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ISO WD 12647-5

Graphic technology — Process control for the manufacture of half-tone colour separations, proof and production prints — Part 5: Screen printing

Technologie graphique — Contrôle du processus de confection de sélections couleurs tramées, d'épreuves et de tirages — Partie 5: Sérigraphie

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Foreword

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Attention is drawn to the possibility that some of the elements of this part of ISO 12647 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12647-5 was prepared by Technical Committee ISO/TC 130, *Graphic technology*. ISO 12647 consists of the following parts, under the general title *Graphic technology — Process control for the manufacture of half-tone colour separations, proof and production prints*:

- *Part 1: Parameters and measurement methods*
- *Part 2: Offset lithographic processes*
- *Part 3: Coldset offset lithography and letterpress on newsprint*
- *Part 4: Publication gravure process*
- *Part 5: Screen printing*
- *Part 6: Flexographic printing*
- *Part 7: Processes using digital printing or reproductions made on various traditional printing processes from digital files* Annex A of this part of ISO 12647 is for information only.

Introduction

It is the purpose of this part of 12647 to define the visual characteristics and the related set of process parameters required to produce a screen printed press sheet to the satisfaction of all the involved parties. While this part of 12647 was originally completely tied to part one, that resulted in a standard that was too offset oriented and therefore not used by screen printers around the world. In this revision, an effort has been made to maintain some of the inherent craft of the screen printing process where essential while following the flow of part one. This is not intended to be a “how-to” on screen printing, but to include any instance of a tolerance or definition where omission would cause confusion between the parties involved in the process. This includes the important viewing distance metric that is indigenous to screen printing and essential to image quality tolerances. Where appropriate many tolerances listed in part one have been included, but this part can no longer be considered to be tied to part one.

1 Scope

This part of ISO 12647 specifies the requirements for production of 4-colour process-color material used for display, signage, and graphics using screen printing. There are no restrictions on the size of the finished product nor on the type of substrate used. Production of the product is by flat bed or cylinder screen printing. This part of ISO 12647 assumes that all input is provided as digital data. The parameters and values are chosen in view of the complete process covering the process stages;

- "Data",
- "printing forme",
- "proof production"
- "production printing"

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12647. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12647 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 5-3, *Photography — Density measurements — Part 3: Spectral conditions*

ISO 2846-4, *Graphic technology- Colour and transparency of printing ink sets for four-colour printing — Part 4: Screen printing,*

ISO 12637-5, *Graphic technology — Multilingual terminology of printing arts — Part 5: Screen printing terms*

ISO 12647-1:1996, *Graphic technology — Process control for the manufacture of half-tone colour separations, proof and production prints — Part 1: Parameters and measurement methods*

ISO 13655, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

3 Terms and definitions

3.1

Computer to Screen Imaging (CTS)

Process of creating a screen print stencil by exposing directly from the computer imaging system. Light crosslinks the emulsion on the printing screen. Water washout creates a screen stencil for printing.

3.2

Dot Fusion

Combination of viewing distance and dot resolution at which rosettes are no longer visible to a viewer with 20/20 vision.

3.3

Direct to screen imaging (DTS)

Process of digitally imaging wax, dye or other light blocking image on the screen. Light, passing through this image, crosslinks an emulsion on the printing screen in areas not meant to be imaged. Water washout creates a screen stencil for printing.

3.4

Rule of 30

This rule defines acceptable viewing quality as a 70 dot per centimeter, cm-1 (Approx. 175 lpi) image held 42 centimeters (Approx. 16.5 inches) from the viewer. For the same viewing quality for other combinations at different distances, divide either the desired distance in meters or the desired resolution in dots per centimeter into 30 to compute the other for that specific pair.

4 Requirements

4.1 Data requirements for screen printing systems

Screen print systems shall accept digital data delivered as PDF/X data files as defined in ISO 15930 or TIFF/IT files as defined in ISO 12639. Where the digital data is delivered as PDF/X data files, the intended printing condition to be simulated shall be that defined in the *OutputIntents* array of the PDF/X file. Where a profile is required for data conversion the profile that is the value of the *DestOutputProfile* key in the PDF/X file shall be used. Where TIFF/IT files are used colour information shall be included using tag 34675 or tag 34029.

The intended printing condition shall be either:

- 1.) Gamuts 5 or 6 from ISO 15339 using the tri stimulus correction factor described in ISO 15339 Annex A to adjust the characterization data set for the intended substrate.

Note 1: These characterization data sets have been adjusted to optimise such factors as neutral grey balance and proper tonal curves as practices by many printing associations around the world. While these factors are not directly included in this standard, they may be separately specified between all parties in advance.

- 2.) A custom data set. Where none of the reference colour characterization data sets of 15339 are considered appropriate for the intended printing because of the inks, paper, or other factors, prior agreement should be obtained between all parties involved before copy preparation work is started and the colour characterization data to be used and any colour management profiles shall be communicated with the job content files.

Note 2: Characterization data sets are the only method recognized by this standard for the proper submission of digital data. Film must be generated by digital data and legacy film can be assumed to represent a one time data set.

4.2 Printing forme requirements

4.2.1 Resolution

The target resolution shall be based on an agreement between the printer and their customer. It should be in accordance with the following three criterion.

- a. The ability to reproduce a tonal range of 1% to 98% using the mesh as configured, the imaging technique, the emulsion and the ink.
- b. A minimum dot size that is not be less than 1.5x the width of the thread diameter of the mesh.
- c. A maximum dot size as recommended by the "rule of 30" for the intended viewing condition.

4.2.2 Stencil production

The silver, thermal or inkjet film used for imaging screens shall have sufficient UV density in printing areas, sufficient UV transparency in the non printing areas to produce all dots required in 4.2.1. Direct to screen and computer to screen systems shall be able to produce all dots required in 4.2.1

4.2.3 Printing forme orientation

4.2.3.1 Printing forme preparation

The angle of the screen mesh attached to the screen frame shall be as close as possible to 0° and 90° with respect to the frame. The angles of the image shall also be 0° and 90° with respect to the frame.

4.2.3.2 Screen angles

For half-tone dots without a principal axis, the nominal difference between the screen angles for cyan, magenta, and black shall be 30°, with the screen angle of yellow separated at 15° from another colour.

For half-tone dots with a principal axis, the nominal difference between screen angles for cyan, magenta and black shall be 60°, with the screen angle of yellow separated by 15° from another colour.

In all cases, no colour should align within 7,5° of the mesh (frame). If flesh tones are present, the yellow should not be referenced to magenta.

NOTE 1: This is to prevent moiré in flesh tones and to insure that no row of dots lines up with the mesh, which would destabilize the small dot structure. It is poor practice to use and rotate offset films to produce the forme.

NOTE 2: It is common practice to use frequency modulated screening for the yellow separation with approximately the same size as the dots in the 10% area of the conventional separations and a different tonal compensation curve.

4.2.4 Image size tolerance

For a set of supplied films in common environmental equilibrium, the lengths of the diagonals shall not differ by more than 0.02 %.

4.3 Print production requirements

4.3.1 Visual characteristics of image components

4.3.3.1 Visual appearance of the supplied proof

Any supplied proof shall use the same characterization data set chosen for production in accordance with either ISO 12647-7 or ISO 12647-8. The tristimulus correction factor shall be use to adjust for the substrate colour when the production stock is not available. Proofs shall have the proper colour but may have a different size than the intended product. Proof resolution may be finer than the intended product. In this case the rule of 30 shall be followed within the constraints of the proofing equipment assuming the proof to be viewed at 42 centimeters.

4.3.3.2 Print substrate colour

For the bes colour reproduction, the print substrate colour should be restricted as shown in Table 2.

NOTE: If the final product is to be surface finished, this may severely affect the substrate colour.

Table 2 — Print substrate colour restrictions

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	$100 \geq L^* a \geq 90$
	$- 3 \leq a^* a \leq 3$
	$- 5 \leq b^* a \leq 5$
^a	Measured according to ISO 12647-1:1996, 5.6.

4.3.1.3 Ink set colours

The screen printing production shall use process inks in accordance with ISO 2846-4.

(NOTE: THESE COLORS ARE UNDER REVIEW AT THIS TIME)

4.3.1.4 Ink set gloss

If it is deemed necessary to specify the gloss of solid tone colours then the specular gloss of the ink set single print solid areas should be measured and recorded at an agreed angle of incidence.

4.3.2 Tolerance for image positioning

The maximum deviation between the image centres of any two printed colours shall not be more than 0.02 % of the printing forms diagonal dimension.

NOTE: This tolerance includes any forme generation deviations.

4.3.3 Image reproduction

For the production print, the target colour co-ordinates of the solids and two colour overprints shall be as given in the selected characterization data set. The deviation from these targets values for an OK sheet or for the average of the production run shall be as specified in Table 4. The variability of the process colour solids throughout the run in production is restricted by the following condition. For at least 68 % of the prints, the colour differences from the OK sheet shall not exceed the appropriate variation tolerance specified in Table 4 and should not exceed one half of that value.

NOTE 1: The secondary colours red, green, blue are dependent on the print sequence and can vary depending on conditions that include the mechanics of the press, the surface characteristics of the substrate and the rheological and transparency properties of the inks. Thus, conformance of the primaries to specifications is not sufficient for the conformance of the secondaries.

The production print should exhibit a predictable middle tone weight and colour balance (neutral grey) and should exhibit a predictable tone value transition and balance throughout the colour space.

NOTE 2: There are several methods to achieve this objective. See ISO 10128 for an assessment of the three optional methods. See Annex A for an example of colour balance.

Table 4 — CIELAB ΔE_{ab}^* tolerances for the solids of the process colours

Type of tolerance	Black	Cyan	Magenta	Yellow
Deviation tolerance	4	5	6	6
Variation tolerance ^a	1,5	2,0	3,0	3,0

^a The distribution of CIELAB colour differences is not gaussian but skewed. For reasons of consistency, the variation tolerance is defined here as the upper limit for 68 % of the production copies. This is analogous to a gaussian distribution where 68 % are within plus or minus one standard deviation of the mean.

5 Test method and reporting: Control strip

For process control a multi-colour control strip shall be used. This control strip shall be printed along with the subject on all proofs and should be printed on all production jobs. It shall contain well-defined control patches with accurate tone value designations and meet the quality and resolution requirements of the accompanying image. The screen print color bar shall include Solid, C, M, Y, K patches, Tonal percentages of C,M,Y,K of 5%,10%,25%,50%,75%,90%, RGB overprints a white patch, and neutral grey C,M,Y patches for 10%,25%,50%,75% and 90%. See Annex B

The control patches on the stencil, together with the subject matter, should be inspected to ensure that the intended tone values have been achieved. In addition, for information purposes, or the checking of stencil and flooding problems, half-tone control patches may be printed along with the control strip that contain the same half-tone screen values as used in the image area of the print.

NOTE 1: The effective measurement aperture diameters of the densitometers on the print must be large enough to accommodate and include the required quantity of half-tone dots in each measurement as specified in the documentation of the densitometers's manufacturer. For measurement with apertures of less than 5 mm diameters it is generally recommended to average over five readings in every control patch.

For line screens 18 dots per centimeter or less it is recommended that an average of five or more reading in every control patch and the measurement should then be averaged.

Annex A Non Normative

A.1 Example of neutral scale values

Table 1 — Example near-neutral CMY tone scale

Step	Cyan tone value	Magenta tone value	Yellow tone value
1	0,00	0,00	0,00
2	1,96	1,18	1,18
3	3,92	2,75	2,75
4	5,88	4,31	4,31
5	7,84	5,49	5,49
6	10,20	7,45	7,45
7	14,90	10,98	10,98
8	20,00	14,90	14,90
9	25,10	18,82	18,82
10	30,20	23,14	23,14
11	34,90	27,06	27,06
12	40,00	31,37	31,37
13	45,10	35,69	35,69
14	49,80	40,00	40,00
15	54,90	45,10	45,10
16	60,00	50,20	50,20
17	65,10	55,29	55,29
18	69,80	60,39	60,39
19	74,90	65,88	65,88
20	80,00	71,76	71,76
21	85,10	78,04	78,04
22	89,80	84,31	84,31
23	94,90	92,16	92,16
24	98,04	96,86	96,86
25	100,00	100,00	100,00

NOTE The tone values of this scale are reported to two decimal places because most characterization data is recorded as 8-bit per channel data and these values correspond to the quantization intervals associated with 8-bit data. As the colorimetric data to be associated with this neutral scale is usually computed or interpolated from colour characterization data, this minimizes an additional set of rounding errors.

Annex B Non Normative

Process control strip example

B.1 Visual example

