TECHNICAL SPECIFICATION

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Graphic technology — Guidelines for schema writers —

Part 1:
Packaging printing

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology.*

A list of all parts in the ISO 19303 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Packaging brand owners and procurement teams are experts in their products and are often not experts in printing technology. This document is intended to be used as a tool to develop global and technically consistent requirements by, for example, certification bodies certifying packaging, national certification groups, trade associations, or brand owners to communicate their expectations throughout the supply chain.

This document recognizes a set of best practices and International Standards related to packaging printing. This document points to those International Standards to align requirements defined inside schemes used in certification programs. See the Bibliography for the list of these International Standards. Packaging and packaging graphics have a significant influence on the consumer buying decision. The packaging printing industry is made up of a large supply chain with many workflows, which produce a variety of printed products.

To ensure tone and colour reproduction quality, many ISO TC 130 standards specify the aims and tolerances that are necessary for the implementation of colour-managed workflows. Even though technical standards specify aims and tolerances, the printer's ability to demonstrate conformity of his production workflow to these standards is both a technical issue and a conformity assessment issue.

The packaging printing industry has unique technical and conformity assessment requirements that are common to its stakeholders.

Certification schemes are developed by certification bodies, such as national certification groups, trade associations, or brand owners, to address market needs. They are regional, workflow-dependent, and with varying technical requirements. This document provides technical and conformity assessment to allow that the various certifications are based on common principles and are comparable. As such, this document enables the individual organizations to more readily agree to mutual recognition of the certifications of other bodies as well as enable international trade organizations to identify comparable competencies on a worldwide basis.

This document provides a framework for typical packaging printing workflow, either using CMYK, CMYK with spot colour, non-CMYK, spot colour only, and multi-colour printing. It also provides a corpus of International Standards, including aims, tolerances, and test methods, applicable at each stage of packaging printing workflow. In addition, supply chain communication guidelines and process-dependent checklists are also included in this document.

This document is also intended to aid the following stakeholders in understanding packaging printing conformity assessment at an international level.

— Print buyers and brand owners

— Printing associations

— Printing organizations

— Printing production personnel

— Printing equipment manufacturers and suppliers

— Printing professionals, including auditors, consultants, etc.

Graphic technology — Guidelines for schema writers —

Part 1:
Packaging printing

1 Scope

This document provides recommended guidelines for the evaluation of colour reproduction capability in the printing of packaging materials. It provides a basis for the development of colour certification schemes by individual brand owners and/or industry associations and for the evaluation of printed results against those schemes.

Because the package printing supply chain involves multiple partners, both the potential impact of each partner on the overall colour control and the individual responsibilities of each partner are identified in this document. The unique requirements of the individual reproduction processes and their impact on colour reproduction are also identified.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19302, *Graphic technology — Colour conformity of printing workflows*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19302 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
actual printing condition
APC
condition of the actual system printing the job defined by colourimetric and/or densitometric parameters

3.2
comp
proof formed to the shape of the final productNote 1 to entry: It is also called mock up.

3.3
certificate of conformance
CoC
document that certifies that the supplied services or goods meet the required specifications

Note 1 to entry: The CoC is normally issued by a recognized authority and is also known as a certificate of compliance.

3.4
certificate of analysis
CoA
document that provides all the required specification and test results about a particular material, including a description of the test or examination method(s) used, limits of the test or examinations and actual results of the tests or examinations, to demonstrate that the requirements of the end user/customer are met

3.5
consumer product company
CPC
company that delivers merchandise or other item of common or daily use, ordinarily bought by individuals or households for private consumption

3.6
device colour
colour designed to be printed using a specific devices process inks

Note 1 to entry: Device colour is typically used to define device specific values that allow reproduction of a spot or brand colour using only process inks, not spot inks

3.7
pre-media
part of the printing or publishing process preceding preparation of a printing plate

3.8
print buyer
organization, individual or group of individuals that prepares data for printing and delivers digital materials to the *print service provider* (3.9)

Note 1 to entry: The print buyer may be the distributor of digital files, the designer, a consumer products company or a trade shop.

3.9
print service provider
organization, individual or group of individuals that receives the files and is responsible for print product delivery

Note 1 to entry: The print service provider may be a prepress company, a printer or a converter.

3.10
process colour
colour that is the outcome of a colour separation operation

Note 1 to entry: A process colour typically requires one or more printing units and process inks to be reproduced.

3.11
process ink
ink that is used to print *process colours* (3.10)

3.12
characterized reference printing condition
CRPC
identified printing condition and its colour characterization data that is used as the aim for a particular printing task (job)

[SOURCE: ISO/PAS 15339-1:2015, 3.4]

3.13
special effect
object inside a PDF that has an impact on colour but is not defined as an ink (for example a varnish) or any non-printed element that should be processed specifically (for example by a cutting line)

3.14
special metamerism index
extent to which colour matching changes with a change of illuminant

[SOURCE: CIE Publication 15]

3.15
spot colour
colour originally designed to be printed using one printing unit and a spot ink

Note 1 to entry: When associated with a corporate product identity, a spot colour is also known as brand colour.

Note 2 to entry: Spot colours are sometimes replicated with process colours or extended process colours.

3.16
spot ink
ink that is primarily used to print a *spot colour* (3.15)

Note 1 to entry: A spot ink may replace or be mixed with process inks to achieve a desired gamut.

3.17
system qualification
assessment operations used to qualify the ability of a print device or a printing process to reproduce a defined colour data set

Note 1 to entry: This qualification is also named "extended scrutiny", because it cannot usually be performed by producers during production as it requires specific testing conditions and protocols.

3.18
total indicated runout
TIR
measure of the out-of-roundness of a printing press roller or cylinder

Note 1 to entry: The difference in the lengths of a roller's radius as measured from the centre to the outside surface. A perfectly round roller would have zero TIR.

4 Principles

4.1 General

The printing of packaging is the most diverse and complicated of any of the many segments of the printing industry. It makes use of any (and all) of the marking technologies available, both analogue and digital, and can use virtually any material as a substrate. The key participants in the packaging workflow are the consumer products companies, the design firms that support them and finally the printer that produces the packaging product. This document provides a collection of packaging industry best practices that may be used as a source for the any stakeholder to build a certification scheme.

While each individual package printed should meet the individual specifications associated with its design, the most important issue is related to the methods used to specify the intended colour appearance of the final product, the exchange of the data necessary for that to be accomplished, and finally the procedures for evaluation of the printed product against the specified aims.

This is often further complicated by the requirement that products printed on different substrates or by different processes may be expected to match colourimetrically.

Certification schemes may be established by any individual consumer product company, groups of consumer product companies, trade associations, or national certification bodies. These guidelines are based on an understanding of the typical workflow, the standards available, and the perceived needs of the industry. It is anticipated that the use of these guidelines will facilitate a commonality between the various schemas prepared.

It is expected that each of the participants associated with the application of a specific schema will demonstrate their ability to conform to the requirements of the schema both during a specific performance evaluation and on an ongoing basis.

Clause 4 describes the guidelines for each of the various tasks in the workflow. Individual schemas may involve some or all of these guidelines, depending on the specifics of the application for which the schema is intended. Subclause 4.2 describes the basic support requirements that all participants may be expected to meet. Subclause 4.3 provides guidance on the definition of the intended colours to be printed and 4.4 describes the encoding of both content data and colour data in the digital file.

Subclause 4.5 covers proofing requirements that may be required. Subclause 4.7 provides for incoming material verification and the printing itself is defined in 4.6

While individual printing processes are expected to produce results that meet common requirements, it is recognized that each process has specific unique requirements and/or options. These are described in Annexes A to D.

4.2 Example of guidelines associated with specific tasks

Each partner in the supply chain has responsibilities to provide one or two communications from the CPC through the supply chain; the base responsibilities for each partner are examples of responsibilities. These requirements should be complied to across multiple CPC's and supply chain partners in order to provide communication across all partners. Subclauses 4.3 to 4.7 define a schema and deliverables from each partner in the supply chain so that deliverables are aligned.

4.3 Consumer product company (CPC)

The consumer product company (CPC) should define:

— viewing conditions according to ISO 3664;

— instrument and settings for measurement verification conforming with ISO 13655;

— specification of aims and tolerances;

— CMYK – aims ICC profile or characterization data;

— spot or brand colours – CxF/X-4 or CxF/X-1 with spectral reflectance;

— minimum size and type of acceptable defect;

— registration – requirements;

— design guide – overview of objectives;

— structural requirements;

— print sequence – (creating an overprint simulation profile);

— die lines indications;

— minimum requirements for print and reporting;

— certificate of analysis (CoA) and certificate of conformance (CoC) testing requirements and reporting requirements;

— standard operating procedure (SOP), documenting all procedures and equipment upgrades.

4.4 Designer, comp house and photographer

The designer, comp house and photographer are responsible for:

— viewing conditions according to ISO 3664;

— instrument for measurement verification according to ISO 13655;

— file format (native files or PDF/X-4)

— validation print protocol – validation of colour accuracy – Verified according to ISO12647-8;

— soft proofing according to ISO 12646 and ISO 14861;

— software compatible with vector/raster formats;

— pre-flighted file delivery – PDF/X-4 – GWG Packaging 2015;

— photography RAW and TIFF with embedded colour profiles;

— standard operating procedure (SOP) documenting all procedures and equipment upgrades.

4.5 Pre-media

Pre-media partners are responsible for:

— viewing conditions according to ISO 3664;

— pre-flight with reporting to supplier the procedure for process improvement;

— instrument for measurement verification according to ISO 13655;

— file format – according to ISO 15390-7 PDF/X-4;

— pre-flighted file delivery – PDF/X-4 – GWG Sheet Spot 2015;

— validation print protocol – validation of colour accuracy – Verified according to ISO12647-8;

— contract proofs per ISO 12647-7 with documentation;

— soft proofing according to ISO 12646 and ISO 14861;

— workflow according to ISO TS 10128;

  a) the matching of tone value curves,

  b) the use of near-neutral scales, and

  c) the use of CMYK to CMYK multi-dimensional transforms;

— Pre-flighted file delivery – PDF/X-4 – GWG Packaging Specification or agreed specification;

— SOP documenting all procedures and equipment upgrades.

Plate supplier should provide:

— micro enlargement and measurement on minimums, and 50 % – all plate delivery.

4.6 Printer

Printer partners are responsible for:

— pre-flighted- conforming that elements received are accurate – with reporting to supplier the procedure for process improvement;

- communicate the actual printing aim to their client if contractual aims cannot be met;
- accurate viewing conditions according to ISO 3664;
- soft proofing according to ISO 12646 and ISO 14861;
- instrument for measurement verification compliant according to ISO 13655;
- bar code verification per ISO/IEC 15426-1;
- CoA for all incoming receivables;
- substrate – documentation per ISO 15397;
- inks – provide CoA with spectral data and conformance
  - colour aims met,
  - light-fast requirement,
  - in case of food packaging conformity to the final use,
  - any specific fastness related to the requested packaging,
  - scuff resistance;
- Laminates and special effects meeting customer requirements;
- Print consistently – optimize to meet requirements of ANSI TR012;
- Reporting of aims and production variation– according to ISO 20616-2;
- SOP documenting all procedures, and equipment upgrades converter or printer.

4.7 Reporting by printer or converter

Converter or printer are responsible to preform testing and report as required:

- CoA and CoC per customer requirements – document and delivery – ASTM/ISO testing and reporting protocols;
- rub resistance;
- solvent rub testing and documentation - Alcohol or any simulant related to final application rub;
- solvent retention in case of packaging inks by solvent based inks;
- repetition and width dimensional verification;
- lightfast testing and documentation;
- coefficient of friction (COF) testing and documentation
- custom testing protocol – defined by consumer products company;
- additional product-specific test as required and documented;
- SOP for all procedures and documentation.

5 Basic support guidelines

5.1 Applicable printing standard examples

Figure 1 extends the reference packaging printing workflow, to include applicable printing standards, at each step of the packaging printing workflow.

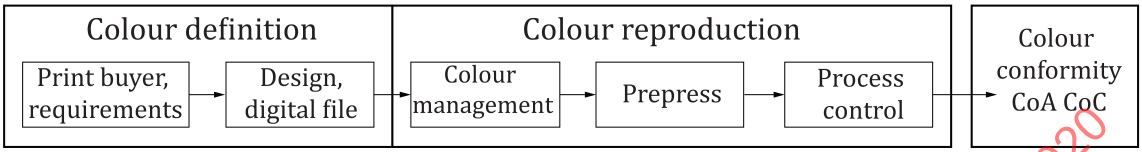


Figure 1 — Applicable printing standards

Colour definition	Colour production	Colour conformity
ISO 15930-7 (PDF/X-4)	ISO/TS 10128	ISO 20616-2
ISO 17972-4 CxF/X-4	ISO 15076-1	ASTM D 5264
ISO 12647-8	ISO 12647-2-8	ASTM D3359
ISO 12646	ANSI/CGATS TR015	ISO 12040
ISO 14861	ISO/PAS 15339-1	ASTM D1894
ISO 12647-7	ISO/PAS 15339-2	ASTM D4518
ISO 13655	ISO 3664	ASTM 1729

5.2 Colour definition

5.2.1 Digital file format

Digital files should be prepared in agreement with ISO 15930-7 (PDF/X-4). For spot colour definition, ISO 17972-4 CxF/X-4 spot colour characterization data and spectral definition should be used.

The validation print that is supplied by print buyer to print service provider should be produced in accordance with ISO 12647-8 and contain the intended ICC profile or characterization data.

Hard proof provided by print buyer to print service provider should be produced in conformance with ISO 12647-7.

Soft proofing should be in accordance with ISO 12646 and ISO 14861 for accurate soft proofing.

Packaging mock-ups and comps should have a colour control bar containing a minimum of patches: Solids, 50 % and 25 %, RGB overprints and RGB and neutral patches - measured and reported with DE00 tolerances.

5.3 Colour reproduction

ISO/TS 10128 identified three general methods by which compensation for differences in printing conditions can be accomplished.

Colour management should be used where TVI or near neutral calibration alone does not allow the printed sample to match the reference data set. This operation can be performed using dedicated software and technologies.

Colour management tools and software should be in accordance with ISO 15076-1 (ICC specification), ISO 18619 (black point compensation) and ISO/TS 10128 (CMYK to CMYK multi-dimensional transform method).

Without any other agreement between stakeholders, every digital file should be pre-flighted and fixed to be in conformance using a proper specification defined by the printer or converter (for example GWG 2015 Packaging Specifications Sheet Spot).

Hard proof and validation print are required and should be identified and controlled respectively according to ISO 12647-7 and ISO 12647-8 before being transferred to production workshop. In the case where the provided proof or validation print fails assessment, the customer should be informed, and a new compliant proof or validation print should be provided.

Regardless of the conformance results, the control report should be joined to the proof or validation print and passed to the next printing workflow step.

If any substrate colour-corrected aims have been used as hard proof or validation print simulation target, reference paper colour and actual paper colour used should be notified on the document.

When required, process colour tone reproduction curves (TRC) may be defined within the framework of process control. Tone response curves should be adjusted and maintained to enable compliance to a defined standard, such as ISO 12647-2 to 6 or ANSI/CGATS TR015.

Prepress should define and document SOPs and be able to demonstrate their ability to adjust files using one of the methods described in ISO/TS 10128.

Tone response curves for spot colours should be characterized. This characterization should be based on spectral reflection values or on colourimetric values. The characterization curve should be used to adjust the printing form to provide a desired tone curve.

Process control is used to check that the solids and tone reproduction curves of a print device are in conformity with defined printing conditions. Process control is normally used during production to ensure that device settings, calibration and stability are within tolerance.

A print device is defined by its regular process colourant units and sequence. Print device colour reproduction can be extended with the addition of spot or special inks in order to meet specific colour requirements.

Process assessment should be made according to defined aims and tolerances. Such aims can be extracted from relevant standards such as the ISO 12647 process control standards series, the ISO/PAS 15339 characterized reference printing condition, or any other agreed-on colour characterization data set.

The control strip should be in conformance with the normative requirements (if existing) provided in process control standards.

If spot ink is used, the control strip and colour bar should conform the requirements of the schema owner and include at least one solid patch for each spot colour. In case of use of spot colour(s), the colour bar and the control strip should include at least one solid patch for each spot colour. In spot colour using tonal ramp, a minimum of a 50 % value should be included. ISO 20654 defines a metric that aligns spot colour tone value across printing processes.

5.4 Incoming material verification

All incoming materials i.e. inks, substrates, coatings, should be verified upon reception using a certificate of conformity with agreed tolerances by the supplier and their customers

5.5 Colour conformity

Print control is used to check the ability of a print device to reproduce pre-determined process colours. These process colours can be defined in a characterization chart such as ISO 12642-2, generally known as an IT8. In this case print control allows checking of the data set conformance of a printing process and enables printing system qualification.

Print or data set conformance should be defined and performed according to the defined aims and tolerances.

Print control aims are extracted from the characterization data set that is mutually agreed between stakeholders. The targeted characterization data set can be one from ISO/PAS 15339-2 or any other colour characterization data set.

Ink qualification should be made with spectral reflectance data measurement. After ink qualification, given reference L*a*b* values for a specified density, control during production process can be performed by press operators using density and L*a*b* measurements.

Without any other agreement, the deviation of spot colour solid and device colour of the OK sheet is restricted by the condition that the colour differences between the OK sheet and the specified aims should align with the requirements of the schema owner. If conformance is not possible, the receiver should communicate deliverables to the schema supplier.

Table 1 — CIELAB example tolerances for the solids of the process colours and spot colours in the following format taken from ISO 12647-6

	Black	Cyan	Magenta	Yellow	Spot colours
Deviation tolerance	$\Delta L^* < 5$	$\Delta h_{ab} < 6°$	$\Delta h_{ab} < 6°$	$\Delta h_{ab} < 6°$	$\Delta h_{ab} < 6°$
Variation tolerance	$2\ \Delta E_{00}$	$2\ \Delta E_{00}$	$2\ \Delta E_{00}$	$2\ \Delta E_{00}$	$1{,}5\ \Delta E_{00}$

For relevant and exact tolerances, it is suggested to use the latest published applicable ISO 12647 standard.

In addition, the variation of spot colour solids and device colour is restricted by the condition that for at least 68 % of the production prints the colour differences between printed sheets and specified aims should not exceed the appropriate variation tolerance specified in Table 1.

Communication of spot colour data conformance should be in conformance with ISO 12647-6 or with the schema writer's definitions. ISO 17972-4 defines spot colour characterization data in an XML format and should be used when spot colours are communicated.

NOTE Refer to ISO 12647-6:—, Annex for measurement of brand or special spot colours. For recommendations for computing narrow-band optical density of spot colour ink, see ISO 13655:2017, Annex C.

6 Additional applicable standards

6.1 Measuring conditions and special metamerism index

For a 0°:45°measurement device, computation of the density values of process colours, CIELAB colour coordinates and CIELAB colour differences should be calculated in conformance with ISO 12647-1, ISO 13655 and ISO 5-4.

Measuring conditions should be specified and communicated between the different actors directly involved in the printing workflow. Communication of such information is crucial to avoid any misunderstanding about data interpretation or conformance assessment results that would be caused by inconsistent measuring conditions.

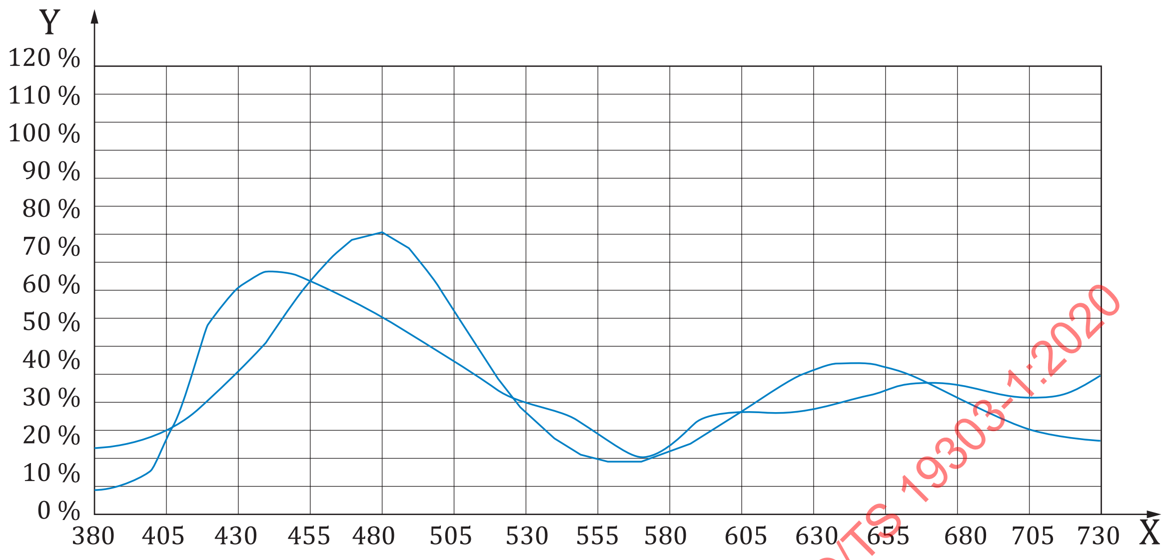
Measuring conditions include source, aperture size, geometry, m conditions.

For spot colour measurement, alternative measuring conditions should be defined. For the time being, no ISO standards or technical specification address this issue.

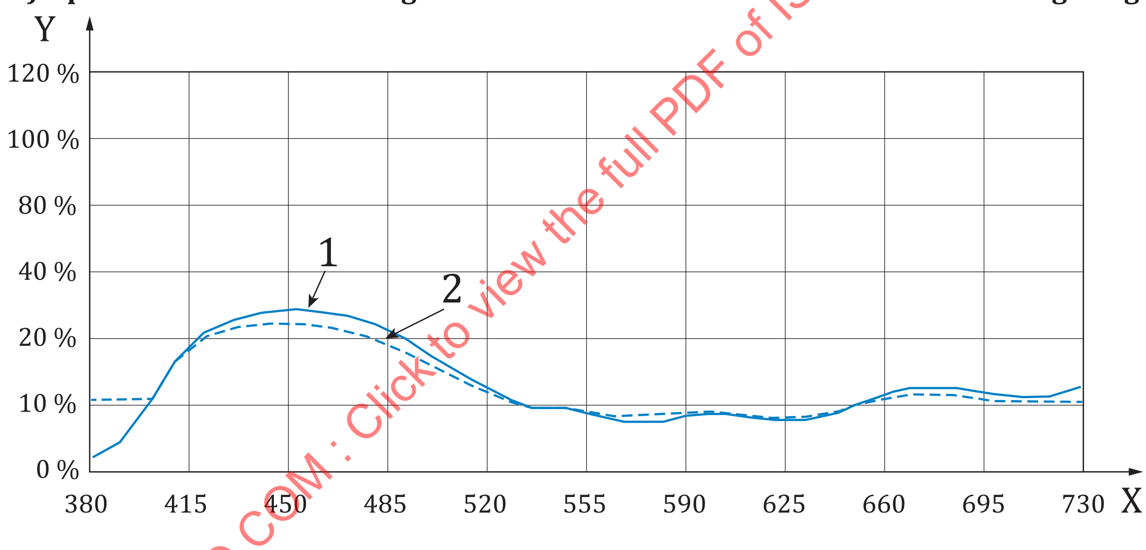
For a sphere-based instrument, the measurement systems should be in conformance with ISO 2469 for paper or with ASTM E1164 for coatings.

The spot-colour special metameric index should be computed according to CIE Publication 15. If the CIELAB colour difference between the pair of colour data under the reference illuminants is not an exact match then the multiplicative correction should be applied to the test specimen data to move it to the location where the trial colour values exactly match the reference colour values. That same translation will be applied to the trial colour coordinates under the test illuminants and the metameric index is given by CIELAB colour difference between the aim and trial colours under the test illuminants.

Effects of metamerism are of concern and importance in many colour formulation and production applications, in particular in packaging for alignment in multiple or mixed lighting conditions see Figure 2 a and b.



a) Spectral curves for two high metameric index colours that match in D50 lighting



b) Spectral curves for two colours with a low metameric Index that match in D50 lighting

Key

Y reflectance (%)

X wavelength (nm)

1 standard

2 sample

Figure 2 — Sample spectral curves for two high-metameric index colours which match in D50 lighting

6.2 Viewing, illumination and visual sensory assessment

6.2.1 General

Viewing and illumination conditions used for visual assessment of printed products should be in agreement with ISO 3664. The printer should be able to provide a certificate of conformance.

All stakeholders that are required to make critical colour decisions and communicate colour to the brand owners should complete a set of colour visions tests such as the Ishihara pseudo-isochromatic screening and the Farnsworth-Munsell 100 Hue test to verify that they have normal colour vision and discrimination.

When significant colour vision abnormalities are detected for a test subject, this last cannot be qualified as a valid inspector of colour goods, colour graders and colour matchers.

The test should be administered on a quarterly basis to all team members involved in colour-related decision-making. All test results should be shared, so as to understand each operator's visual colour discrimination. All operators involved in colour discrimination tasks should minimally achieve a score of "Average Discrimination".

6.2.2 Printing conformity assessment requirements

6.2.2.1 General

This document refers to ISO 19301 and ISO 19302 for sector-specific conformity assessment requirements. Sector-specific conformity assessment requirements are tied to their unique workflows. Packaging printing certification schemes should specify the following requirements before, during, and after the workflow audit.

6.2.2.2 Preparation

To prepare for the certification, the interested party should form an internal project team responsible for planning and executing the steps leading up to the certification. Typically, this team consists of a team leader plus representatives from prepress, quality control, and printing. It is possible that a consultant is also involved in the preparation.

The team should specify the workflow(s) to be certified. For advertising agencies, only digital file creation, colour proofing, and proper viewing condition are of interest. For printing organizations, platemaking, colour measurement, viewing conditions, colour deviation, and production variation are of interest.

An audit is required to assess applicable activities based on the scope of the certification schema. Thus, the scope of certification directly affects the time required to complete the audit process and the costs incurred to achieve the printer's certification objectives.

6.2.2.3 Selecting the standards

Choosing a standard is an important business decision that should meet the needs of both the organization and its customers.

6.2.2.4 Site audit

The site audit should follow a standardized sequence of events beginning with an introductory briefing between the project team leader and participants.

The briefing establishes the scheduled activities and responsibilities for conducting each activity. For example, the participants should confirm the standard, scope, and test files for the participants to process.

Following the briefing, each of the areas identified in the scope of the audit will be assessed using the protocols described. During this phase of the audit, the printer is expected to independently demonstrate its ability to operate a workflow conforming to the standard(s) selected. If the printer has employed a consultant to help in the preparation of the audit, the consultant is allowed to attend the audit, but only as an observer.

The audit team collects a series of test forms (processed files and printed samples) for colour measurement and analysis. The person responsible for sampling should be specified. All samples should be should and timed. Samples should be dried prior to shipment or handling. Samples should be kept for a specified time period.

6.2.2.5 Determination

The certification body should meet the requirements in ISO/IEC 17065.

The colour measurement instrument, or spectrophotometers, should be calibrated and traceable to standards. The average of measurements is used for conformance assessment.

6.2.2.6 Statement of conformity

The audit report is first provided to the printing organization seeking certification in case there are non-conformance issues that need to be addressed prior to the certification.

The certification body should assign at least one person not from the audit team, to make the certification decision based on all information related to the evaluation, its review, and any other relevant information (see ISO/IEC 17065).

If the audit report demonstrates that the printer met or exceeded the level of performance required to achieve certification, a certificate will accompany the audit report. Certified companies are recognized on the certification body's website and are authorized to use the certified logo and service mark.

6.2.2.7 Surveillance

Surveillance is a systematic iteration of conformity assessment activities as a basis for maintaining the validity of the statement of conformity. For the printing industry

a) printing of the IT8.7/4 target as a dedicated press run is not recommended,

b) samples from open markets are not recommended because colour bars are removed in the finished products, and

c) samples, containing colour bars, should be drawn from the printing factory to verify production variation conformity only.

Frequency of surveillance may be semi-annually or annually.

6.2.2.8 Certification of analysis or conformance

In addition to tone and colour conformity, CoA/CoC testing is required by consumer products companies (CPC). These tests are designed to ensure that all packaging components maintain the desired design intent and equity by withstanding the rigours of the CPC's converting operations, transportation, and the distribution chain to retail.

Typical testing required could be:

— Brand colour validation – print quality

— Sutherland rub test (see ASTM D 5264)

— Alcohol rub

— Scratch resistance test

— Tape test (see ASTM D3359)

— Light -fastness testing (see ISO 12040)

— Slide angle test COF (coefficient of friction) (see ASTM D 1894, ASTM D4518)

— Burst test

— Brand colour statistical process control reporting

— Print quality

— Flop index (metallic inks) (see ASTM D1729)

— Bar code verification (see ISO/IEC 15426-1)

— Specific requirements from schema or brand owners for their specific products

Annex A
(informative)

Flexography — Specifics

A.1 General

Flexography is a method of direct rotary printing that uses resilient relief image plates made of rubber or photopolymer material. Anilox rollers, which deliver a precise amount of ink, are the heart of flexography, and set it apart from other printing processes. Flexography utilizes fast-drying fluid inks that print onto virtually any substrate, absorbent or non-absorbent.

Throughout the flexographic workflow there are many process control points that are specific to the flexographic printing process.

A.2 Digitally imaged photopolymer plates

A.2.1 General

The digitally imaged photopolymer plate is made without the use of photographic film. The sheet photopolymer material is supplied to the plate maker with a carbon black layer on the surface that is imaged from an electronic file using a laser.

The laser removes, or ablates, the carbon black layer in the image areas of the design. After ablation, the carbon black layer acts as a mask, blocking the ultraviolet light in the non-image areas, during the platemaking exposure process.

The carbon black mask should have a density greater than 3,0, have a uniform consistency of coating, and be free of visual defects (such as pinholes, scratches, abrasions, and smudges) prior to ablation. After ablation, the carbon black opening "stain level" should have a density of 0,06 or less on a transmission densitometer.

A.2.2 Mask imaging inspection

The mask should be inspected prior to imaging, after imaging, and after UV face exposure.

Prior to imaging, check the mask layer for any visible scratches, abrasions, or marks. Plate material should be clean and flat. The carbon mask can be very sensitive to abrasions; therefore, plates should be handled carefully throughout the imaging and exposure process.

After imaging and prior to UV face exposure, re-inspect for damage to the mask layer. Flaws in the non-image area of the mask can be corrected with tools, such as high-density opaque or red litho tape. Be sure to remove tape prior to plate processing.

After UV face exposure, measure the device calibration target using a transmission densitometer. A CCD camera may also be used to obtain a surface measurement of the plate. Check the 100 % area to ensure complete clearing. The minimum dot should not vary more than ± 1 %. Should the scale exhibit 2 % or more variation, the imaging process should be checked for imaging and processing. Process checks should include the imaging equipment, setup parameters and raw material.

The device calibration target is a tone scale without a bump curve. It identifies where dots begin to fully form at printing height in the digital imaging process. The scale should include, but not be limited to values Substrate, 10 %, 25 %, 50 %, 75 %, 90 %, and solid. A device calibration target should be placed in a void, or non-print area, for each plate being imaged

A.3 Plate processing and evaluation

Vacuum is not required and not recommended during ultraviolet light exposure. If digital plates are exposed with a point light source, use maximum light diffusion in combination with extended exposure time to avoid loss of fine detail, such as highlight dots.

— Print Height: All imaged areas should be at full printing height. Recessed dots on a digital photopolymer plate are not recommended by FIRST. An inadequate bump curve can result in fine details, such as highlight dots, not achieving full printing height. Measure the height of the minimum dot patch with a micrometer and compare to a solid area. Or, if that is not possible, carefully inspect the highlight dots to ensure they are fully formed and not recessed.

— Relief Specifications: Digital photopolymer plates image with a unique dot profile and structure. Digital dots have a straighter shoulder than conventional dots; therefore, they require less relief to achieve maximum dot support. Variances in cylinder build-up, press tolerances, or press operation may influence relief requirements for a particular application. Confirm target relief specifications with the printer.

— Caliper: Plates should be inspected and measured with a micrometer. Gauge readings should be marked on the plates for use during plate mounting. Measure the thickness uniformity and relief of flexographic printing plates with a plate micrometer (either analogue or digital readings). Calibrate the instrument using a precision machine block inserted between the surfaces. Accuracy of calibration should be within ± 0,000 5" (0,013 mm) of the calibration block. When measuring caliper and relief with the plate micrometer, the test area should be at least 1" × 1" (25 mm × 25 mm). Take multiple measurements across the plate to determine the uniformity of plate thickness. Digital plate micrometers equipped with a printer can output statistical data of the plate measurements. To confirm that the plates comply with certification requirements, the printer should verify the data.

— Dot Accuracy: Use a calibrated "Flexo Plate Analyzer" to measure screen values and confirm dot accuracy. The flexographic plate analyser measures halftone dot size. A high-resolution video camera allows for precise measurement; it can read halftones regardless of the contrast, colour, or graining of the image. Excellent correlation is possible with conventional densitometers when measuring film-to-plate. Stochastic or FM screen images can also be verified for quality. Multiple measurements should be taken to determine the repeatability of the measurements, especially with highlight dots.

A.4 Pressroom process control

A.4.1 Cylinder inspection — Parallelism

The impression cylinder, plate cylinders, anilox rolls, drive rolls, and idler rolls should be aligned and parallel. When the anilox roll or impression cylinder is not perfectly parallel with the plate cylinder, one side of the print cylinder will begin to print before the other.

Another consideration is alignment of drive, nip, and idler rolls in the web or sheet path. When they are not aligned, baggy web edges, wrinkles, drifting substrate, and inconsistent register occur. The anilox roll and doctor blade chamber (or rubber roll) should also be in alignment with each other, and with the print cylinder, for uniform ink metering.

A.4.2 Balancing rolls and cylinders

Balancing is a process whereby the distribution of mass in a roll or cylinder is altered to eliminate vibration at the bearings. The vibration is eliminated by "dynamic balancing"; weights are placed in two different planes of the roll or cylinder, perpendicular to the axis of rotation. Imbalance is caused by the lack of homogeneity in the roll or cylinder material, such as uneven wall thickness. The following problems are a direct result of vibrations caused by unbalanced cylinders:

— excessive plate wear;

— excessive bearing wear;

— excessive roll wear;

— uneven print impression;

— resonant vibration of other parts of the press.

There are two types of roll/cylinder imbalance that should be corrected:

— Static imbalance: Only gravity or weight force is involved; balancing can be accomplished without rotation. This type of balancing is not adequate for flexographic rolls or cylinders because of the rotational speeds at which they operate and the ratio between their diameter and axle length.

— Dynamic imbalance: This is caused by centrifugal force when the roll or cylinder is rotating. The magnitude of the centrifugal force produced by an unbalanced condition is a function of the speed of rotation. Therefore, the accuracy of balance required increases with press speed.

A.4.3 Anilox roll inspection

A.4.3.1 General

The anilox roll supplier should issue a certificate of analysis (CoA) with each anilox roll. The CoA should include both the engraving characteristics and the roll dimension characteristics of the anilox roll being shipped. The actual roll data should be compared to the specifications ordered. A printer may elect to have the CoA replace an in-house engraving and dimension inspection for incoming anilox rolls. Some printers conduct "random" audits of incoming rolls to confirm that the CoA accurately describes the roll being received.

If the printer performs an incoming dimensional and engraving inspection, it should be completed as soon as possible after the roll is received and before it is used. An inspection table for general, visual inspection and to check that total indicated runout (TIR) is required. A microscope with a minimum 10x eyepiece and objectives of at least 20x, 40x, and 80x are also needed to inspect the overall appearance of the engraving.

TIR measures the roundness of the anilox roll. Rolls that are out-of-round will negatively impact the consistency of the ink lay characteristics on the press.

A.4.3.2 Anilox roll inspection procedures

a) Check the roll for any damage that may have occurred in shipping, or in the press, by looking at the face of the roll and the shafts.

b) Check the TIR of the roll face and journals. Compare to the roll specifications.

c) Using a microscope, inspect the engraving for general quality. Evaluate:

   1) excessive land area between the cells,

   2) cell shape, and

   3) unspecified channelling – excessive amounts of channelling or excessive channel depth indicate an inferior engraving.

d) Measure the cell volume using the agreed upon volume measurement method. Usually three readings across the roll face are sufficient to determine the average cell volume of the roll.

e) Photograph the engraving or request that the supplier provide a photograph of the anilox roll engraving.

f) Document all anilox roll information, both CoA's and in-house inspections, and maintain this documentation for reference.

A.4.4 Anilox roll maintenance

To maximize the life of an anilox roll, regular inspection and maintenance procedures should be implemented. Anilox rolls should be routinely inspected to monitor the cleanliness and wear of the engraving. Maintain a data sheet for each roll recording:

a) manufacturer;

b) cell count;

c) cell volume;

d) engraving angle;

e) age;

f) location;

g) cleaning and inspection history.

Wear and ink dried in the cells reduces the actual print volume of the anilox roll. Press wash-ups are critical to keeping the anilox roll clean, which will help maintain the print density and extend the life of the anilox roll. To minimize wear, run proper doctor blade pressures and install/maintain magnets and filters in the ink-delivery system to reduce the potential for score lines. If a decrease in density occurs during printing with a clean roll, the roll should be inspected to verify that the current cell volume agrees with the actual cell volume when the roll was new. Anilox roll suppliers should assist in designing and implementing an anilox roll monitoring and maintenance program.

Annex B
(informative)

Gravure — Specifics

B.1 Gravure cylinder

B.1.1 General

The engraved cylinder is the printing matrix of rotogravure technology. The cylinder contains all the features to guarantee the required quality at high production speeds. The production process of a rotogravure cylinder is complex and involves different types of processing: mechanical, galvanic, electromechanical and chemical.

B.1.2 Cylinder characteristics

B.1.2.1 General

The cylinder is made from a seamless steel tube or aluminium, or particular solutions with a polyurethane core to lighten the weight of the cylinder, on which, at the ends, two flanges are hot-mounted, which reflect the technical drawing provided by the manufacturer of the printing press for the correct assembly.

The cylinder should be ground externally, turned internally and balanced statically and dynamically according to the indications of the technical drawing.

It is recommended to deposit a layer of copper from 4/10 mm to 6/10 mm on the diameter, the final layer of copper will be then engraved, and finally the cylinder is covered with a thin layer of chrome.

Engraving is the heart of the preparation process of the rotogravure matrix, in this phase the cells that will be the inkwell in the printing process are engraved on the cylinder. Today there are different types of engraving: electromechanical, indirect laser auto typical and direct laser engraving.

B.1.2.2 Electromechanical engraving

Electromechanical engraving is the most widespread technology thanks to engraving speed, quality and repeatability of the result. The engraving takes place by means of a diamond mounted on an engraving head which performs a drum-like movement on the surface of the cylinder which is made to rotate on its axis. Thanks to this movement and to the shape of the diamond the copper is removed, and the engraved cells are created. Before proceeding with the engraving, a calibration test is performed to ensure conformance with the defined parameters, intervening on the “vibrations and currents” sent to the incident head.

B.1.2.3 Indirect autotypical/laser engraving

The autotypical engraving with laser or indirect laser exposure, compared to electromechanical engraving, requires a longer engraving process, because it comprises several preparation phases. It overcomes the limitations of using an engraving tool, enabling special engravings for specific applications to be attained. In the first phase of processing the cylinder is sensitized with a lacquer, which can be UV or thermal depending on the laser used. The cylinder is then exposed to the laser which will work on the lacquer present on the cylinder inerting the parts that are to be engraved. Once the inert lacquer is removed, the cylinder is etched with an electrolytic process inverse to the copper plating phase, or that is, inverting the anode and cathode, the longer the cylinder is left in the electrolytic bath, the deeper the engraving becomes. At any time, the engraving can be stopped and its progress measured until the required parameters are reached.

B.1.2.4 Direct laser engraving

Direct laser engraving was introduced in the rotogravure market in the mid-1990s, using zinc-coated matrices for flexible packaging, or steel and other metals for special applications. The characteristics that distinguish it from electromechanical technology are high definition, quality of the marks and the possibility of reproducing three-dimensionality.

In recent years, direct laser engraving on copper has also developed, allowing integration with electromechanical engraving, increasing print quality, especially in texts and halftones. The cylinder is engraved directly with the laser which, depending on the power, can generate cells with different dimensions and different depths.

B.1.3 Automation in cylinder production

Process automation is a reality that has been present for several years in the production of rotogravure cylinders, this makes it possible to optimize times by effectively eliminating the assembly and disassembly of the cylinders for each processing step described above and guaranteeing an optimization of processing times. The first automatic lines to enjoy success on the market were the galvanic lines, where in fact all the galvanic copper plating processes were carried out, in some cases even chrome plating and only the engraving phase was managed off-line. In recent years, with the complete digitisation of the process, the engraving phase has also been integrated into the automatic lines. Hence starting from a steel or re-used cylinder, we can today attain the chrome cylinder via a completely automated process. In this case, it is essential that the cylinder that is loaded on the automatic line respects the expected physical and geometrical characteristics from the beginning, because during the process the operator intervention to measure and correct any defects is limited. In automatic lines is recommended the presence of an automatic control station that measures the geometry of the cylinder, its hardness and roughness to guarantee the quality of the work performed.

B.1.4 Cylinders printing proof

At the end of production, the cylinders are tested before delivery to the customer. The test is a simulation of the production in a rotogravure printing press and has the function of guarantee the printer or/and Brand owner the accuracy of the engraving made prior to printing start-up.

The cylinders printing proof is carefully checked and compared with the reference colour proof to evaluate the accuracy of the engraving compared to the required chromatic result and if there is any defects on the printed part. Dedicated software are available that allows the cylinders printing proof to be compared with the pdf approved by the customer, digitally simulating a physical overlay of the sample printed with the file and highlighting the differences found.

B.2 Cylinder inspection

a) Check TIR of cylinder face to the bearing surface or insert shaft into hollow cylinder and check TIR.

b) Check for scratches, or damage to the surface of the cylinder and that the edges of the cylinder face are smooth.

c) Ensure that the surface and the engraved areas are free from dried ink, or any contaminants.

d) Check for loose metal, or debris on the side faces of the cylinder.

B.3 Image inspection

a) Check both the cylinder proof and/or the digital proof against the standard and layout.

b) Identify each colour against the engraving and load the press accordingly in sequence.

B.4 Web and substrate

a) Ensure that the web is loaded into the press according to the manufacturer's specifications.

b) Ensure that the correct substrate surface is in contact with the cylinder surface.

c) Check the print width against the substrate width.

d) Check the surface tension of the substrate against the specification.

B.5 Impression rollers

a) Check and compare the dimensions and shore hardness of the impression rollers.

b) Check the width of the impression rollers against the cylinder and image width.

c) Check the contact area using compressible material.

d) Check the total indicated runout (TIR) of the cylinder surface, the superficial finish and the uniformity of the grinding. Any irregularity may compromise the printing quality and it can cause wrinkles during the process.

e) Check the conductivity of the rubber cylinder in case of use of the electrostatic system assist (ESA) during printing.

f) Check of the concentricity of the rubber roll.

g) Check of the homogeneity of the printing pressure between front side and back side.

h) Check the alinement between the pressure roller and the printing cylinder.

B.6 Ink supply

a) Add the appropriate ink to each pump in the appropriate order.

b) Bring to an approximate viscosity and check colour with a draw-down bar.

c) Verify that the ink used in the process is compliant to the specifications provided by the machine manufacturer. Ensure that the machine is able to process the specific typology of inks used (solvent base or water base, Atex regulations).

d) Pump control and adjustment, to ensure the adequate ink supply for the printing process, by verifying a consistent return of ink from the ink tray.

e) check the correct ink flow inside the tray to avoid ink turbulence that could generate foam and printing defects.

f) File the composition of each ink in respect its components including batch numbers (traceability).

g) In case of use of leftover inks ensure that all components of left-over inks comply with CoC.

B.7 Ink viscosity control

a) Ensure the designated viscosity cup that will be used to check that the ink has been calibrated against a "control" cup. The control cup should be certified, and inventoried under the responsibility of the QA department.

b) Ensure that the designated viscosity cup is clean and free of any obstructions at the passage orifice.

c) Ensure that the designated time measurement tool (stop watch) has been certified and/or calibrated by the QA department.

d) Ensure that the designated employee who will be measuring the ink viscosity is in conformance with all plant/department PPE.

e) With the certified stop watch in one hand and viscosity cup in the other, the designated employee should hold the viscosity cup near the top of the wire handle and insert the cup into the ink tank in a method that will ensure NOT to incorporate any bubbles. This is generally done by moving the cup in a slow circular motion with the cup submerged three quarters of the way into the ink tank (a quarter of the top of the cup should be visible above the fluid level in the tank). Once the bubbles (if present) have been forced from the centre of the circle, totally immerse the cup into the ink. At this point, bring the viscosity cup directly up from the submersion - simultaneously press the START function on the stop watch. It is important to ensure that the stop watch has been cleared to “0” prior to pressing the START function.

f) Observe the stream of fluid flowing from the viscosity cup. This procedure is generally performed from a kneeling position and would be covered in the safety portion of the standard operating procedure (SOP). The viscosity measurement of ink performed in this method is quantified in time (seconds). That time measurement is quantified by observing the continuous stream of fluid flowing from the cup, and accurately measuring the exact moment the break in the continuous stream occurs. Therefore, the designated employee should press the STOP function on the stop watch at the point the continuous stream breaks. The amount of time the fluid flowed continuously through the cup (in seconds) is the measured viscosity of the ink.

g) With an approved solvent container, thoroughly clean and inspect the viscosity cup and repeat these steps with any remaining inks that require measurement.

e) Ensure that the viscosity adjustment system is correctly calibrated and verify the stability of the parameters by using the manual viscosity control cup, especially when the ink type is changed.

B.8 Doctor blade

a) Electrostatic printing assist (ESA)Check of the correct dimensions of the doctor blade (width, thickness and overhang from the locking frame).

b) Check of the correct dimensions of the counter pressure (width, overhang and thickness).

c) Check of the doctor blade operating position in relation to the print form.

d) Check of the doctor blade angle.

e) Check of the uniformity of doctor blade action between front side and back side.

f) Check of the wearing condition of the bevel.

g) Clear visualization of doctor blade working pressure during the printing run.

B.9 Electrostatic printing assist (ESA)

a) Check of the proper operation of the electrostatic assistance system according to the technical specifications provided by the manufacturer.

b) The electrostatic system is recommended when printing a pattern with low coverage.

c) The electrostatic printing assist is strongly recommended in case of water-based inks.

B.10 Hot air dryer

a) Ensure the correct drying temperatures, in relation to the technical specifications of the ink manufacturer and the substrate manufacturer used in the process.

b) When using solvent-based inks, taking a sample of the output obtained with production operative conditions for subsequent solvent residuals control.

c) Ensure the correct blow-out speed of the nozzles along the length and width is equal everywhere. Maximum deviation ±4 m/s.

d) Constant temperature distribution along the web width and dryer length. Maximum deviation ±2 °C.

Annex C
(informative)

Offset — Specifics (Example)

C.1 Devices and protocol

- Plate tone value measurement: device should be certified at manufacturer specified intervals.
- Operator can demonstrate capability to select proper settings and accurately measure and document results.
- Spectrodensitometer: device should be certified at manufacturer specified intervals.
- Operator can demonstrate capability to select proper settings and accurately measure and document results.
- pH/Conductivity: device should be certified at manufacturer specified intervals.
- Operator can demonstrate the capability to correctly utilize the device(s) and interpret results demonstrating protocol to document results.
- Durometer gauge: device should be certified at manufacturer specified intervals.
- Operator can demonstrate the capability to correctly utilize the device(s) and interpret results.
- Calliper gauge: device should be certified at manufacturer specified intervals.
- Operator can demonstrate the capability to correctly utilize the device(s) and interpret results.
- Packing gauge: Calibrated per manufacturer recommendations.
- Operator can demonstrate the capability to correctly utilize the device(s) and interpret results.

C.2 Plate process control

Plate verifications:

- Plate maker can validate linear patch, protocol for documentation of process control;
- Curve patch measurement: Plate maker can validate curved patch;
- Processor maintenance: Chemistry is being replenished or replaced per manufacturers recommendation and documented in a log;
- Roller maintenance: Rollers pulled and cleaned during chemistry change and documented;
- Press chemistry: Plant can demonstrate pH, conductivity and temperature are monitored and controlled on a regular basis with documentation;
- Ink roller train: Plant can demonstrate temperature is monitored and controlled on a regular basis, with documentation;
- Dampening system: Rollers are in good condition and properly set. Control of water flow return and temperature with proper pH, and conductivity.