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Graphic technology — Processless lithographic plates —

Part 1: Evaluation methods for characteristics and performance

Technologie graphique — Plaques lithographiques sans traitement — Partie 1: Méthodes d'évaluation des caractéristiques et des performances

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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 24487 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

Processless plates represent a simple way to prepare plates in prepress. Once a plate has been imaged, it is mounted directly on the press where the plate coating is removed on start-up of the press. This approach eliminates the plate processor, associated chemistry, energy required to power the processor, water, and waste from plate preparation.

Perceived benefits of processless plates include ease of use and improved speed of production compared to traditional plate preparation systems since there is no need for a plate processor or finishing unit. Processless plates are mounted directly on press once imaged. Since costs associated with processors and finishing units, including developer and cleaning solution, time and labour are eliminated, printing using processless plates is perceived as a low-cost method.

The unique characteristic of processless plates is on-press development. After the exposure process by computer to plate (CTP) exposing equipment, the non-image area of the photosensitive layer is physically removed along with the ink and the fountain solution of the press.

The removal procedure is as follows.

— When the press is started, fountain solution and ink are applied. The fountain solution permeates the unexposed (non-image) area of the photosensitive layer. The unexposed photosensitive layer is then peeled from the base material by the viscosity of the printing ink.

— This peeled photosensitive layer is finely dispersed into the ink which is discharged on paper from the press in the usual way. Parts of the peeled layer are also discharged into the fountain solution.

Graphic technology — Processless lithographic plates —

Part 1:
Evaluation methods for characteristics and performance

1 Scope

This document applies to processless lithographic plates and specifies evaluation methods for lithographic plate characteristics, on-press development performance, usability and print image quality.

It specifies measurement conditions for materials and equipment and provides guidelines for the selection of suitable processless lithographic plates by a printing organization and requirements for comparative assessment tests.

The assessment of waterless lithographic plates is out of scope of this document.

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 2846-1, *Graphic technology — Colour and transparency of printing ink sets for four-colour printing — Part 1: Sheet-fed and heat-set web offset lithographic printing*

ISO 12647-2, *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints — Part 2: Offset lithographic processes*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 https://www.electropedia.org/

3.1
processless plate
plate loaded directly on to a printing press following exposure without any intermediate processing step other than mechanical processes such as plate punching and bending

Note 1 to entry: Intermediate processing steps typically include plate development, cleaning, fixing (or desensitization) and other treatments

Note 2 to entry: Strictly speaking, these plates are 'processed' on press using the press fountain solution and ink.

3.2
pre-dampening amount
fountain solution amount used to wet plates prior to printing

3.3
pre-inking amount
ink amount applied to plates prior to printing

4 Test procedure

4.1 General

Printing machines in use today differ in physical structure, fountain technology and ink delivery systems. The test conditions in this document are designed to be practical and to show significant differentiation between performance of different processless plate technologies.

Test conditions have been chosen to control key factors that have an impact on processless plates performance.

Two categories of testing are anticipated by this document.

a) Individual test: testing by a printer who wishes to choose the most suitable plate for his purpose and for this category of test, the production methods and materials used for testing should be those used by the printer for print production.

b) Comparative test: scientific testing to allow the performance of printing plates to be compared to one another and for this category, the testing requires the use of specified test materials and methods which in some cases may be specified by the press or plates manufacturer.

Unless explicitly indicated, requirements shall be applied to both testing categories.

4.2 Test environment

The temperature of the printing room shall be 24 °C ± 2 °C.

The relative humidity of the printing room shall be (55 ± 10) % RH.

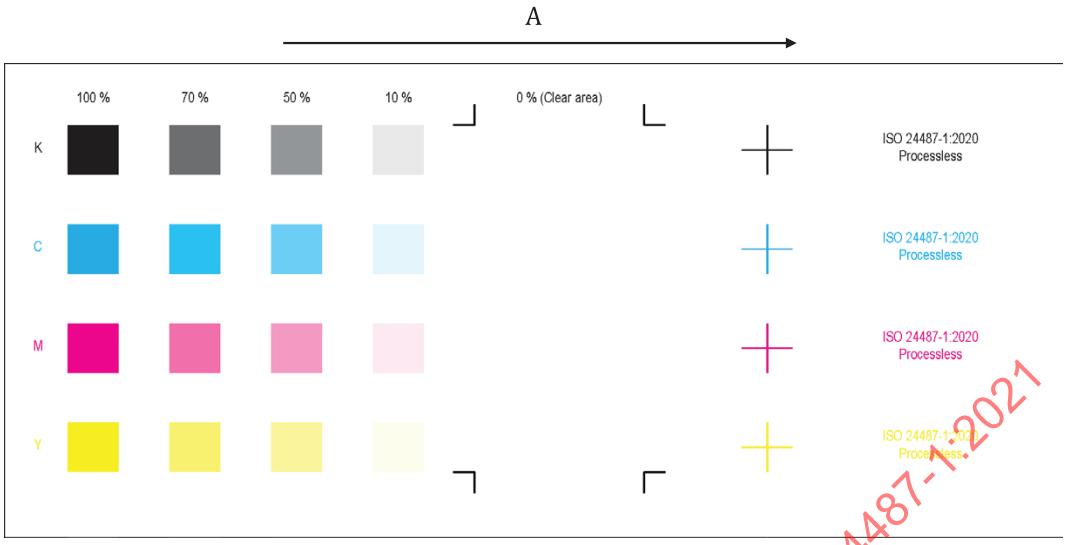
4.3 Plate imaging

Printing plates shall be prepared to include the following content. Additional inked content shall be added in such a way as to ensure approximately equal inking across the plate of between 20 % to 40 % coverage.

A CMYK test form with a set of rectangular or square patches shall be prepared comprising: a solid (100 %) patch in each process colour, and patches of intermediate tones from 10 % to 70 % tone value in each process colour. A region of at least 100 mm × 150 mm of the sheet shall be left blank (the non-image area).

Each patch should have a minimum size of 10 mm × 10 mm and patches should be spaced by a minimum of 5 mm. Where visual assessment is required, patches should have a minimum size of 40 mm × 40 mm. The plate image area shall have a large region of approximately half the total image size where no marks are imaged. An example test form is shown in Figure 1.

NOTE 1 The minimum size for each patch has been specified so that the patches can be measured easily. The minimum spacing of patches is required to allow visual assessment of toning between printed elements.



Key

A preferred printing direction

Figure 1 — Example CMYK test form

The test form should be imaged in several positions and with different orientations. When oriented in the press direction, it shall be aligned with the preferred printing direction as indicated.

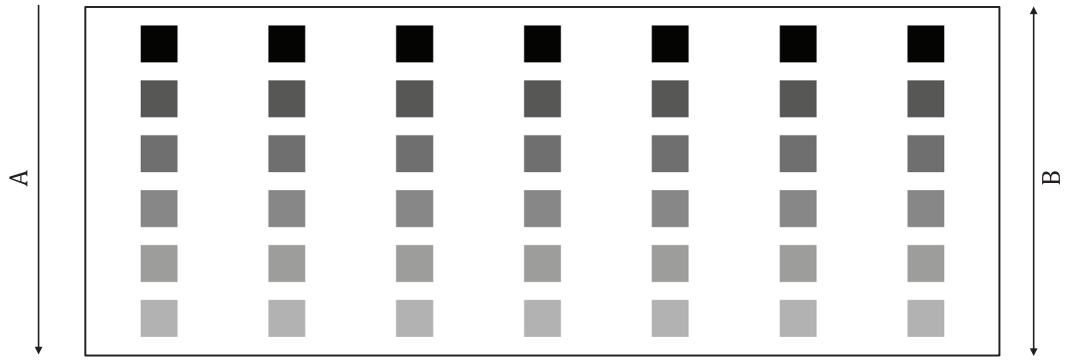
NOTE 2 Where a subset of the process inks is to be tested, not all plates need to be imaged. For example, to test the performance with cyan ink, only the cyan plate needs to be imaged.

The plates shall be exposed as recommended by the manufacturer for optimum image sensitivity and should be adjusted to ensure that the halftone dot area on plate corresponds to patch tone value.

When printing is not 4-colour (CMYK), for example monochrome printing or printing of spot inks or varnish, a test chart comprising the set of process colours generally used in print production shall be used.

Where abrasion resistance tests are to be performed, a monochrome test form comprising seven sets of the patches shall be imaged. This test is generally performed on the black plate, but the same monochrome image may also be used to image the cyan, magenta or yellow plate. An example of a suitable test form is shown in Figure 2. Sets of patches shall be separated sufficiently to allow abrasion resistance testing to be performed on one set without affecting any other set.

This test form may also be used when testing chemical resistance.



Key

A preferred printing direction

B abrasion direction

Figure 2 — Example abrasion resistance test form

When printing CMYK, all test forms shall be prepared and printed to meet the requirements of ISO 12647-2 with the exception of the tone value increase which should not be adjusted from the natural behaviour of the printing press. Additional content necessary for process control should be added as required. The reference paper type that is closest to the paper actually used for printing shall be identified and reported. When comparative testing is performed, a half-tone screen ruling of 60 cm^{-1} (approximately 150 lines per inch) should be used.

4.4 Pre-dampening amount

The pre-dampening amount should be as small as possible and shall be no greater than the recommended value from the press vendor.

4.5 Pre-inking amount

The pre-inking amount shall be set to the recommended value from the plate manufacturer or press vendor.

4.6 Ink selection

When individual testing is performed to determine whether the plate is suitable for a printing operation, the inks used for testing should be the same as are typically used for production.

When comparative testing is performed, inks conforming to ISO 2846-1 shall be used.

For the evaluation of resistance to toning, a low viscosity and low tack ink with a large content of varnish should be used.

Details of the inks used shall be reported.

NOTE Low viscosity and low tack inks show more differences when comparing processless plates.

4.7 Substrate selection

When individual testing is performed to determine whether the plate is suitable for a printing operation, the substrates used for testing should be the same as are typically used for production.

When comparative testing is performed, paper for the appropriate ISO 12647-2 printing condition shall be used. Where possible, an environmentally friendly paper such as recycled paper and FSC certified paper should be used.

Details of the substrate used shall be reported.

4.8 Fountain solution

When individual testing is performed to determine whether the plate is suitable for a printing operation, the fountain solution used for testing should be the same as are typically used for production.

When comparative testing is performed, a fountain solution recommended by the press manufacturer shall be used. Where possible, an environmentally friendly fountain solution should be used. A list of fountain concentrates tested by Fogra and approved by the printing press manufacturers is given in Reference [2].

Dilution of the fountain solution shall be made as recommended by the printing press manufacturer.

The fountain solution and dilution amount used shall be reported.

4.9 Press preparation and control

4.9.1 Press preparation print run

The number of sheets required for plate development depends on the press condition when the print run starts and can vary by more than a factor of two. To avoid this problem, two sets of identical plates shall be prepared. The first set shall be used for a press preparation print run of at least 300 sheets during which ink key settings are established and the second set shall be used for the test print run.

During the press preparation press run, the press settings should be established according to the press and plate manufacturer's recommendation. The blanket shall then be washed and dried before the plates to be tested are fitted to the press and the testing begins.

NOTE The start-up procedure according to the plate manufacturer's and the press manufacturer's recommendation can be different for each press or plate.

The press shall be adjusted to achieve the printing aims within the deviation tolerances as specified in ISO 12647-2 for the solid cyan, magenta, yellow and black process colorants and all patches are within the variation tolerances.

Printing speed shall be the speed generally used for print production or a standard setting as recommended by the press manufacturer. Press speed shall be reported.

Other press parameters such as fountain solution cooling temperature, ink roller cooling temperature, blanket, water supply system, slip ratio between fountain solution rollers and impression throw-in should be operated as recommended by the press manufacturer. In cases where the press is operated differently from that recommended by the manufacturer, the differences shall be reported.

Where available, press manufacturer recommended programs for processless plates should be used. Where no such recommendation exists, the same press condition as is used for printing using conventional plates shall be used.

All settings and materials necessary to repeat the result of the press preparation print run shall be reported.

4.9.2 Reference printing aim values

A set of sheets shall be selected from the end of this press preparation print run that are within the specified tolerance and shall be measured to establish reference aim values for all coloured patches and for the unprinted substrate.

4.10 Printing method

Using the printing procedure recommended by the printing press manufacturer or, when individual tests are performed, by the standard printing method used by the printing operation, approximately 100 sheets should be printed after on-press development is observed by the press operator to be complete.

NOTE Printing procedures include adjustment of ink roller and dampening roller settings, adjustment of spacing between plate and blanket cylinder, balance between water and ink, and blanket freshening.

Where assessment of toning, chemical resistance and press stop-and-restart is performed, additional prints shall be made as follows. Print an additional 1 000 sheets using the standard printing procedure before stopping the press. The last 30 sheets before stopping shall be collected. The press shall be stopped for one hour. The press shall be restarted and at least 100 additional sheets printed.

The press state during the period where the press is stopped can affect the stop-and-restart testing. The best result can be different for each press or plate type and so where they exist, the manufacturers' recommendations for press stop-and-restart should be used.

The last 30 sheets collected before the press is stopped are used to evaluate toning performance.

The last 30 sheets collected before the press is stopped, along with sheets 70 to 100 printed following the restart, are used to evaluate chemical resistance and stop-and-restart performance.

4.11 Plate exposure to light

The performance of some plates is affected when exposed to light. This can happen when plates are prepared and placed next to the press during a previous print run as is often done.

In order to test the effect of light exposure on the plates, a set of plates shall be produced and exposed to typical pressroom lighting for a period of 1 h.

Where comparative testing is performed, the lighting condition of ISO 3664 P2 should be used.

Plates for this test should be new and stored in a dark place before the test begins.

5 Assessment methods

5.1 General

The following test methods are designed to evaluate processless plates. Measurements shall be made in accordance with ISO 13655. ISO 3664 viewing condition P2 should be used for visual assessment.

NOTE Some of these test methods can also be used to evaluate standard process plate properties.

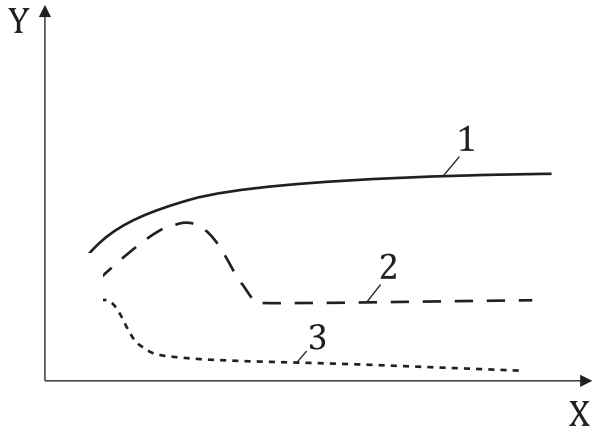
Examples of reporting of results are shown in Annex B.

5.2 On-press development

5.2.1 Number of sheets required for on-press development

Figure 3 shows the typical relationship between the number of sheets printed and the CIELAB colour change for each region of the plate.

NOTE The curve shapes shown in Figure 3 can vary significantly from one press to another, can depend on the processless plates, and can depend on the start-up condition of the press.



Key

X number of sheets
Y ΔE_{ab} from substrate
1 colour change of solid image area
2 colour change of intermediate tones
3 colour change of non-image area

Figure 3 — Typical colour coordinates and tone values by number of sheets

The press shall be started, and the colour of regions 1, 2 and 3 shall be monitored until:

— the colour of regions 1 and 2 match the printing aim values established in 4.9.1 to within the variation tolerances of ISO 12647-2,

— no ink is visible on the non-image area (region 3), and

— the colour of the unprinted sheet matches the reference (see 4.9.1) to within the variation tolerance specified in ISO 12647-2.

The set of sheets printed from the time the press is started shall be numbered and the sheet number where all conditions are met shall be identified. The number of this sheet is defined as the number of sheets required for on-press development.

Details of how to print and measure the sheets are provided in Annex A.

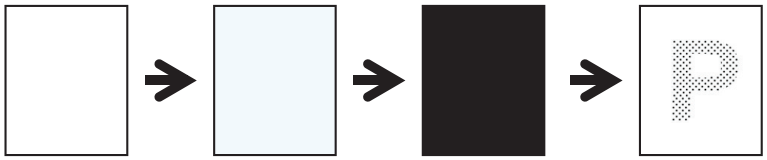
5.2.2 Assessment of non-image area

Assessment of the non-image area provides an indication of the effective removal of the photosensitive layer. The maximum density of the non-image area generated during the on-press development period affects the toning in the printing press and the quality of the prints and provides a measure of the effectiveness of on-press development.

Sheets shall be assessed by visual inspection using a loupe to ensure that no ink is visible on the unprinted region. Care shall be taken to check that the edges of the printed region are sharply defined with no residual ink beyond the edge.

The number of sheets required to reach the point where the printed matter does not have any visible ink shall be recorded along with the maximum CIELAB76 colour difference between the print area and the unprinted substrate colour on any of the sheets printed from the time the press is started.

When the ink spreads over the entire surface of the plate, excess ink contaminates the printing press and can cause various quality failures. The maximum ink density in the non-image area provides a measure of the effectiveness of on-press development.



Key

1 exposed plate
2 plate covered with fountain solution
3 plate covered with ink
4 plate with ink remaining only on halftone dots

Figure 4 — Fountain solution and ink spread

Figure 4 shows the steps in the formation of the non-image area. The exposed plate is completely covered by fountain solution and is then covered by ink which removes the non-image region to leave the plate ready to print. When printing ink should only remain on the image area and no ink should be present on the non-image area.

The set of sheets from the press preparation print run (see 4.9.1) shall be measured at multiple non-printing area positions on the sheets. The mean value of these measurements shall be recorded as the reference paper colour and the maximum colour difference between all measurements and this mean value shall be calculated and recorded as the expected maximum paper colour variation.

Multiple measurements of the non-printing area of selected sheets from subsequent print runs shall be made and the mean value calculated. The maximum colour difference between all measurements of the sheet and this mean value shall be calculated. This maximum colour difference should not exceed the expected paper variation by more than 0,2 ΔE_{ab}. Details of this procedure are given in Annex A.

NOTE Measurement variation can be as much as $\Delta E_{ab} \pm 0{,}2$.

5.2.3 Assessment of solid area

The number of sheets printed before the point where the ink is evenly distributed on the plate with no visible mottle provides a measure of the effectiveness of on-press development.

The colour of solid areas shall be measured, and the number of sheets printed before a stable colour is reached shall be recorded. The printing colour shall be considered stable when the variation in colour is within the tolerance specified in ISO 12647-2.

Visual inspection of the sheets shall be performed and any non-uniformity in the solid tones shall be noted.

Reference print samples are collected from the press preparation print run and comparison is performed against that.

Details of the assessment of the solid patches are given in Annex A.

5.2.4 Assessment of intermediate tones

Effective and consistent printing of intermediate tones is a measure of print quality and so effective removal of the photosensitive layer around halftone dots in the intermediate tone area provides an effective measure of on-press development.

The tone value of each of the intermediate tone patches shall be measured and the number of sheets printed before a stable printed tone value is reached for all intermediate tone patches shall be recorded.

Visual inspection of the sheet where stable printing density is reached shall be performed and any nonuniformity in intermediate tones shall be recorded. Inspection of dot formation in intermediate tones shall be performed using a loupe and any missing or malformed dots shall be noted.

Details of the assessment of intermediate tones are provided in Annex A.

5.3 Abrasion resistance

This test provides an indication of abrasion resistance of the plate surface. Abrasion resistance as described here is a qualitative test for cases where plates are rubbed against each other or the edge of one plate scores another when handling the plates. This test is not for wear during the print run. Abrasion can occur, for example, during plate feeding, sorting, shipping, and transportation of a stack of plates from a plate making site to a printing site. Plate abrasion reduces the print image quality.

This document specifies a rub test using a commercially available nylon nonwoven fabric to reproduce the shape and extent of abrasion generated in practical situations. A nonwoven fabric, similar to that used for the surface of the 3M™ Scotch-Brite™ General Purpose Scuff Sponge 7441[1)], should be used.

The rub test is generally performed using the black printing plate after the abrasion resistance test form has been imaged.

The exposed plate is rubbed with the nylon nonwoven fabric in the direction shown in Figure 2. The size of the nylon nonwoven fabric should be approximately 30 mm × 30 mm. A weight is placed on a sponge covered by the nylon fabric to ensure a pressure on the plate of 0,1 kPa and the surface of the plate is rubbed once in one direction over one set of black patches. The test shall be repeated for each of the black patches increasing the pressure by 0,1 kPa each time so that the last set of patches has a pressure of 0,7 kPa applied.

NOTE kilopascal (kPa) = 101,97 kg force per metre squared kgf/m^2.

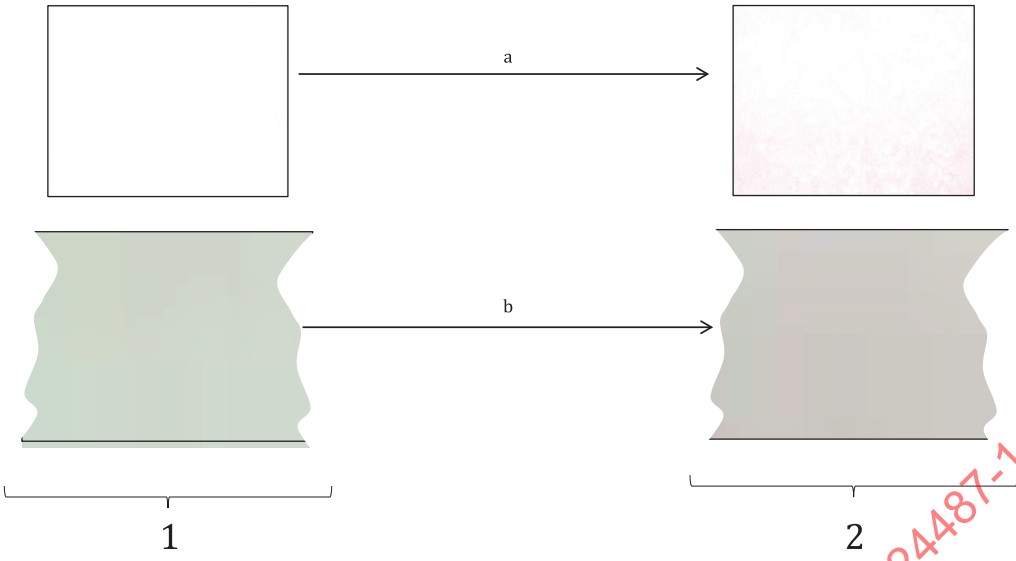
Following rubbing of the plate, a visual inspection of the plate shall be performed and any damage recorded. The plate shall be used for a print run until on-press development is complete. Following this print run, the printed black patches in the region of the plate area rubbed shall be compared with the printed black patches that have not been rubbed and any differences noted.

5.4 Resistance to toning

The evaluation of the resistance to toning by ink stain and paper dust for processless plates has two aspects. The first is the toning of non-image area within the sheet and the other is the toning outside of the sheet. When on-press development is completed and the print quality is confirmed, clean the blanket and impression cylinder before print production. In order to make toning effects easily visible, low viscosity and low tack ink should be used. The graphics region of the test image should be included in this evaluation.

Within the area of the printed sheet, both the sheet and the blanket shall be evaluated. Following the press preparation print run, a visual inspection shall be performed and any defects recorded (left of Figure 5). Following the assessment print run, prints shall be compared with prints from first run and any differences noted.

1) 3M™ Scotch-Brite™ General Purpose Scuff Sponge 7441 is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.



Key

1 press preparation print run

2 assessment print run

a Toning of non-image area within sheet.

b Toning of strips at outside of sheet.

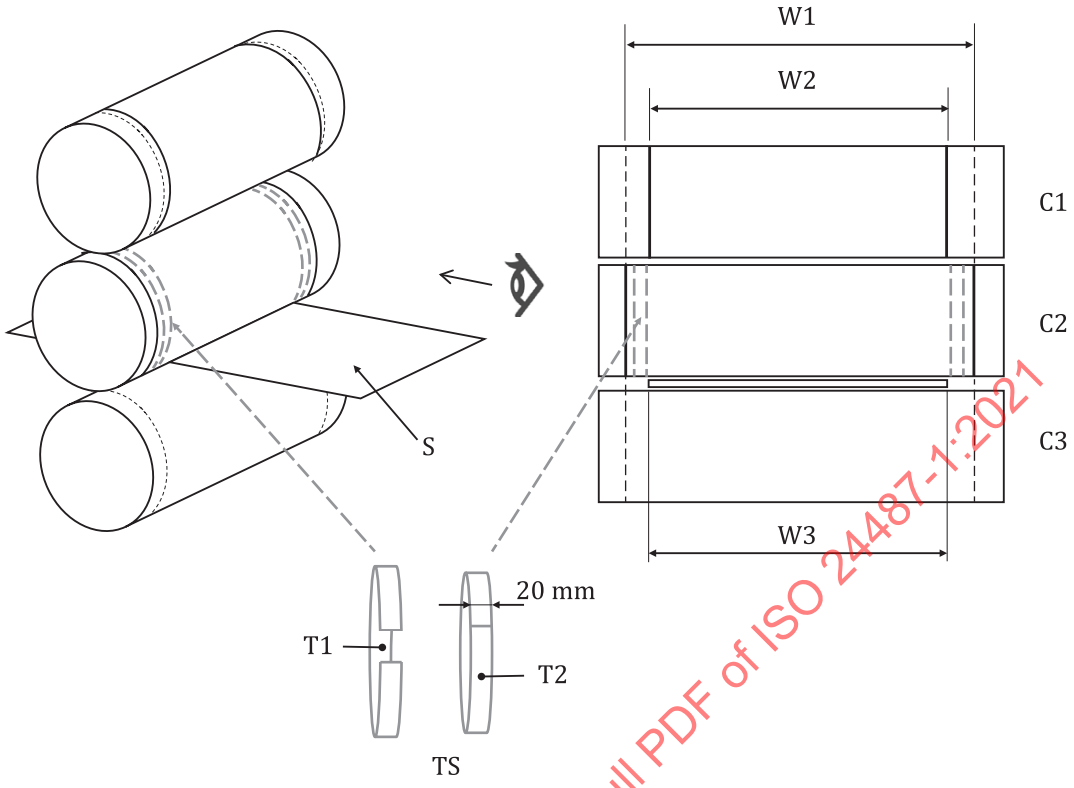
Figure 5 — Examples of defects

In the region outside the sheet, toning of the blanket and the impression cylinder shall be evaluated by visual inspection. As shown in Figure 6, pieces of paper about 20 mm wide should be placed on the area corresponding to the region outside the sheet on the blanket, printing pressure applied and the impression cylinder rotated several times. The impression cylinder is then removed and the pieces of paper collected for inspection. One side of the paper has transferred toning from the blanket and the other side has transferred toning from the impression cylinder.

Toning on these paper strips shall be assessed visually and by taking the average of 9 colour measurements distributed evenly along the strip and comparing to the substrate reference colour in the same way as for the non-image area or the solid area when the reference themselves has a stain. The paper strips should be positioned such that they include the area where the toning is generally most noticeable.

The criteria for assessment of toning on these paper strips shall be based on criteria generally used for print production or as recommended by the press manufacturer.

If the amount of dampening solution is too small, toning can increase, so it is necessary to print using an appropriate amount of dampening solution.



Key

C1 plate cylinder
C2 blanket cylinder
C3 impression cylinder
W1 blanket width
W2 plate width
W3 substrate width
S substrate
TS white strip for toning
T1 inner toning from blanket side
T2 outer toning from impression side

Figure 6 — Method for toning assessment

5.5 Chemical resistance

5.5.1 General

These tests should be used to evaluate plate cleaners and other cleaners that can come in contact with a plate, for example blanket roller cleaner and dampening water roller cleaner.

According to the standard printing procedure of each printing machine, including adjustment of the balance between water and ink and blanket cleaning, a print run shall be conducted where at least 100 sheets are printed following the point where on-press development of the plates is complete. A set of sheets shall be selected from this set of 100 sheets.

The plates shall be de-curled and the rub test or drop test described below performed.

Following the rub or drop test and inspection, the plates shall be refitted to the printing press and at least 100 further sheets should be printed. This set of sheets shall be compared with the set printed

before plate cleaning and any degradation of the print quality noted, especially in the intermediate tones. Any variation between sheets 10 to 20 and the last 10 sheets of this set of sheets shall be noted.

Details of these procedures and examples of assessment results are provided in Annex A.

5.5.2 Rub test

The plates are cleaned with a chemical cleaner and sponge. Where the cleaner, sponge and cleaning method (cleaner amount, dilution, and other details) are recommended by the plate manufacturer, these shall be used when comparative testing is performed, otherwise the cleaner may be selected by the printer.

A recommended cleaning method is to apply the cleaner to the sponge and rub back and forth on the surface of plate 10 times with sufficient force to clean the plates. The plates are left for about 1 min and the cleaner wiped off.

Following the plate cleaning, any degradation in the print quality shall be recorded and any discoloration of the plate image area should be recorded.

NOTE For some plates, discoloration can occur without affecting the printing behaviour.

Details of the cleaner, sponge and cleaning method shall be reported.

5.5.3 Drop test

One or more cleaners that are used daily in the press room and that can come into contact with the plate shall be tested using the drop test. For comparative testing, the blanket roller cleaner and the dampening water roller cleaner recommended by the press manufacturer should be used.

A dropper pipette with a drop size of around 0,1 ml shall be used to place a drop of each cleaner to be tested on a set of intermediate tones patches on the printing plate. These drops should be allowed to stand on the plate for 60 min before any remaining fluid is gently removed.

Following the drop test, any degradation in the print quality shall be recorded and any discoloration of the plate image area should be recorded.

Details of the cleaners used shall be reported. Any variation between sheets 10 to 20 and the last 10 sheets of this set of sheets shall be noted.

5.6 Plate performance for stop and restart

Only in-sheet toning is performed in this case.

The set (set A) of 30 print samples made after on-press development is complete and before the press was stopped and the set (set B) of sheets numbered 70 to 100 printed immediately following restart shall be compared.

Visual evaluation shall determine whether the intermediate tone patches are the same for both sets of print samples and whether non-image areas or graphics area of the test chart have any toning.

The colour of each patch on both sets of sheets shall be measured and the average colour for corresponding patches on set A of sheets calculated. The difference in colour ΔE_{ab} between this average and each patch of set B shall be calculated and the average and maximum value reported.

Details of this procedure are provided in Annex A.

6 Reporting requirements

User should report the test conditions and the test results as described in the relevant clause of this document.

The report should state that the tests were conducted according to ISO 24487-1 and should provide a list of the tests performed.

An example of one method of reporting is shown in Annex B.

In order to ensure effective communication of the evaluation results, these may be classified into different quality bands. Where this is done, the method of classification should be clearly specified.

An example of one method is shown in Annex C.

Annex A
(informative)

Examples of measurement method and results

A.1 Printing method

The figure below shows one method that produces the set of printed samples required for evaluation of on-press development, stop and restart, toning and chemical resistance.

In the case of chemical resistance tests, it can be more convenient to use the abrasion resistance test form rather than the CMYK Test Form shown here. This test form may be printed in a separate print run using a single ink or incorporated in the black plate image.

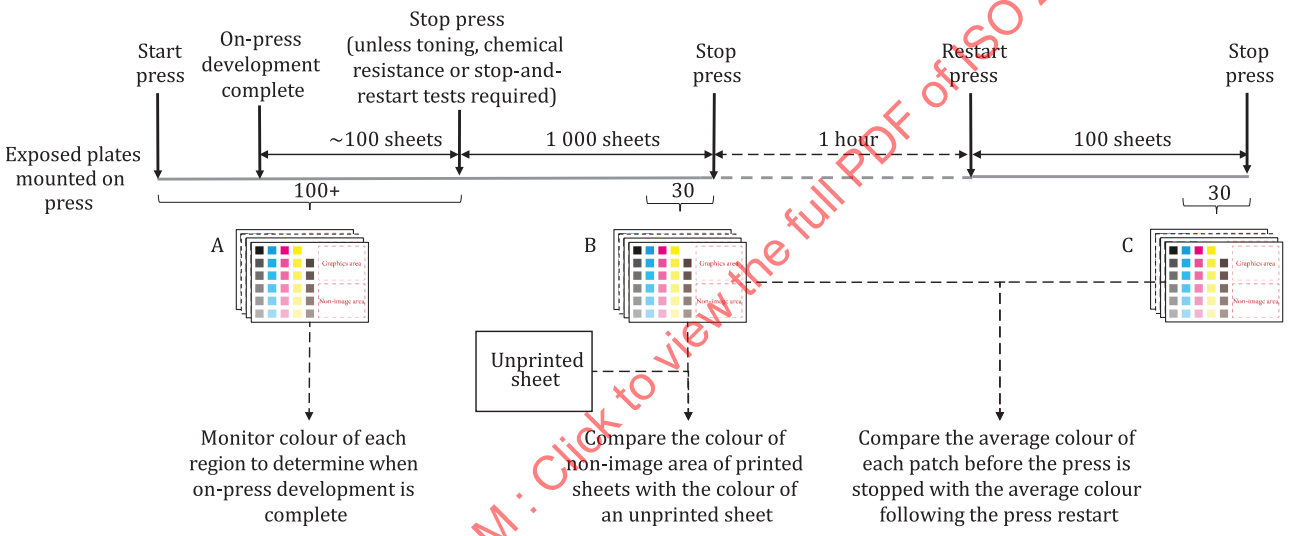


Figure A.1 — Printing of sheets

A.2 Assessment of non-image area

A.2.1 Method

A.2.1.1 Calculation of paper reference colour and reference colour difference

For a set of at least three sheets printed towards the end of the set of sheets printed during press preparation (see 4.9.1), divide the non-image area into nine roughly equal regions and measure the CIELAB colour of the centre of each region as shown in Figure A.2.

The mean value of all measurements of all these sheets is the paper reference colour and is calculated as shown in Formula (A.1):

$$Lab_{REF} = \frac{\sum Lab_{ij}}{n} \quad \text{A.1}$$

where

Lab_{REF} is the paper reference colour;

Lab_{ij} is measurement j (j = 1-9) for sheet i;

n is the total number of measurements (9 × number of sheets).

For each of these sheets, calculate its mean colour value as shown in Formula (A.2).

$$Lab_{Sn} = \frac{\sum Lab_{j}}{9} \quad \text{A.2}$$

where

Lab_{Sn} is the mean colour value for sheet n;

Lab_{j} are the nine measurements at different points of the sheet as shown in A.2.

Calculate the maximum CIEDEab colour difference between the mean colour value of each sheet and the paper reference colour. This value is used as the reference colour difference (ΔEab_{REF}). See Formula (A.3):

$$\Delta Eab_{REF} = max(CIEDEab(Lab_{REF} - Lab_{Sn})) \text{ for all n sheets.} \quad \text{A.3}$$

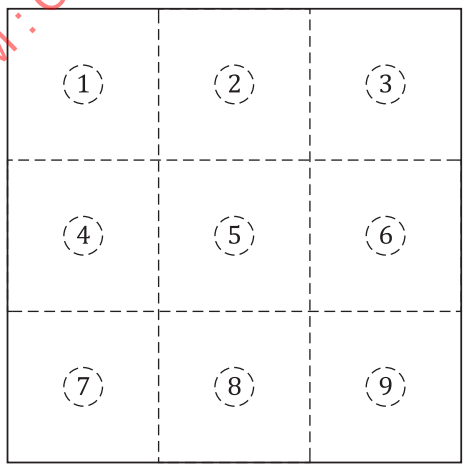


Figure A.2 — Selection of nine measurement points in the non-image area

A.2.1.2 Assessment method

For each printed sheet from set A, divide the non-image area into nine roughly equal regions and measure the CIELAB colour of the centre of each region as shown in Figure A.2. For each sheet, calculate the mean value of these nine measurements (sheet colour) as shown in Formula (A.4):

$$Lab_{An} = \frac{\sum Lab_j}{9} \quad \text{A.4}$$

where

Lab_{An} is the sheet colour of the nth sheet from set A;

Lab_j are the nine measurements at different points of the sheet as shown in subclause A.2.

Calculate the maximum colour difference between all measurements for the sheet and this mean value, as shown in Formula (A.5):

$$\Delta E\text{ab}_S = \max\left[CIEDE\text{ab}\left(Lab_{An} - Lab_j\right)\right] \quad \text{A.5}$$

where ΔEab_S is the in-sheet colour difference.

The sheet shall be declared to have no measurable toning when:

a) the colour difference between the sheet colour (Lab_{An}) and the reference colour (Lab_{REF}) does not exceed the reference colour difference (ΔEab_{REF}) by more than 0,2 CIEDEab. See Formula (A.6):

$$\Delta Eab_{XSn} = CIEDE\text{ab}(Lab_{An}, Lab_{REF}) < 0{,}2 + \Delta E\text{ab}_{REF} \quad \text{A.6}$$

and

b) the in-sheet colour difference (ΔEab_S) does not exceed the reference colour difference (ΔEab_{REF}) by more than 0,2 CIEDEab. See Formula (A.7):

$$\Delta Eab_s < 0{,}2 + \Delta Eab_{REF} \quad \text{A.7}$$

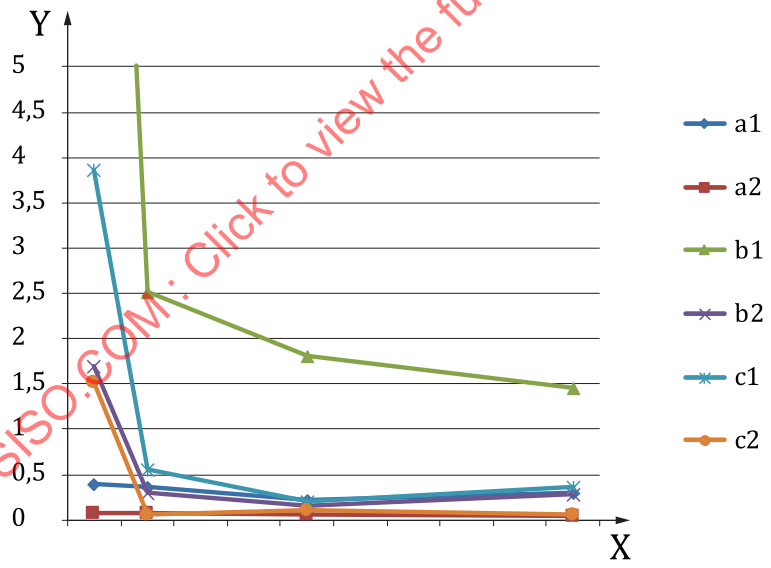
Sheets shall also be assessed to ensure that there is no visible toning and any visible toning for sheets with no measurable toning shall be noted.

A.2.2 Example results

Table A.1 and Figure A.3 show the result for measurement of three sets of sheets using three different sets of plates a, b and c. As can be seen from the table, the number of sheets required for on-press development for set a is about 10, for set b is at least 100 and for set c is about 20.

Table A.1 — Result of measurement of non-image area

Plate set	Sheet number	Reference colour difference ΔEab_{REF}	Between-sheet colour difference ΔEab_{XSn}	In-sheet colour difference ΔEab_{S}	Visual assessment
a	10	0,42	0,40	0,08	No toning
	20		0,36	0,08	No toning
	50		0,22	0,06	No toning
	100		0,30	0,05	No toning
b	10	0,42	14,42	1,70	Toning
	20		2,52	0,31	Toning
	50		1,81	0,16	Toning
	100		1,45	0,29	Toning
c	10	0,42	3,87	1,52	Toning
	20		0,56	0,06	No toning
	50		0,20	0,11	No toning
	100		0,37	0,07	No toning



Key

X sheet number
Y ΔE_{ab} colour difference
a1 plate a ΔE_{ab} colour difference between sheets
a2 plate a ΔE_{ab} in-sheet colour difference
b1 plate b ΔE_{ab} colour difference between sheets
b2 plate b ΔE_{ab} in-sheet colour difference
c1 plate c ΔE_{ab} colour difference between sheets
c2 plate c ΔE_{ab} in-sheet colour difference

Figure A.3 — Toning assessment comparison

A.3 Assessment of solid area

A.3.1 Method

A.3.1.1 Determining aim values and tolerances

Referring to ISO 12647-2, identify the closest matching reference print substrate category to the substrate to be used to test on-press development. Identify the CIELAB coordinates for solid black, cyan, magenta and yellow for this print substrate. These are the colour aim values that should be used for testing:

— the deviation tolerance is 5 ΔE_{ab} for black, and is 3,5 ΔE_{ab} for cyan, magenta and yellow;

— the variation tolerance is 4 ΔE_{ab} for black, cyan and magenta and is 5 ΔE_{ab} for yellow.

Number sheets in set A in printed order from 1 to n where 'n' shall be 100 or more and should be 200. For the highest numbered sheet measure the colours of the solid areas. These shall be recorded as the reference colours and should be within the deviation tolerance of the colour aim values.

A patch colour is deemed to be stable when the CIELAB colour on the sheet and on 10 subsequent sheets are within the variation tolerance from the reference colours.

A.3.1.2 Assessment method

Starting from the highest sheet number, measure all patches until one patch is not stable and record sheet number. From that sheet number and higher check this sheet and subsequent sheets and identify the first sheet with no toning (see subclause A.2).

Record this sheet number as the number of sheets required for on-press development of solid colour patches.

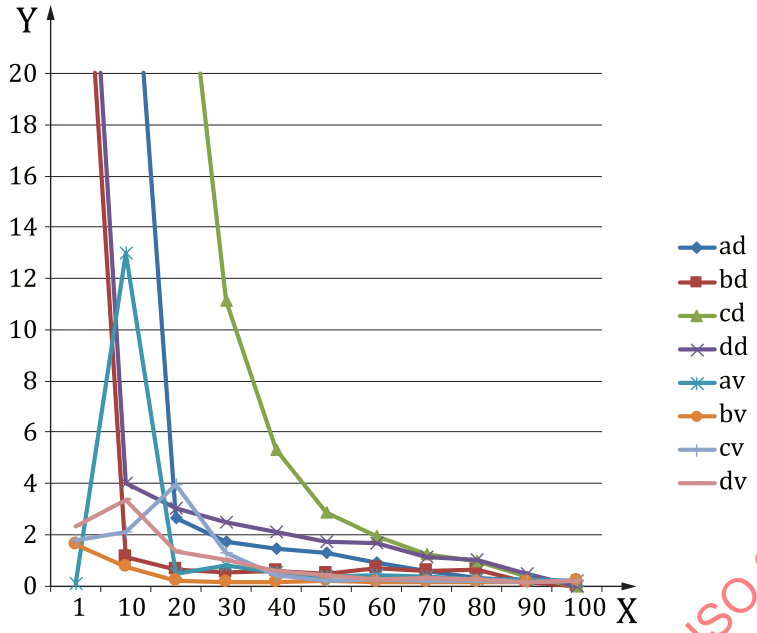
Sheets shall also be assessed visually to ensure that patches are uniform and any visible non-uniformity for sheets with stable colours shall be noted.

A.3.2 Example results

Table A.2 and Figure A.4 show an example of the assessment of the solid area. In this example, when patches become stable, almost all samples have good uniformity on solid colours, however plate c samples show significant mottling.

Table A.2 — Result of measurement of solid area

		CIE DE ab measurement for solid areas							
		Deviation				Variation			
		Plate a	Plate b	Plate c	Plate d	Plate a	Plate b	Plate c	Plate d
Sheet number	1	87,3	31,8	63,1	35,8	0,1	1,6	1,8	2,3
	10	29,5	1,1	80,0	4,0	13,0	0,7	2,1	3,3
	20	2,7	0,6	28,3	3,0	0,5	0,2	4,0	1,3
	30	1,7	0,5	11,1	2,5	0,8	0,2	1,3	1,0
	40	1,4	0,6	5,3	2,1	0,5	0,1	0,4	0,6
	50	1,3	0,5	2,9	1,7	0,4	0,2	0,2	0,4
	60	0,9	0,7	1,9	1,7	0,4	0,1	0,2	0,2
	70	0,6	0,6	1,2	1,1	0,4	0,1	0,2	0,3
	80	0,3	0,6	0,9	1,0	0,3	0,1	0,2	0,3
	90	0,2	0,1	0,4	0,4	0,2	0,2	0,2	0,2
	100	0,0	0,0	0,0	0,0	0,2	0,2	0,2	0,2
		first sheet number where visual assessment was acceptable							
		18	6	70	9	18	6	70	9



Key

X sheet number

Y ΔE_{ab}

ad colour deviation for plate a

bd colour deviation for plate b

cd colour deviation for plate c

dd colour deviation for plate d

av colour variation for plate a

bv colour variation for plate b

cv colour variation for plate c

dv colour variation for plate d

Figure A.4 — Solid area assessment comparison

A.4 Assessment of intermediate tones

A.4.1 Method

A.4.1.1 Determining aim values and tolerances

Referring to ISO 12647-2, identify the closest matching reference print substrate category to the substrate to be used to test on-press development. Identify the CIELAB coordinates for solid black, cyan, magenta and yellow for this print substrate and the tone value increase.

Where the tone value is 50 %, the deviation tolerance is 4 % and the variation tolerance is 4 % for black, cyan, magenta and yellow.

Number sheets in set A in printed order from 1 to n where ‘n’ shall be 100 or more and should be 200. For the highest numbered sheet measure the tone value of the intermediate tones. These shall be recorded as the reference tone values and should be within the deviation tolerance of the aim values.

A patch colour is deemed to be stable when the tone value on the sheet and on 10 subsequent sheets are within the variation tolerance from the reference tone value.

A.4.1.2 Assessment method

Starting from the highest sheet number, measure all patches until one patch is not stable and record sheet number. From that sheet number and higher check this sheet and subsequent sheets and identify the first sheet with no toning (see subclause A.2).

Record this sheet number as the number of sheets required for on-press development of intermediate tones.

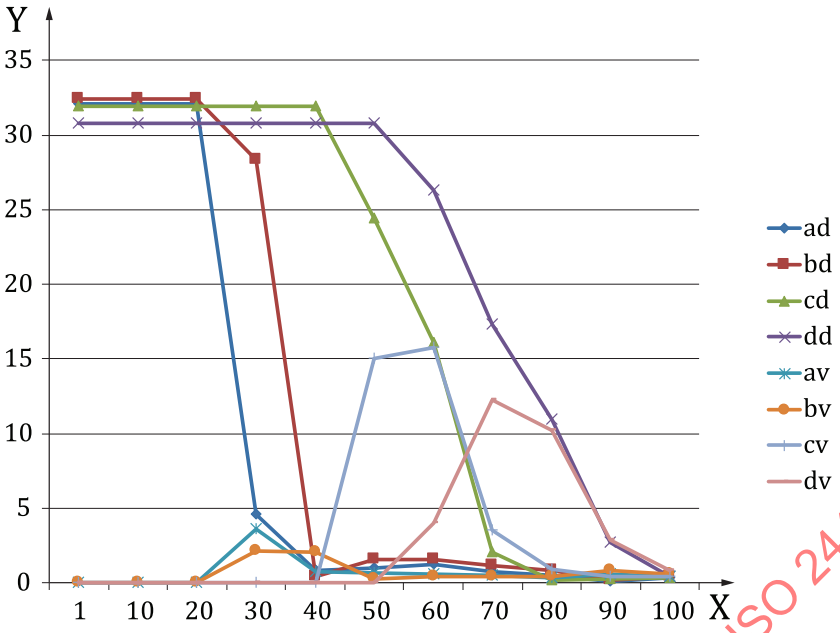
Sheets shall also be assessed visually to ensure that patches are uniform and any visible non-uniformity for sheets with stable colours shall be noted.

A.4.1.3 Example results

An example of assessment of intermediate tones is shown in Table A.3 and Figure A.5. In this example, when patches become stable, almost all samples have good uniformity on intermediate tones, however plate c samples show significant missing dots.

Table A.3 — Result of measurement of intermediate tone

		Tone value increase measurement for intermediate tones							
		Deviation				Variation			
		Plate a	Plate b	Plate c	Plate d	Plate a	Plate b	Plate c	Plate d
Sheet number	1	32,1	32,4	31,9	30,8	0,0	0,0	0,0	0,0
	10	32,1	32,4	31,9	30,8	0,0	0,0	0,0	0,0
	20	32,1	32,4	31,9	30,8	0,0	0,0	0,0	0,0
	30	4,6	28,3	31,9	30,8	3,6	2,1	0,0	0,0
	40	0,8	0,4	31,9	30,8	0,7	2,1	0,0	0,0
	50	1,0	1,6	24,4	30,8	0,6	0,3	15,0	0,0
	60	1,2	1,6	16,1	26,3	0,6	0,4	15,8	4,0
	70	0,7	1,2	2,1	17,3	0,5	0,4	3,5	12,3
	80	0,5	0,8	0,2	10,9	0,3	0,4	0,9	10,2
	90	0,1	0,2	0,3	2,7	0,6	0,9	0,4	2,9
	100	0,4	0,5	0,3	0,4	0,4	0,6	0,4	0,8
	150	0,0	0,0	0,0	0,0	0,7	0,9	0,3	0,2
		first sheet number where visual assessment was acceptable							
		35	45	100	90	35	45	100	90



Key

X sheet number
Y tone value increase
ad tone value increase deviation for plate a
bd tone value increase deviation for plate b
cd tone value increase deviation for plate c
dd tone value increase deviation for plate d
av tone value increase variation for plate a
bv tone value increase variation for plate b
cv tone value increase variation for plate c
dv tone value increase variation for plate d

Figure A.5 — Intermediate tones assessment comparison

A.5 Assessment of plate performance for stop and restart

This assessment uses the sheets in sets B and C shown in Figure A.1.

For the non-image area, measure its colour (CIELAB) and for each 10 % patch, measure its tone value on all sheets in set B and calculate the mean colour for all sheets in this set (mean B).

For the non-image area, measure its colour (CIELAB) and for each 10 % patch, measure its tone value on all sheets in set C and calculate its mean colour for all sheets in this set (mean C).

For the non-image area and each 10 % patch, calculate the colour difference (CIEDEab) and tone value between mean B and mean C.

The mean and maximum of this set of colour differences and tone value shall be reported as a measure of the stop-and-restart performance of the plates.