Separation

The ICC profiles for ISO coated v2 (eci) offer different rendering intents for colour separations.

The left side of the image shows the RGB ramp.

The separation using the respective rendering intent is added to the right.

1. Perceptive
2. Relative colorimetric
3. Absolute colorimetric

A visual inspection allows to choose the rendering intent with the closest result compared to the RGB ramp

The examples use sRGB ramps build with steps of 16 RGB values difference.

Profilttest - Farbseparation mit Photoshop

RGB sRGB
separiert mit ISO Coated v2 (ECI)

CMYK-Daten der separierten RGB-Abstufungen 16 - 255

Vergleich der Rendering Intents
1 perzeptiv 2 relativ farbmetrisch 3 absolut farbmetrisch

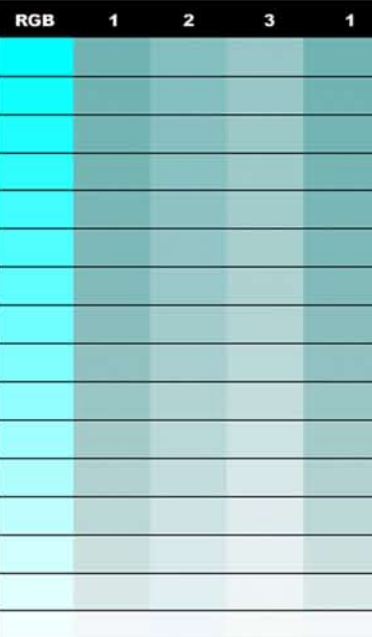


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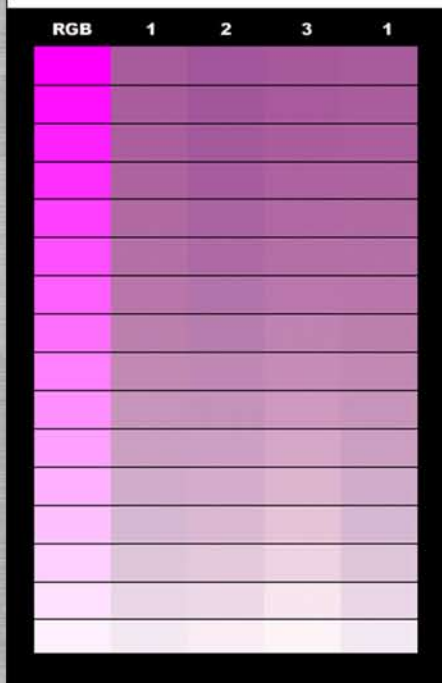
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Profilttest - Farbseparation mit Photoshop

RGB **sRGB**
separiert mit **ISO Coated v2 (ECI)**
CMYK-Daten der separierten RGB-Abstufungen 16 - 255

Vergleich der Rendering Intents
1 perzeptiv 2 relativ farbmetrisch 3 absolut farbmetrisch



Profilttest - Farbseparation mit Photoshop

RGB **sRGB**
separiert mit **ISO Coated v2 (ECI)**
CMYK-Daten der separierten RGB-Abstufungen 16 - 255

Vergleich der Rendering Intents
1 perzeptiv 2 relativ farbmetrisch 3 absolut farbmetrisch

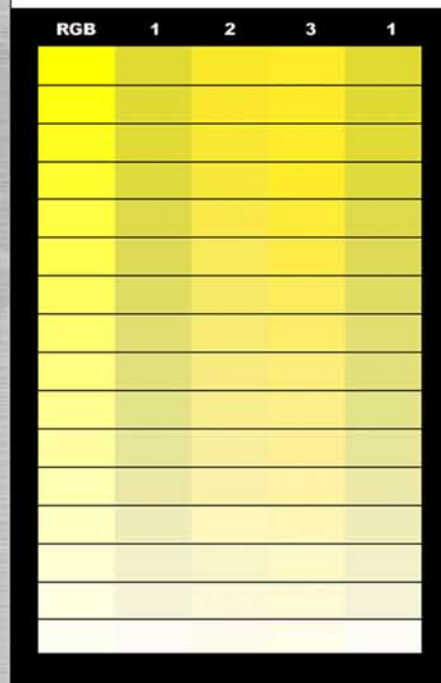


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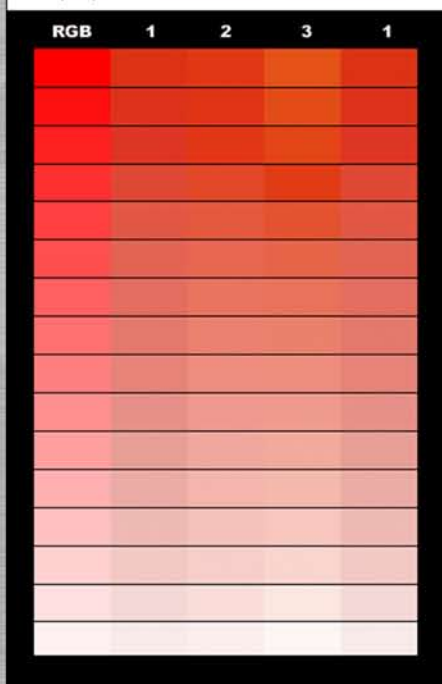
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Profilttest - Farbseparation mit Photoshop

RGB **sRGB**
separiert mit **ISO Coated v2 (ECI)**
CMYK-Daten der separierten RGB-Abstufungen 16 - 255

Vergleich der Rendering Intents
1 perzeptiv 2 relativ farbmetrisch 3 absolut farbmetrisch



Profilttest - Farbseparation mit Photoshop

RGB **sRGB**
separiert mit **ISO Coated v2 (ECI)**
CMYK-Daten der separierten RGB-Abstufungen 16 - 255

Vergleich der Rendering Intents
1 perzeptiv 2 relativ farbmetrisch 3 absolut farbmetrisch

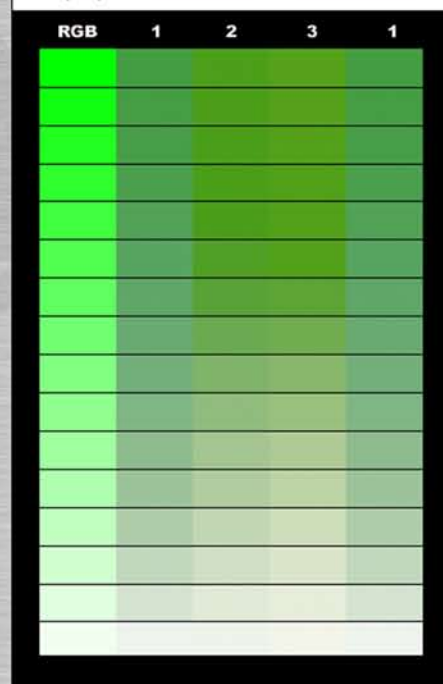


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The closest result of separation compared to the original sRGB ramp is achieved with:

- Cyan: absolute colorimetric
- Magenta: absolute colorimetric
- Yellow: absolute colorimetric
- Red: relative colorimetric
- Green: relative colorimetric
- Blue: perceptible

A single rendering intent for generally good results can not be identified.

Profiltest - Farbseparation mit Photoshop

RGB sRGB
separiert mit ISO Coated v2 (ECI)

CMYK-Daten der separierten RGB-Abstufungen 16 - 255

Vergleich der Rendering Intents
1. perceptiv 2. relativ farbmetrisch 3. absolut farbmetrisch

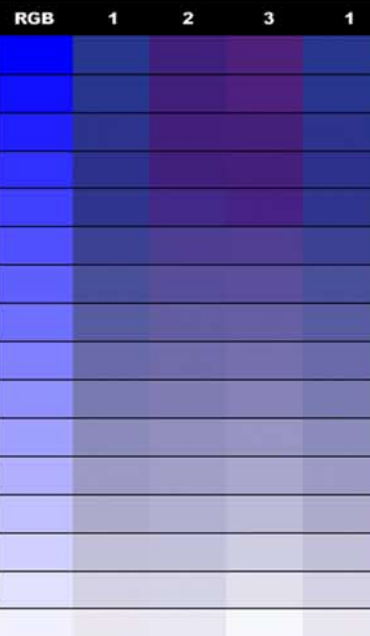


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Visual comparison of Print / Proof 27L / Proof 39L

Proofed CMY Colour patches different to the offset print

ISOcoated 27L

24 von 139 Farbfeldern stimmen beim optischen Vergleich deutlich nicht mit dem Andruck überein (17%):

Magenta
CMYK 0 70 0 0
CMYK 0 80 0 0
CMYK 0 90 0 0

Orange
CMYK 0 50 100 0
CMYK 0 60 100 0
CMYK 0 70 100 0
CMYK 0 80 100 0
CMYK 0 90 100 0

Braun
CMYK 60 60 60 0
CMYK 70 70 70 0
CMYK 80 80 80 0
CMYK 90 90 90 0
CMYK 100 100 100 0

Blau
CMYK 100 100 0 0
CMYK 100 100 10 0
CMYK 100 100 20 0
CMYK 100 100 30 0
CMYK 100 100 40 0
CMYK 100 100 50 0
CMYK 100 100 60 0
CMYK 100 100 70 0
CMYK 100 100 80 0
CMYK 100 100 90 0
CMYK 100 100 100 0

gemessene Abweichungen:
Durchschnitt avg ΔE 1,97
Maximum max ΔE 3,06
Primärfarben max ΔE 3,07
Bedruckstoff max ΔE 1,19



ISOcoated v2 39 L

14 (16) von 139 Farbfeldern stimmen beim optischen Vergleich deutlich nicht mit dem Andruck überein (10%):

Grün
CMYK 100 0 100 0 (3 x)
CMYK 100 0 40 0
CMYK 100 0 50 0
CMYK 100 10 100 0

Magenta
CMYK 0 60 0 0
CMYK 0 70 0 0
CMYK 0 80 0 0
CMYK 0 90 0 0

Orange
CMYK 0 40 100 0
CMYK 0 50 100 0
CMYK 0 60 100 0
CMYK 0 70 100 0
CMYK 0 80 100 0
CMYK 0 90 100 0

gemessene Abweichungen:
Durchschnitt avg ΔE 1,15
Maximum max ΔE 2,29
Primärfarben max ΔE 1,39
Bedruckstoff max ΔE 0,33

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Colours

The German Media Standard Print uses some colours from ISO 12647-2 AMD1, but is not identical with the standard.

Differences are:
CY 3,6 dE;
CM 5,0 dE;
CMY is not referenced.

ISO 12647-2 / ISO 12647-2 AMD1 / Medien Standard Druck 2007									
K	C	M	Y	MY	CY	CM	CMY	K	
							not avail.		ISO 12647-2
									ISO 12647-2 AMD1
									Medien Standard Druck 2007
									ISO 12647-2
K	C	M	Y	MY	CY	CM	CMY	K	
ISO 12647-2 / ISO 12647-2 AMD1 differences in delta E (white backing)									
0	0	0	2	4,583	8	9,434	5,831	0	
ISO 12647-2 / Medien Standard Druck 2007 differences in delta E (white backing)									
0	0	0	2	4,583	6,708	5,831	--	0	
ISO 12647-2 AMD1 / Medien Standard Druck 2007 differences in delta E (white backing)									
0	0	0	0	0	3,606	5	--	0	

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The problem with Blue

Blue (CM / overprint of Cyan and Magenta) is different in ISO 12647-2 and Amendment (AMD 1).

ISO coated v2 (eci) and the German Media Standard Print are using a blue definition that is 5,8 (5) dE different from both standards.

Difficult Blue CM

According to the "Read me files" the values for Blue (CM) have all been captured using the the same standards and methods.

Nevertheless the resulting color values are in measuring and visual comparison quite different.

Colouredifferences in delta E

Source	Media Standard Print 2007
ISO 12647-2	5,831
ISO 12647-2 AMD 1	5
ISO Coated v2 (eci)	0

ISO 12647-2 AMD 1

Medien Standard Druck 2007

ISO 12647-2

ISO Coated v2 (eci)

Separations of RGB images

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CMYK values of sample colours separated either with ISO Coated eci (ISO 12647-2 / FOGRA 27L) or ISO Coated v2 eci (ISO 12647-2 AMD1 / FOGRA 39L) are significantly different.

CMYK results according to the RGB original are not achievable without significant manual corrections.



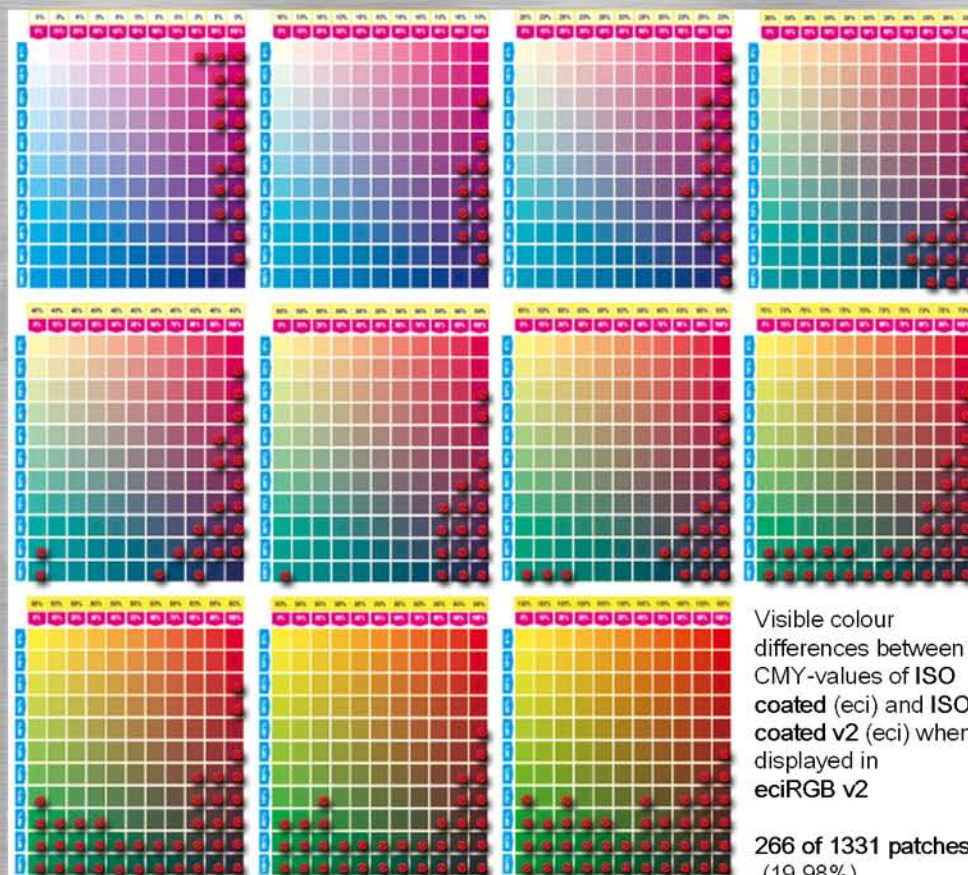
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SWS Software Support

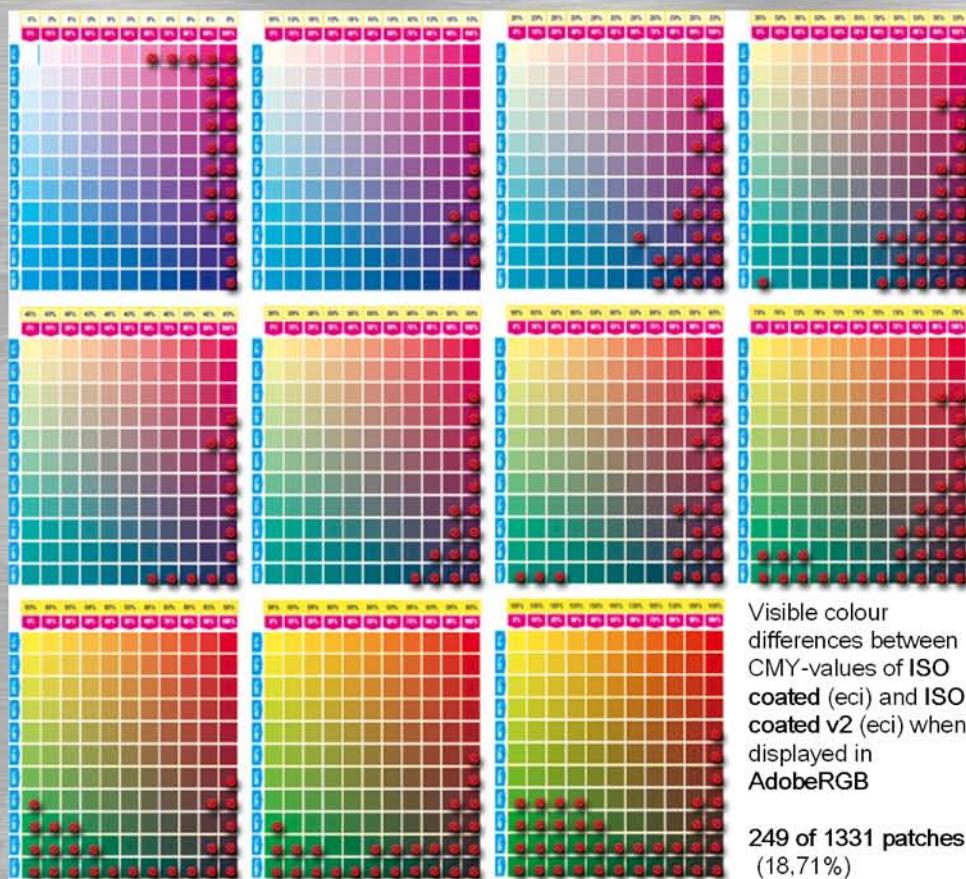
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Visible colour
differences between
CMY-values of ISO
coated (eci) and ISO
coated v2 (eci) when
displayed in
AdobeRGB

249 of 1331 patches
(18,71%)



SWS Software Support

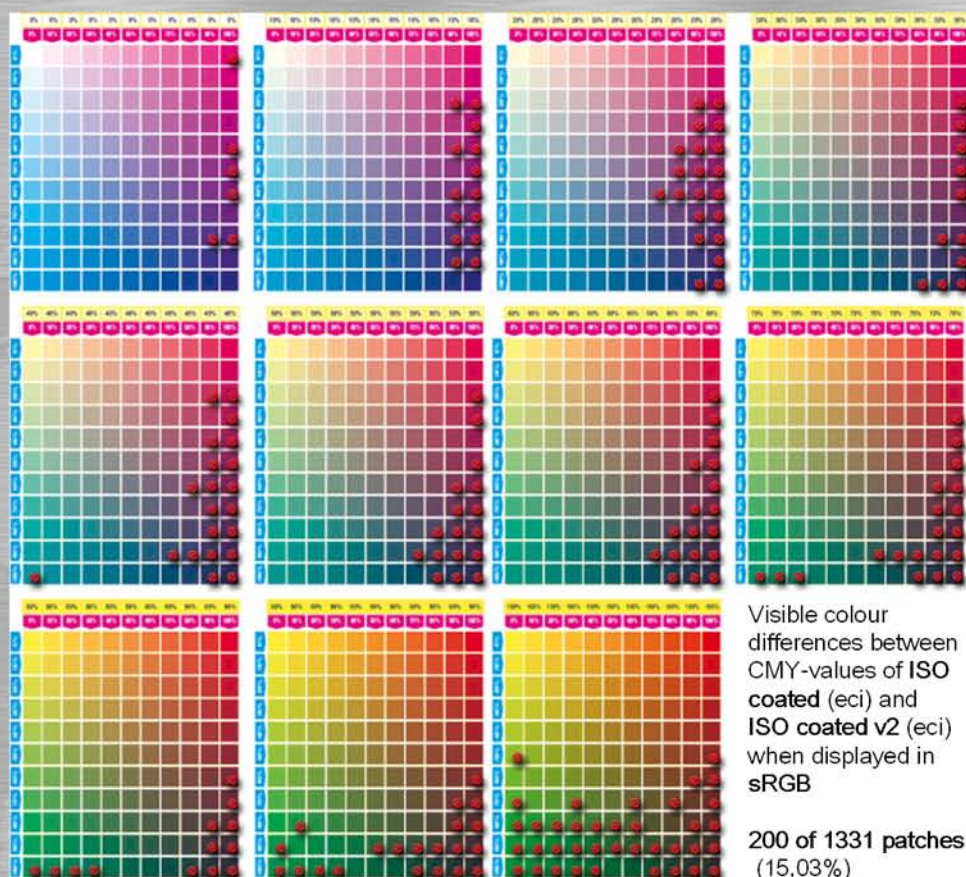
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Visible colour
differences between
CMY-values of ISO
coated (eci) and
ISO coated v2 (eci)
when displayed in
sRGB

200 of 1331 patches
(15,03%)

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Summary & Details (part 1/5)

ISO 12647-2 AMD1 is the standard of ISO TC 130 (graphic technology) for controlling and separating colours for proof and print.

Images processed in workflows mainly have the same sRGB source colour space. Office, home office and private users expect to be able to print what they see on the display. With existing technologies, tools and methods used in graphics technology, this can not be achieved without trained users and significant manual corrections to CMYK images.

ISO 12647-2 AMD1 (FOGRA 39L), derived profiles and colour management (as is) can not be adapted for a consistent and reproducible colour workflow for office, home office and private users. The main reason for this statement is, that all rendering intents show significant problems in separations.

Details:

FOGRA 39L characterization data

- 39L is based on a mix of measurement and idealized colours picked from different prints
- 100% of K, C and M are less than 1dE darker than in 27L
- other differences to 27L are detected in Y (2 dE), MY (4,6 dE), CY (8 dE), CM (9,4 dE), CMY (5,8 dE)
- percentages of colours especially K, M and CM are not homogenous, effects of single colours are not reflect in the overprint and vice versa

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Summary & Details (part 2/5)

Issues with ISO 12647-2 AMD1 and the derived profile ISO Coated v2 (eci)

- Colours (39L) are not homogenous. The brightness of several colour patches, when expected to get darker get brighter instead. Colour definitions in some areas are idealized and can not be achieved in one and the same print.
- The variety of rendering intents (ISO Coated v2 – eci) for colour separations does not include a single option useable for all kinds of images.
- For colour separations according and close to the original sRGB-file a lot of experience and manual corrections are necessary.
- In several colour areas, proof prints (ISO Coted v2 – eci) are misleading and generate confusion if colour corrections are necessary or not.
- Visual comparison of CMY-values when assigned to different RGB colour spaces show mismatches between 15% (sRGB), 19% (Adobe RGB) and 20% (eciRGB, recommended by eci).

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Summary & Details (part 3/5)

ISO Coated v2 (eci)

using ISO Coated v2 (eci) for proof simulation and colour separations the summary of all effects already mentioned applies.

Additional effects while proofing with ISO Coated v2 (eci) are:

- CMY-grey's are less, but still greenish
- CM-blue is redish and closer to the real print
- CY-greens and combinations with M do **not** match the print
- MY (orange) does not match the real print
- CMY overprint is brighter than K

Colours in grey, green, blue, orange and brown areas are misleading.

The proof gives the impression that colour corrections in these areas are necessary - although the CMYK-values will print correctly on the press without correction

German Media Standard Print

references to FOGRA 39L and ISO 12467-2 AMD1, but colours are not identical with the standard. Differences are:

- CM (5 dE),
- CY (3,6 dE),
- CMY is not given and can not be compared

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Summary & Details (part 4/5)

Additional effects in colour separations with ISO Coated v2 (eci) are:

- no general rendering intent for separations of sRGB-images can be identified
- for a good representation of all colours, corrections have to be applied manually
- best results are achieved for the separation of sRGB images mainly containing the colours:
 - C (Cyan), M (Magenta) & Y (Yellow)
absolute colorimetric rendering intent
 - MY (Red) & CY (Green)
relative colorimetric rendering intent
 - CM (Blue)
perceptive rendering intent
- separations of sRGB sample colours (blue skies, green beans, red spices and muddy brown water with leaves) are very much darkened and show different color casts that are not according to the original image.
- Colours in some areas are differently displayed than the CMYK values will print. This makes it difficult for the user, because it is not possible to rely on the colours of the image displayed.

Summary & Details (part 5/5)

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Visually decetable differences between CMY colours when displayed with ISO Coated (eci) and ISO Coated v2 (eci). Depending of the RGB color space (display color space) the comparison of color differences between ISO Coated (eci/27L) and ISO Coated v2 (eci/39L) profiles show differences and recognizable mismatches using

- eciRGB, 266 of 1331 color patches (19.98%)
- Adobe RGB, 249 of 1331 color patches (18.71%)
- sRGB, 200 of 1331 color patches (15.03%)

Approximately 4% more color differences are visible using displays with bigger gamuts than sRGB.

Conclusion

All the details of this summary add up to the conclusion that the standards and derived tools and profiles (as is) used in graphic technology can not be adopted for office, home office and private users, because they are:

- too complicated
- too inconsistent
- too inaccurate
- images need significant manual corrections to match the original

Other technologies should be evaluated and considered for standards targeting at office, home office and private users.

Situation & Future Tasks

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- Digital technology makes colour available and affordable for professionals, semi-professionals and private users
- Colour displays and printers are adopted in all offices and homes
- The customer demand is **What you see is what you get**

To achieve the customers demand, images and image files should to be handled like music files.

Images should be passed unmodified to all applications and devices. The customer should be able to adjust the respective device (loudness / brightness and sound / colour) without modifying the data. Modifications should be added as overlay (skin) or stored as a new file. Nevertheless metadata should be transported from one version to the next and not deleted by incompatible or incomplete software adaptations.

An agreed device-independent colour space must be established. Absolute colour information should be passed to the respective devices. Tools for adjusting colour output for the respective devices should be implemented in drivers or separate software for visual or measured calibration.

Different aspects of colour are in the work area of a variety of standardisation committees, including ergonomics, lighting technologies, office equipment, photography as well as paper and pulp.

A combined effort to evaluate and adjust the respective standards should be started for the benefit of easier, faster and better colour output.