# Fogra Specification – System and Process Check for Large Format Printing application V1.0

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Streitfeldstrasse 19

81673 Munich

www.fogra.org

Authors: Andreas Kraushaar, Dorin Pitigoi



**Foreword:**
This specification originates from work of Fogra Digital Printing Working Group (DPWG). This was originally proposed as an ISO Technical Specification (ISO TC130 WG3) but it was felt by the group that it would be difficult to gain consensus around many of the details and that this would be better as an industry specification in the first instance. Working group experts were not clear about its intended audience, the scope and use. For this reason it was agreed at the 2015 DPWG meeting to ask ISO to pause the ISO project (ISO/DTS 15311-3) and to develop a Fogra specification in the short term to show how this standard can be used in practice. When it has been demonstrated that the ideas are workable (and perhaps some of the tolerances adjusted) we plan to restart this work in ISO TC130 WG3.

# Introduction

When producing a colour reproduction, it is important that the persons responsible for data creation, colour separation, proofing and printing operations have previously agreed on a minimum set of parameters that define the visual characteristics and other technical properties of the planned print product. This Fogra specification is based on ISO/DTS 15311-1 and specifies the requirements and print quality attributes that can be applied to digital large format signage printing products and by implication to the systems that uses a print combination to produce the respective print products.

Recommendations are provided with regard to appropriate test methods associated with these requirements and print quality attributes. In cases where the effects of environmental factors are relevant, additional permanence requirements are provided. Based on different market requirements and expectations, any signage application produced using large format digital printing technologies is requiring different aim levels of the relevant set of parameters that should be stipulated to allow the printer to evaluate, control and test an entire print combination that will produce the print product and the print buyer to test the resulted print product against defined specifications and expectations. This specification therefore addresses two use cases:

**a)** Printers/Printing systems and Substrate manufacturers: To check if process control methods and procedures, when applied to an entire print combination, comprising of a digital printing system, substrate, ink and printing parameters, meets the criteria set out by the aim of an intended typical signage application ("system check " or "process check")

**b)** Printers/Print buyers: To check if a given print product meets the criteria set out by a typical signage application ("print check")

The metrics represents a collection of laboratory methods to be conducted by an equipped print shop or test lab and practical methods to be used by the printers and print buyers. Due to the lack of appropriate objective methods, some image quality metrics are still subject to be checked by visual inspection.

This marketplace had been historically centred on screen printing and is today mostly dominated by roll-to-roll, flatbed or hybrid large format inkjet printers with inkjet technology and various ink technologies such as aqueous, solvent, UV-curable or latex inks. The used substrates very much relate to the final application, which is extremely diverse. Here, typical substrate widths can be grouped into small, middle and superwide format.

This specification is focused but not limited on typical applications in the digital large format printing field such as fine art and photography, architectural design and interior decoration, textile graphics, promo display, Point of Sale (POS) and Point of Purchase (POP), advertising posters, displays, exhibition and events graphics, information, personalized, traffic and transit signs, banners and building covers, billboards, vehicle wraps, fleet graphics and truck curtains. It should be noted that this specification is restricted to production print substrates that allow for a meaningful interpretation of ISO 13655-compatible measuring instrument readings for front and/or backlit viewing conditions corresponding to reflectance response (0:45 or 45:0 geometry) and transmittance response (d:0 geometry). In other words, matching measurements for conventional (isotropic, i.e. paper like) and digital prints covered in this specification need to be consistent with the visual judgement. Provisions for printing on non-paper like substrates with specific requirements such as metallics or ceramics are subject for further specifications.

Following the concept of ISO 15311-1, to prefer a use case or purpose oriented classification instead of a process or technology oriented one, two governing aspects, which correspond to different requirements, have been addressed in this specification. The first relates to the final viewing distance and the second is the indoor or outdoor usage. Combining requirements derived from the intended signage application and print buyer quality expectations, leads to the need for different print image quality aims being achieved and hence specified.

A typical large format print combination is responsible for the resulting print image quality. This means that the criteria and aims are not connected with the underlying printing technology, but according to the requirements of the intended use case. Standardization does not mean that materials such as substrates, inks or machinery must be limited. On the contrary this specification allows for a manageable facilitation of a material and process diversity in terms of rigours and consistent print quality. Only then is it possible for the printer to identify suitable print combinations, i.e. collection of digital printing

system, substrate, ink and printing parameters that meets the criteria set out by the aim of an intended typical signage application.

The print buyer then objectively evaluates the resulting print image and its quality by a set from a defined suitable criteria addressing colour rendition capabilities such as colour and surface finish, micro- and macro- homogeneity (uniformity), detail rendition capabilities such as resolution, artefacts and further permanence aspects such as light and weather fastness which are relevant for lasting applications. Furthermore, the same approach may be used by printing systems and substrate manufacturers to evaluate the suitability of their products intended markets and signage applications.

While the majority of the stipulated criteria and associated uncertainties can be understood as absolute metrics that can be evaluated and codified without a physical reference, in contrast, colour accuracy can be understood as a relative metric. It describes the level of visual closeness between the digital production print and the intended colour aims defined by the reference printing condition.

The colour accuracy of the printed matter is categorized into two different types of image reproduction or more general colour expectations:

— "Absolute": Full Colour Reproduction FCR-Side by Side (FCR-Absolute or double stimulus), provides the established principle of matching a reference characterization data set within the tolerance specified by the pertinent quality level. A typical application would by a trade fair stand asking for matching image content. "Full" refers to the colorimetrical definition of the entire document such as a complete exchange by means of PDF/X-data. This kind of image reproduction can be attributed to lead to identical colours.

— "Media Relative": Full Colour Reproduction FCR-Media Relative (single stimulus), provides a colour rendering mechanism where the image content is persevered relatively with respect to pertinent substrate of use. Although the entire document must be colorimetrically defined (including RGB objects) the colour transformation between the reference printing condition and the actual printing condition shall be done with the ICC V4 media relative rendering intent with our without the use of black point compensation. This kind of image reproduction can be attributed to lead to media relative colours and shall only apply when the reference and the actual printing gamut are similar. Concrete aim values are provided in the pertinent clauses.

Based on the provided aim values and associated uncertainties for each of the four product categories (Fine art, POS, Banner and Billboard) it is the responsibility of the parties involved to agree on a set of tolerances.

# 1 Scope

This FograSpec specifies the requirements, aim values and tolerances for print quality attributes that can be applied to digital large format signage print products and by implication to the systems that uses a print combination to produce the respective print products. Recommendations are provided with regard to appropriate test methods associated with these requirements and print quality attributes. The print check reflects an abridge test of a printed sheet against colour accuracy, uniformity and details sharpness. The process check, also known as system check, covers an extended test of the entire print combination. In cases where the effects of environmental factors are relevant, additional permanence tests are provided. This specification is

— directly applicable to roll-to-roll, flatbed or hybrid large format inkjet digital printing systems regardless of their marking technology, ink technology and width;

— not applicable to metallic or interference inks, nor functional printing applications.

# 2 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15311-1 and the following apply.

**3.1**
**digital contract proof**
digital print of high colour accuracy, useable as reliable visual colour reference for printing and as a part of a commercial agreement as defined in ISO 12647-7

**3.2**
**digital printing systems**
group of production printing systems that prints one unique iteration at a time for either variable data or classical printing applications. They include but are not limited to xerographic and ink jet marking engines.

**3.3**
**single pass inkjet**
way of jetting where the head is placed in a fixed position

**3.4**
**print combination**
components and settings used for printing that significantly constitute the final visual appearance of the print product.

Note 1 to entry: When related to device mode printing, a typical print combination comprises the printer, the substrate, the ink, the used interpreter (RIP) and the print mode. In addition, simulation mode print includes the colour management settings and the reference printing condition to be simulated.

**3.5**
**spot colour**
single colorant, identified by name, whose printing tone-values are specified independently from the colour values specified in a colour coordinate system

**3.6**
**validation print**
print produced directly from digital data early in the production chain meeting the requirements of ISO 12647-8

Note 1 to entry: A validation print can have reduced accuracy compared to contract proof.

**3.7**
**production print substrate**
intended substrate to be used for digital production printing

**3.8**
**media profile**
also known as media set, it comprises of all data files including the used interpreter (RIP) specific file(s) and the ICC colour profile(s) used to capture the components, settings, calibration, adjustments and characterization of the respective print combination, files that are used by the same interpreter (RIP) during job processing stage prior to the actual printing stage

**3.9**
**production workflow**
software suite used in large format printing that integrates specific technologies, standards and tools for job submission, preparation and interpreting (RIP), media profile creation and colour handling, printing system driving

# 3 Comments (intentionally blank)

# 4 Requirements

## 4.1 General

### 4.1.1 Product categories

This specification is focused but not limited on typical applications in the digital large format printing field such as fine art and photography, architectural design and interior decoration, textile graphics, promo display, Point of Sale (POS) and Point of Purchase (POP), advertising posters, displays, exhibition and events graphics, information, personalized, traffic and transit signs, banners and building covers, billboards, vehicle wraps, fleet graphics and truck curtains. This area is very dynamic with signage applications updated or evolved into new and niche applications as result of technological improvements, creative ideas and market demands, migration from more conventional printing technologies and also cross-industries production. Same application may require and might be produced using various production print substrates with different appearance and colour gamut constrains. As such, neither applications, nor application to substrate relation, nor indoor or outdoor usage aspect are not mutually exclusive and collectively exhaustive.

The grouping of four different use cases is based on the assumption that market needs can be well correlated with the typical viewing distances at which the related products are typically been viewed and assessed. In addition it is important if the product is subject for indoor or outdoor usage.

Table 1 presents four viewing distance based categories and typical associated use cases derived from the optimal viewing/reading distance that is defined to be equal to the diagonal of the media format of the printed product.

**Table 1 — Viewing distance use case classes**

| Use case categories | Examples of typical applications | Typical intended viewing distance |
|---|---|---|
| Close range – Photo | Fine Art, Photography, Interior Decoration, Small POP/POS, Backlit, Displays and Signs, Decoration | Up to 1,5 m |
| Average range – POS | POP/POS Displays, Trade Show Graphics, General Purpose Signage, Citylight, Advertising Posters | 1,5 – 5 m |
| Increased range – Banner | Outdoor Backlit, Unipol, Wall Murals, Large Trade Show Graphics, Banners, Scroller, Transportation/Bus Shelters, Vehicle Wraps | 5 – 15 m |
| Distant range – Billboard | Billboards, Big banners & Building covers | Over 15 m |

### 4.1.2 Reference printing conditions

Most of the production workflows in the digital large format printing field are using colour management to print in simulation mode by applying the appropriate colour transformation between the intended production printing condition (also known as the reference printing condition) and the output printing condition (actual printing condition) fully characterizing the chosen print combination comprising of a digital printing system, substrate, ink and printing parameters.

The data sets to be supplied for printing, should be accompanied by a digital contract proof according to ISO 12647-7 or a validation print according to ISO 12647-8, unless there is agreement to the contrary by all parties concerned. This print shall simulate the intended printing condition. Unless otherwise specified those proof prints shall not be used to gather measurements to be used as reference values in this specification. However, it should be used as a visual check in the set-up and approval phase to determine that the rendering technique has achieved a sufficient match at the predetermined quality level.

Digital proofs using an electronic display meeting the requirements of ISO 14861 [7] should be treated like digital proofs on a substrate.

NOTE There are no provisions for non-colour related information such as varnishes, die cutting and other special purpose overlays.

### 4.1.3 Colour measurement

The colour measurements and calculation of tristimulus values for reflective and transmissive samples shall always be made in accordance with ISO 13655. The measurement conditions (M0, M1, M2 or M3) and the backing to be used (white or black backing) should be in accordance with those specified for the characterization data set being used.

NOTE 1 When measuring special perforated and lower opacity substrates (mesh, one-way view, some textiles) using a measuring device with an appropriate large sized aperture, black backing provides better correlation between measurement and visual appraisal, regardless of the backing specified by the reference characterization data set.

It should be noted that this specification is restricted to production print substrates that allow for a meaningful interpretation of ISO 13655-compatible measuring instrument readings for front viewing conditions corresponding to reflectance response (0:45 or 45:0 geometry) and transmittance response (d:0 geometry). In other words, matching measurements for conventional (isotropic, i.e. paper like) and digital prints covered in this specification need to be consistent with the visual judgement. This can reasonably be expected by using ISO 3664 compliant viewing cabinets and transparency viewers. The relationship between transparency luminance and reflective illuminance should be the one described by ISO 3664. However, the principles of this specification may be applied in general for printing on a non-paper like substrate if it is passing the substrate conformance – visual based plausibility test method described in Annex 1. By analogy to the screen ruling factor considered when selecting the instrument sampling aperture in order to reduce uncertainty of the single measurement, it is highly recommended to use appropriate large aperture sizes that allows consistent measurements. Scanning instruments that facilitate a virtual averaging are providing also such means [5].

NOTE 2 Usually the d:0 transmittance measurements are taken media relative – device is calibrated or "zeroed" on the substrate white resulting in a relative white point with the L*a*b* value of 100/0/0.

### 4.1.4 Digital Print Combination

All image quality attributes are derived from a concrete set of physical print samples. For each evaluation the used print combination shall be identified by listing the primary components defined in Table 2.

**Table 2 — Print combination primary components**

| ID | Print combination primary components |
|---|---|
| 1 | Reference printing condition (and type of appraisal: Side-by-Side or Media Relative) |
| 2 | Colour accuracy Level (artwork): A, B or C |
| 3 | Printing system |

| | |
|---|---|
| 4 | Printing substrate |
| 5 | Colour management software |
| 6 | Production workflow |
| 7 | Intended Viewing Distance (Category: Fine Art, POS, Banner, Billboard) |

Additional settings also contribute to the final appearance but typically to a lower extent. They should be reported by means of an application data sheet. It is expected that a trained operator of the used print combination can use this information to unambiguously achieve similar output.

## 4.2 Data files

### 4.2.1 Data delivery

Printing systems that facilitate production workflows driving digital large format printing systems shall accept digital data delivered as PDF/X data files as defined in ISO 15930. If other formats are used it is the responsibility of the data provider to ensure that all information required for printing is delivered as supplementary data.

The intended printing condition should be defined by an ICC output profile being either a RGB-based or a CMYK-based profile. In case of spot colour reproductions this specification is limited to spot colours being used as solids in contrast to tint values or overprints with other colours. If not defined otherwise (e.g. to use a physical sample such as a swatch book) the reference is the colorants dictionary entry of the PDF file. The creator is responsible for a consistent use of spot colour names.

If the data is other than PDF/X, the data shall be defined colorimetrically using appropriate ICC source, destination or devicelink profiles and pertinent transforms. The provider needs to communicate with the receiver about that transformation (often called optimization) in order to avoid conflicts. This could be done by means of a proof print or soft proof based on the resulting image data. Annex C provides informative recommendations to optimize PDF data that is not fully defined (ambiguous) [24].

Additional requirements such as minimum image resolution or line width are use case dependent and should be defined on an individual basis.

NOTE 1 It is recommended to use guidelines provided by trade organizations such as the GWG or PDF/X-ready.

NOTE 2 Typical colour management transforms are used facilitate the so called simulation mode transform. However the device mode transform can be used to determine the system capability rather the final image quality of a practical print job.

In order to visually match a characterization dataset or a printing condition and related print quality level according to this specification, the print combination (see 4.1.4) shall be communicated.

## 4.3 Print quality measures

### 4.3.1 Overview

The format for reporting the metrics values and findings shall be done using the pertinent clauses of ISO 15311-1 (if present).

### 4.3.2 Colour and surface finish

#### 4.3.2.1 General

Based on the minimum requirements being communicated (see 4.1), the criteria are applicable for the evaluation of a printed matter produced as a result of a production process using a print combination comprising of a digital printing

system, substrate, ink and printing parameters. The print combination comprises all information about the used components or settings that significantly constitute the final print product.

The information defining the printed matter being assessed shall meet the requirements of 4.5.

#### 4.3.2.2 Print substrate

The print substrate name and colour shall be reported as required attributes according to ISO 15311-1 clause 4.3.2.2. Optional attributes should be reported if identified as being relevant for a specific use case or if those attributes are imposing limitations on other components of the print combination, such as substrate thickness relation to printing system maximum accepted thickness.

NOTE 1 White ink may be used to compensate for a dark, coloured or transparent substrate or to provide a uniform coloration of the anticipated lightness or reflection level. For such a case, the substrate colour is the result of white ink on substrate.

NOTE 2 Substrate colour is the actual white point of the print combination and can be extracted from the corresponding media profile.

Other relevant substrate requirements that are not covered by ISO 15311-1 such as the degree of curl (flatness, waviness) or shrinking (sizing) of substrates, should be provided as part of the data exchange between provider and receiver as a separate communication.

#### 4.3.2.3 Colour accuracy

The requirements for the OK-sheet are separated into practical colour accuracy assessment using control strips on the one hand and an extended scrutiny of the entire colour gamut using ISO 12642-compliant colour charts on the other hand.

The extended scrutiny of process check colour accuracy is to determine the relation of print combination to the intended reference printing condition throughout the entire colour gamut using ISO 12642-compliant colour charts and appropriate test forms (deviation from the intended target), while the practical colour accuracy assessment using control strips (representative subsets of the full colour charts) is to monitor variation during the print run and also the current status of the media set associated with the print combination in order to determine drifts from the master state indicating the need for readjustment/recalibration of the print combination by means of specific tools provided by the production workflows and/or printing system itself.

The control strip to be used for the practical evaluation shall meet the requirements of 5.2. The test chart to be used for the extended scrutiny shall be in conformance to ISO 12642-2.

NOTE Due to measurement recommendations of print combinations used for LFP signage applications, it is recommended to use a large patch size test chart such as DPWG Universal LFP Chart in order to facilitate measurement device with large aperture size and continuous averaging in strip measurement mode [31].

The three colour accuracy levels A, B and C shall be understood in a way that all criteria, met in the tolerance bands reflecting the practical uncertainties, define the relation between the reference and the reproduction, i.e. a typical colour assessment with only one criteria that meets Level B while all the rest are meeting Level A, than the entire assessment is defined as a Level B.

#### 4.3.2.3.1 OK-sheet requirements – "Absolute"

The deviation tolerances are derived by comparing the OK-sheet with the corresponding values of the reference printing condition.. The tolerances listed inTable 3 shall be applied for the three colour accuracy levels A, B and C for both the process and print check.

**Table 3 — Deviation tolerances bands for "Absolute" reproductions**

| Patch in digital printing form | Level C | Level B | Level A |
|---|---|---|---|
| **Practical colour quality assessment – print and process check evaluation:** | | | |
| Patch e) of 5.2 for substrate | $\Delta E^*_{00} \leq 3.0$ | $\Delta E^*_{00} \leq 3.0$ | $\Delta E^*_{00} \leq 3.0$ |
| All other patches of 5.2<br>CC95%, CSAve | 95 % percentile $\Delta E^*_{00} \leq 8.5$<br>Average $\Delta E^*_{00} \leq 6.5$ | 95 % percentile $\Delta E^*_{00} \leq 6.5$<br>Average $\Delta E^*_{00} \leq 4.5$ | 95 % percentile $\Delta E^*_{00} \leq 4.5$<br>Average $\Delta E^*_{00} \leq 2.5$ |
| Patches c) of 5.2<br>CSMaxNeutral | Max $\Delta C_h \leq 4.5$ [b] | Max $\Delta C_h \leq 3.5$ [b] | Max $\Delta C_h \leq 2.5$ [b] |
| **Extended scrutiny – process check only** | | | |
| All patches of ISO 12642-2<br>CCAve, CC95% | Average $\Delta E^*_{00} \leq 6.5$<br>95 % percentile $\Delta E^*_{00} \leq 8.5$ | Average $\Delta E^*_{00} \leq 4.5$<br>95 % percentile $\Delta E^*_{00} \leq 6.5$ | Average $\Delta E^*_{00} \leq 2.5$<br>95 % percentile $\Delta E^*_{00} < 4.5$ |
| [a] Due to the sign character of $\Delta H$ the absolute values ought to be used before averaging | | | |

#### 4.3.2.3.2 OK-sheet requirements – "Media relative"

A media-relative assessment is only applicable for actual printing conditions gamut's that are similar in size and shape to the gamut of the reference printing condition. This gamut check should be evaluated by using the print outs to be assessed. A separate (device mode) print out is not required.

In order to evaluate the gamut difference the following 10 patches shall be measured or extracted from characterization data set for both the reference and the actual printing condition and compared in order to determine the:

— Process colour black for the reference (Ref_K100) and actual (Act_K100),

— Composed Grey for the reference (Ref_CMY100) and actual (Act_CMY100) and

— Overprints of the chromatic process colours for the reference (Ref_CK100, Ref_MK100, Ref_YK100) and actual (Act_CK100, Act_MK100, Act_YK100).

Alternatively the minimum CIEL* lightness values may be obtained from the Black Point of corresponding ICC profiles assuming their achromatic nature.

When performing a media relative assessment as described by clause 4.3.2.4 of ISO 15311-1, the tested printing condition gamut shall meet the tolerances in Table 4 when compared to the reference printing condition gamut. The shadow area comparison results from the difference between the CIEL* lightness values of the reference printing condition (Ref_Min_CIEL_Dark) and of the actual printing condition (Act_Min_CIEL_Dark). The highlights area comparison results

from the $\Delta E^*_{00}$ difference between the substrate patches of the reference printing condition (Ref_paper) and of the actual printing condition (Act_paper).

**Table 4 — Tolerances for gamut difference to check if "Media relative" is applicable**

| | Black point difference | White Point difference |
|---|---|---|
| Level A | Abs(Act_Min_CIEL_Dark - Ref_Min_CIEL_Dark) < 3.5 | $\Delta E^*_{00}$ (Ref_paper,Act_paper) < 6.5 |
| Level B | Abs(Act_Min_CIEL_Dark - Ref_Min_CIEL_Dark) < 10.5 | $\Delta E^*_{00}$ (Ref_paper,Act_paper) < 8.5 |
| Level C | Abs(Act_Min_CIEL_Dark - Ref_Min_CIEL_Dark) < 15.5 | $\Delta E^*_{00}$ (Ref_paper,Act_paper) < 11.5 |

Once the criteria of Table 4 have been met, the measurements of the control patches defined in 5.2 and all patches of 12642-2 shall be transformed to media relative numbers using the same method employed by a colour transformation using the ICC V4 media relative rendering intent [8] without the use of black point compensation.

The colour differences between the test printing condition and the revised reference shall agree with the values in Table 5 and are applicable for both process check and print check. They are identical with those defined in Table 3, despite the paper requirements.

**Table 5 — Deviation tolerances bands for "Media relative" reproductions**

| Patch in digital printing form | Level C | Level B | Level A |
|---|---|---|---|
| All other patches of 5.2<br>CC95%, CSAve | 95 % percentile $\Delta E^*_{00} \leq$ 8.5<br>Average $\Delta E^*_{00} \leq 6.5$ | 95 % percentile $\Delta E^*_{00} \leq$ 6.5<br>Average $\Delta E^*_{00} \leq 4.5$ | 95 % percentile $\Delta E^*_{00} \leq$ 4.5<br>Average $\Delta E^*_{00} \leq 2.5$ |
| Patches c) of 5.2<br>CSMaxNeutral | Max $\Delta C_h \leq 4.5$ [b] | Max $\Delta C_h \leq 3.5$ [b] | Max $\Delta C_h \leq 2.5$ [b] |

#### 4.3.2.3.3 Spot colours reproduction

If present, the reproduction of spot colours shall meet the requirements stipulated inTable 6. Spot colours are used mostly as solids, compared to tone values or overprints with other colours, and the control strip to be used for the practical evaluation shall meet the requirements of 5.2 g). The values shall be reported using the spot colour name as supplied either from the data file or the driving production workflow and at least two significant figures.

**Table 6 — CIEDE2000 tolerances for spot colours**

| | Level C | Level B | Level A |
|---|---|---|---|
| Maximum colour difference | $\Delta E^*_{00} < 5.5$ | $\Delta E^*_{00} < 3.5$ | $\Delta E^*_{00} < 2.5$ |

NOTE 1 For the process check evaluation it is recommended to check the spot colours coverage in order to identify and use the particular print combination that allows the appropriate colour accuracy level of spot colour match.

NOTE 2 Note to entry: In larger format printing, spot colours are typically reproduced using "process ink emulation" as compared to conventional printing using separate spot colour ink. A separate ink usually gives a more uniform reproduction since there are no screening effects. Spot colours that are out of the gamut of the actual print combination are handled the same way as CMYK content that is out of gamut.

#### 4.3.2.3.4 Short and long term repeatability of a print combination

For each print combination the short term and long term repeatability should be evaluated and reported.

The repeatability derived by printing a control strip in conformance with 5.2 shall not exceed the pertinent values given in Table 7:

— when the colours are being measured at the same approximate position on the sheet; and

— when measured on the first sheet drawn after the vendor specified warming-up period and, if necessary, after readjustment/recalibration of the print combination by means of specific tools provided by the production workflows and/or printing system itself.

**Table 7 — Repeatability of control strip patches (CIEDE2000 colour differences)**

| | Level C | Level B | Level A |
|---|---|---|---|
| Average | $\Delta E^*_{00}$ < 3.5 | $\Delta E^*_{00}$ < 2.5 | $\Delta E^*_{00}$ < 1.5 |
| Standard deviation | $\Delta E^*_{00}$ < | $\Delta E^*_{00}$ < | $\Delta E^*_{00}$ < |

#### 4.3.2.3.5 Variation tolerances

In the LFP signage market, print runs are usually limited in volume and as such the evaluation is usually limited to one single reproduction designated as the OK-sheet. Specific applications like mass production for interior decoration, fine art, big national campaigns, etc., should require repeatability check within the same printing run when shared across different printing systems and locations. A similar situation is created when different reproductions as parts of the same print run are assembled to form a much bigger product. In many cases commercial and practical aspects are imposing specific limitations related to the number of samples being subject of the evaluation.

Each selected sample of printed matter from the entire print run shall be evaluated and shall meet the colour accuracy requirements of 0 for "Absolute" or 4.3.2.3.2 for "Media relative".

### 4.3.2.4 Tone value reproduction limits

Intermediate tone values between the (simulated) substrate white and solid shall transfer onto the digital printing in a consistent and uniform manner over a tone value range that should include at least the tone reproduction limits of the printing condition to be simulated. However, the reproduction of extreme highlights and shadow tones becomes less relevant with the increasing of the intended viewing distance.

NOTE It is good prepress practice that no image parts need to rely on tone values outside of the tone value reproduction limits of the production printing process

Test objects of adequate size using CMYK tone values (data) of 0 – 5 % and 95 – 100 % shall be printed and visually checked to be within the tone value reproduction limits as typically presented by Table 8, when viewed under ISO viewing condition P1 according to ISO 3664 and corresponding intended viewing distance.

**Table 8 — Typical tone value reproduction limits for viewing distance use case classes**

| Use case categories | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| Tone value reproduction limit | 1 – 99 % | 2 – 98 % | 3 – 97 % | 5 – 95 % |

#### 4.3.2.5 Tone smoothness

The test objects specified in 5.3.1 shall show no easily visible steps within the tone value reproduction limits if viewed under ISO viewing condition P1 in accordance with ISO 3664 and corresponding intended viewing distance. Any findings should be reported.

#### 4.3.2.6 Number of tonal steps (P-score)

The numbers of visual discernible tonal steps should be measured according to the method described by ISO/PDTS 18621-12 [11]. Table 9 show the typical values for viewing distance use case classes.

**Table 9 — Typical number of visual discernible tonal steps for viewing distance use case classes**

| Use case categories | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| Minimum number of tonal steps for CMYK (average) | 80 | 60 | 40 | N/A |
| Typical uncertainty | ±10 | ±10 | ±10 | N/A |

#### 4.3.2.7 Gloss

Definitions for reference printing conditions often do not specify a gloss level for either the substrate or ink set. In cases where information about the gloss is known, e.g. by means of a required class value (matte, semi-matte, glossy), the gloss of solid tone colours should be visually similar to each other and in relation to the production substrate. However, the gloss difference becomes less relevant with the increasing of the intended viewing distance.

The gloss should be measured according to the method described in clause 4.3.6.3 of ISO 15311-1 [23].

NOTE If the gloss of the production print is substantially changed by the applied colorants, a surface-finishing step might improve the situation.

### 4.3.3 Uniformity

#### 4.3.3.1 General

Uniformity (homogeneity) refers to the subjective impression of colour uniformity across a large image that is intended to have a uniform colour. When measuring homogeneity the intended viewing distance use case classes should be taken into account.

When referring to digital printing systems used to produce printed matter in conjunction with this specification, it is of interest to assess the resulted coloration across the printing width of such a system and to a lesser extent into the direction of the substrate feeding. The size of a typical print product is often connected to the used printer (printing width). In order

to avoid many different test form layouts, the files should be designed, imposed and printed to the available printing size using the following principles:

— It should be A3 size format,

— It should allow the identification of their position in relation to the printing width and length,

— It should cover at least 2/3 of the printing width.

NOTE The following schema is using a step and repeat layout of 9, 18 or 27 A3 format test form marked by means of rows (A, B and C) and columns (1 to 3, 6 or 9).

— For printers up to 155 cm (61"): use 3x3 test forms (description: A1 to C3)

— For printers up to 264 cm (104"): use 6x3 test forms (description: A1 to C6)

— For printers over 264 cm (104"): use 9x3 test forms (description: A1 to C9)

#### 4.3.3.2 Large area uniformity

The variability of the coloration across and down the print format should be verified by printing a test form containing at least one control patch element composed from a chosen CMYK combination and using the requirements of 4.3.1. Each such patch found on the printed test forms should be taken into consideration and shall be measured and the CIEDE2000 colour differences between any patch and the average of all patches shall be computed. Typical values for viewing distance use case classes are presented in Table 10. It shall be reported if the test forms have been printed either using a device mode or a simulation mode transform.

**Table 10 — Typical within format uniformity for viewing distance use case classes**

| **Use case categories** | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| Standard deviation of CIEL* CIEa* and CIEb* of all patches | 1.5 | 2.5 | 3.5 | N/A |
| Maximum $\Delta E^*_{00}$ | 3.0 | 4.0 | 5.0 | N/A |

NOTE For printing systems with lower within format uniformity a common practice in case of tiles that will be assembled to form a bigger product is to rotate each adjacent tile by 180 ° in order for the overlapping area to be printed in same area of the printing system, hence reducing the visual impact due to variability.

This evaluation could also be applied for redundant colour patches e.g. part of control strips (placed within or across the printing format) in order to check the local inhomogeneity.

#### 4.3.3.3 Streakiness (visual method)

The print should be visually inspected in order to show no reasonable amount of streaks or banding, i.e. 1-dimentional bands within an area that should be homogeneous. Any findings should be reported.

#### 4.3.3.4 Mottle and graininess (visual method)

The print should be visually inspected for microscopic in-homogeneities such as mottling or graininess caused by both substrate formation and the imaging process. Using a magnifying glass or a microscope, mottle effects such as coalescence may be observed indicating a possible improper ink substrate interaction. In a similar manner, increased graininess usually

indicates either in between print heads misalignment or incorrect print heads carriage height in the relation to the substrate. Any findings should be reported.

#### 4.3.3.5 Mottle (Alternative method – M-Score)

Macroscopic (process related) in-homogeneity should be measured according to the method described in ISO/PDTS 18621-21 [12]. Typical values for viewing distance use case classes are presented in Table 11.

**Table 11 — Typical M-Score values for viewing distance use case classes**

| Use case categories | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| M-Score | 90 | 80 | 70 | 60 |
| Typical uncertainty | ±5 | ±5 | ±5 | ±5 |

#### 4.3.3.6 Graininess (colour extension)

The graininess should be measured according to the method described in ISO/PDTS 18621-22 [13] using all patches of a control strip in conformance with 5.2 and a scanning resolution of 300 dpi. The spatial filtering shall be applied in correspondence with the given viewing distance use case classes and the value shall be reported.

**Table 12 — Graininess values for viewing distance use case classes by means of the ΔE00_STD**

| Use case categories | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| ΔE00_STD | <1.0 | < 2.0 | < 3.0 | <4.0 |

### 4.3.4 Detail rendition capabilities

#### 4.3.4.1 General

Resolution (or sharpness) is a measure of the ability of a digital printing system to print fine detail. It is a perceptually complex concept, which has no single, simple, objective measure. Sometimes sharpness and resolution will be further differentiated where sharpness of a printer refers to the capability of that printer to produce a distinct edge and the resolution of a printer refers to the capability of that printer to reproduce fine details.

The attributes described in this section contribute to resolution perception.

#### 4.3.4.2 Detail sharpness (L-Score)

The perceived resolution of the print should be measured according to the method described in ISO/PDTS 18621-31 [14] and typical values for viewing distance use case classes are presented in Table 13.

**Table 13 — Typical L-Score values for viewing distance use case classes**

| Use case categories | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| L-Score | 80 | 60 | 50 | 30 |
| Typical uncertainty | ±5 | ±5 | ±5 | ±5 |

#### 4.3.4.3 Line Width

The minimal width of the line should be measured according to the method described in clause 4.3.4.2 of ISO 15311-1 [22] and typical values for viewing distance use case classes are presented in Table 14.

**Table 14 — Minimal Line widths for viewing distance use case classes**

| Use case categories | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| Line width K/CMY | 0.15 mm | 0.3 mm | 0.45 mm | N/A |
| Typical uncertainty | ±0.03 mm | ±0.03 mm | ±0.03 mm | N/A |

#### 4.3.4.4 Line blurriness

The edge blurriness should be measured according to the method described in clause 4.3.4.4 of ISO 15311-1 [22]. The value should be reported.

#### 4.3.4.5 Line raggedness

The edge raggedness should be measured according to the method described in clause 4.3.4.5 of ISO 15311-1 [22]. The value should be reported.

#### 4.3.4.6 Colour registration

Problems related to the accurate positioning of the printing elements are grouped into "image-to-image" or "colour plane to colour plane" (misregistration), "image-to-edge" (crop mark) and "frontside-to-backside" (front/back register). The registration characteristics across the print format shall be verified by printing and evaluation the following register marks:

Register marks using Black against the chromatic primaries Cyan, Magenta and Yellow. They should be positioned in the four corners with a minimal distance to the nearest edge between 2 and 10 cm. They shall be positioned in the centre of the format close to the important image areas and surrounded by a black frame. First measure the distance between the edges of the chromatic colours against black both in horizontal and vertical direction. The misregistration is determined by calculating the maximum deviation for each mark and compute the average of those readings. The misregistration should also be computed for any two other printed colours.

Front/back register marks shall be placed once preferably in the centre. For not opaque substrates the evaluation should be done in transmission by means of a light table. For opaque substrates the front/back register marks shall contain two pin holes placed next to each. The holes will be punched and the print will be fixated on two rigid pins. The holes shall be sized and positioned to accurately fit the pins. The Front/back register shall be determined by calculating the maximum deviation for the process colour black and should be for the remaining process colours.

The form register should be measured by comparing the size of a rectangular image element with the reproduction by means of a deviation expressed as percentage values.

The typical "image-to-image" registration tolerances values for viewing distance use case classes are presented in Table 15. Potential problems related to Front/back register (where applicable), form register and crop mark should be investigated and any findings should be reported.

**Table 15 — Registration tolerances for the four use cases**

| Registration Type | Close range – Photo | Average range – POS | Increased range – Banner | Distant range – Billboard |
|---|---|---|---|---|
| Misregistration ("image-to-image") | <= 80 µm | > 80µm <= 120 µm | > 120 µm <= 160 µm | N/A |

#### 4.3.4.7 Native Addressability

The native addressability should be reported.

#### 4.3.4.8 Effective addressability (laboratory method)

Effective addressability should be measured according to the method described in clause 4.3.4.7 of ISO 15311-1 by printing a contrast-resolution-target. Such a target is the RIT Con-Res-target [25]. The visual evaluation, under ISO 3664 P1 conditions, basically consists of counting and adding up the fields (elements) that are visually discernible. The percentage of the number in relation to the entire number of fields (typically 100) should be reported.

#### 4.3.4.9 Patterning

The reproduction of patterns such as bar codes is not covered by this specification.

#### 4.3.4.10 Bleeding

Using a magnifying glass or a microscope to inspect a control element in conformance with 5.2, potential problems related to over inking should be visually checked. The findings should be reported.

### 4.3.5 Artefacts

#### 4.3.5.1 Contouring

The print outs should be visually checked for contouring and other artefacts such as random points which are needed for inkjet based systems to prevent nozzle clogging. Any finding should be reported.

#### 4.3.5.2 Spreading (misdirected dots, satellites)

In case of ink jet printing, jet column instability and breaks up into a stream of small satellite droplets might occur. They should be checked visually with a magnifying glass or a microscope. Any finding should be reported.

#### 4.3.5.3 Shine through and strike through

Shine through and strike through shall only be applied for front viewed applications. The level to which a colorant is seen from the back of a print (shine through) and the measure of how much a colorant has penetrated onto the substrate and is seen from the back of a print (strike through) should be measured according to the method described in clause 4.3.3.5 of ISO 15311-1. The value should be reported.

#### 4.3.5.4 Use case specific criteria

Further, use case specific criteria, shall be communicated between the provider and the receiver (typically the service provider).

### 4.4 Permanence

Printed digital images are used in many applications, which are classified in this specification into indoor and outdoor applications. Digital prints made for indoor applications will be scrutinized with respect to dark storage stability and the colour stability when exposed to light of specific intensities at specific temperatures and humidity.

Outdoor applications usually face more climate conditions summarized here as outdoor weathering. In outdoor testing, critical factors that cause image degradation include light, water, heat, ozone, and local and diurnal variations in climate. In accelerated testing, it is important that the most critical factors of light, water and heat are included. The coupling of the xenon arc lamps and "daylight" filters with a water spray and elevated temperatures forms the basis for testing with accelerated laboratory weathering. The methods should be used to provide a means for predicting the behaviour under actual outdoor exposure.

All permanence tests shall begin immediately following the print stabilization period specified by the manufacturer but not later than a week.

#### 4.4.1 Indoor light stability

The indoor light stability of the print should be measured according to the method described in clause 4.3.5.1 of ISO 15311-1 [19] The maximum and mean colour change ("fading") derived by printing a control strip in conformance with 5.2 should be reported.

#### 4.4.2 Weathering

The outdoor light stability of the print should be measured according to the method described in clause 4.3.5.2 of ISO 15311-1 [16] The maximum and mean colour change ("fading") derived by printing a control strip in conformance with 5.2 should be reported.

#### 4.4.3 Thermal stability

The long-term stability of the print stored at the specific environmental condition should be measured according to the method described in clause 4.3.5.3 of ISO 15311-1 [15] The estimated stability should be reported.

#### 4.4.4 Print life specification

The print life should be evaluated according to the method described in PWI/ISO 18940 [20]. The estimated print life should be reported.

#### 4.4.5 Water resistance

The water resistance should be evaluated according to the method described in ISO 18935:2005/Cor 1:2007 [17]. The estimated water resistance should be reported.

#### 4.4.6 Scratch resistance

The scratch resistance should be evaluated according to the method described in ISO 15184:2012 [9]. The estimated scratch resistance should be reported.

#### 4.4.7 Abrasion resistance

The abrasion resistance should be evaluated according to the method described in ISO 18947:2013 [21]. The estimated abrasion resistance should be reported.

### 4.4.8 Additional requirements

The provider needs to communicate and agree with the receiver about additional permanence. A list of such requirements is given in Annex B.

## 4.5 Margin Information

For the purpose of identifying the printed matter being assessed, the following information shall be provided and every sheet being part of this assessment should include this information as a human readable commentary line:

— Colour reference ("Absolute" or "Media Relative" and reference printing condition);

— File name;

— Printing system designation;

— Printing substrate;

— Print mode name and/or parameters (e.g. Best/MaxDPI and/or resolution, passes, colour channels)

— The printing condition simulated; and

— Time and date of production.

NOTE The intent of including the printing condition is to identify this clearly to a user. The conventions used to indicate printing conditions vary but a good way to do this would be to identify the name of a characterisation data set, for example using its name as registered on the ICC registry or using the filename or Profile Description Tag of an ICC profile that represents the printing condition.

It should also include:

— Time and date of last calibration (printing workflow based, usually the creation/modification date of the associated media profile);

— Colorant name (ink designation);

— Colour management profile(s) and intent used;

— Spot colour names (if present);

— RIP name and version;

— Scaling (if applied); and

— Type of coating (if applied or simulated).

When print production is the reproduction of a PDF/X document, the margin information shall include the filename and the date and time of the last modification and should include the document ID. When the document ID is included this shall be printed as two hex strings and the last 5 digits of each string should be highlighted in some way in order to assist identification.

### 4.6 FograCert

This specification addresses the testing of an entire printing system combination and the evaluation of a practical print job where only a control strip is present:

**a)** Printers/Printing systems and Substrate manufacturers: To check if process control methods and procedures, when applied to an entire print combination, comprising of a digital printing system, substrate, ink and printing parameters, meets the criteria set out by the aim of an intended typical signage application ("process check" also known as "system check")

**b)** Printers/Print buyers: To check if a given print product meets the criteria set out by a typical signage application ("print check")

In order for a print combination to be in conformance ("process check") as defined by this specification, all requirements stipulated in clause 4 are applicable.

A practical print job ("print check") is in conformance to this specification when the criteria 0 (in case of FCR Side by Side "Absolute" reproduction) or 4.3.2.3.2 (in case of "Media relative" reproduction) are met. In addition the misregistration and the uniformity shall be visually judged and reported.

## 5 Test methods

### 5.1 General

Printing shall be targeted at a specific reference printing condition with a known characterization data set (see 4.1.2).

### 5.2 Control Strip

The Fogra MediaWedge CMYK 3.0 shall be used. The control patch types to be used includes:

**a)** solid tones of the chromatic primaries for the target characterization data set and their secondaries C,M,Y,R,G,B (6 patches);

**b)** mid- and shadow tones of the chromatic primaries for the target characterization data set and their secondaries C,M,Y,R,G,B (12 patches);

**c)** a tone step scale composed of the primary colour K (of the target printing condition) including the solid and a minimum of 5 other patches evenly distributed in CIELAB L*;

**d)** a tone step scale with same number of patches as for bullet c composed of the primaries C, M, Y such that it roughly replicates the colours of the scale in c) for the target printing condition;

**e)** a selection of critical tertiary colours such as flesh tones, brown, aubergine, violet (e.g. 15 patches);

**f)** the print substrate colour of the production printing condition (1 patch); and

**g)** solid tones of all spot colour being simulated (if present).

NOTE Due to measurement recommendations of print combinations used for LFP signage applications, it is recommended to use a large patch size control strip in order to facilitate measurement device with large aperture size and continuous averaging in strip measurement mode.

## 5.3 Additional test objects

### 5.3.1 Gradients

For checks of gradients smooth reproduction, vignette targets such as the test image S6 of ISO 12640-1 should be used. In addition to checks of the primary and secondary process colours C, M, Y, K, R, G, B, several gradients made from various CMYK combinations should be used. The size of the vignettes should be big enough to allow reasonable visual assessment from the intended viewing distance.

### 5.3.2 Bleeding

For checks of bleeding, a mesh formed from several lines with a width between 0.5 and 1 mm over a yellow (Y) background should be used. Each line should be coloured with one of the primary or secondary process colours C, M, K, R, G, B and the overlay should be made as such that each one of them should pass both under and over the rest, e.g. K is passing over C,M,R,G,B and the other way around.

# Annex A
(informative)

## Substrate conformance – Visual based plausibility test

Until there is an objective method to judge a substrate with respect to its printability and runnability properties for a specific printing process using a digital printing system the following visually based approach is recommended.

1. Perform the maintenance and basic setup of the digital printing system.
2. Assure printability and runnability for the given print combination by choosing the desired printing modes and specific digital printing system (hardware) and production workflow (driving software) parameters.
3. Perform the adjustments and calibration i.e. ink transitions (if present, light & dark ink relation), total and per channel ink limits, linearization, other driving production workflows specific options.
4. Perform the characterization by printing and measure a test chart that is in conformance to ISO 12642-2. If possible use a large patch version of the chart and the layout requirements of 4.3.1. The measurements shall be done accordingly to the 4.1.3 requirement. In order to increase the quality of the measurement data, several measurements coming from several sets should be averaged with optional interpolation and smoothing. Print also in device mode several test images of choice by using the same settings.
5. Create an ICC output profile ("PRINT_COMBINATION.ICC") and save the measurement data in a separate file using one of the standard ASCII or CxF file formats.
6. Use a contract proofing system and create a new printing condition by facilitating the created output profile (or the standard measurement data) as the aim values.
7. Proof the same data set (test chart and test images) according to the requirements of ISO 12647-7 by simulating the newly created printing condition ("PRINT_COMBINATION.ICC").
8. Visually compare the original print out (step 4) with the proof print under norm light conditions using ISO 3664 compliant viewing cabinets and transparency viewers. Appropriate viewing distance should be taken into account as part of this comparison.
9. Using a control strip that meets the requirements of 5.2, check if the measured colour differences on your proof do correlate with what you see. This is a subjective decision but based on your experiences it should be possible to make an educated guess about the suitability of the substrate. This check tells you if the ISO 13655 compliant readings are meaningful, which is the paramount prerequisite for "printing the expected".

In case your test fails, the used measurement protocol (aperture size, instrument geometry, backing, software algorithms) can't be used in the context of this specification to measure and mimic the pertinent substrate. Practically this restricts substrates to paper-like media where this test is usually performed successfully.

# Annex B
(informative)

## Additional  Large Format Printing related permanence requirements

Large format prints are subject for all kinds of mechanical, chemical or physical stress. Hence a lot of further permanence related criteria are used in the market. The following list provides an informative, not complete list of such criteria.

Coating cracking
Ozone fastness
Drying
Curing
Curling [[
Adhesion
Abrasion
Smearing
Slipping
Rub-off test
Adhesion using a Tesa-test
Bending
Folding
Fold cracking / Breaking in the Fold
Water resistance / absorption
Deposit
Carbonation
Mailing test
Caking (Sticking)
De-inking [De-Inking]
Scratch resistance
Type and quality of cracked fold
Impact resistance
Blister test
Grease permeability
Odour
Embrittlement
Dark stability
Outdoor stability
Spill resistance
Humidity fastness
Fastness of weathering

# Annex C
(informative)

## Recommendations to optimize PDF data that is not fully defined (ambiguous)

The following criteria makes provisions for creating print ready data based on PDFs originating from office environments. They are intended to support service providers that have to consume such data in order to achieve a unified reproduction across different service providers. The destination profile (output condition) is ISOCoated v2 (ECI) reflecting the printing condition FOGRA39. All CMYK objects and spot colours are maintained. Line art elements defined in RGB will keep their vivid colour by means of a freely available DeviceLink profile. RGB Gray gets converted to pure Black, Black text is set to overprint.

General:

— Always Use Rendering Intent from PDF,

— If a page contains transparency and the blending space is undefined, set to it to sRGB,

— Define Output Intent using the destination profile, e.g. ISOCoatedV2.icc from ECI,

— Apply the rules from Table C.1**Fehler! Verweisquelle konnte nicht gefunden werden.** in the presented sequence.

**Table C.1 — Rules (to be applied only in the following sequence)**

| Objects | Encoding | How to convert |
|---|---|---|
| All | DeviceGray | Map to K-Only DeviceCMYK |
| All | ICCbasedGray | Discard Profile and map to K-Only DeviceCMYK |
| Images | DeviceRGB | Assign sRGB and convert to destination profile |
| Images | ICCbasedRGB | Keep profile and convert to destination profile |
| All (R=G=B)[a] | DeviceRGB and ICCbasedRGB | Convert to K-Only DeviceCMYK |
| All | Lab | Convert to sRGB |
| Line Art (including text) | ICCbasedRGB | Discard profile and treat as DeviceRGB |
| Line Art (including text) | DeviceRGB | Apply DeviceLink profile "sRGB2ISOCoatedV2.icc" |
| All | DeviceCMYK | Do not convert |
| All | ICCbasedCMYK | Discard Profile |
| All | Spot | Do not convert |

[a] For images, this should be applied when this is true for all pixels

[b] Fogra recommends DeviceLink profile "sRGB2ISOCoatedV2.icc" for optimized colour rendering of line arts. It can be provided free of charge to any user and vendor.

Assumptions and preparation steps for unambiguous PDF/X creation:

- If page description contain transfer curve, apply transfer curves
- Assure correct nesting of page geometry boxes
- Discard all actions (including JavaScript actions)
- Discard all form submission, import and reset actions
- Discard embedded PostScript
- Embed fonts
- Make spot colour appearance consistent
- Merge annotations and form fields into page content (except "post its")
- Recompress LZW as ZIP
- If both, TrimBox and ArtBox, are defined remove ArtBox
- If ArtBox is defined and TrimBox is not defined, set TrimBox to ArtBox
- Ensure that valid creation and modification dates are present
- If Title entry is present ensure that is not empty
- Set Trapped key to „false" if Trapped key is neither „true" nor „false"
- If no TrimBox is defined set TrimBox to CropBox or, if no CropBox is defined, to MediaBox)
- Set minimum LineWidth to 0.14 pt (for LineWidth less or equal than 0.14 pt)
- For 100 % black text smaller than 12 pt and 100 % black thin lines less than 2 pt set overprint (Set OP to true and OPM to 1)

Typical production workflow colour management settings:

- Check Use embedded profiles,
- Set default source profiles (to handle content that is not tagged), e.g. sRGB/AdobeRGB/eciRGB_v2 for RGB content and ISOCoatedV2.icc from ECI for CMYK content,
- Check Use PDF/X Output Intent,
- Uncheck Pure Colours,
- Use simulation profile (common nominator for all content), e.g. ISOCoatedV2.icc from ECI,
- Use your preferred choice of rendering intent (according to the type of appraisal: Side-by-Side or Media Relative), e.g. Relative Colorimetric with Black Point Compensation.

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