Wide Format System Certification Program

V12.1

Program Overview

1.1 Abstract

This document describes the procedure and tolerances for the PRINTING United Alliance Wide Format Inkjet Printer Certificate program. This program is for wide to grand format inkjet printers in roll-fed and flatbed formats. Certification can be used for manufacturers to verify printing, production, and application qualities of a given system for a specific printing, ink and media combination.

Wide and grand format inkjet printers are used in a wide variety of applications including point-of-purchase, display, vehicle wrap, and many more. There is no existing standard to specify the standard printing quality of a wide format inkjet printer. As a widely accepted specification, GRACoL is mostly focused on publication printing. Wide format inkjet printing commonly targets to different color gamut than publication printing. The draft standard, ISO/DIS 15339-2:2013-09 Graphic technology - Printing from digital data across multiple technologies - Part 2: Characterized reference printing conditions, defines multiple printing conditions and color gamut for different printing conditions. Wide format inkjet printing uses wide variety of print media and targets to wide variety of applications. The choice of color gamut is strongly related to the combination of ink and media and viewing distance. For this certification program, there is no predefined color gamut. The Submitter may choice the reference data set listed in ISO/DIS 15339-2:2003-09 and the media which fit their application the best.

The Wide Format Inkjet Certificate program consists of testing and certification in print quality, production efficiency, and application quality. In the certificate process, a series of

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test forms are provided. Suppliers print the form according to specified criteria. The printed forms are send to the PRINTING United Alliance designated Evaluation Contractor where the printed forms will be measured and compared against predetermined tolerances. The Evaluation Contractor will also verify the production efficiency information. A system is defined as the combination of wide format inkjet printer at certain configurations and printed on certain media choice. Systems that pass all the tests are awarded certification with the indication of the reference data set met. One certification is awarded to one system. Names of certified systems are published and displayed on the PRINTING United Alliance website. Suppliers are able to display the certification logo on their product collateral.

1.2 What is a Wide Format Inkjet Printer?

For the purpose of this certification, wide format inkjet printer refers to the inkjet printers with the width of over 24 inches, roll-fed and/or flat bed printers using UV, aqueous, latex, solvent based inks for display, point-of-purchase, wrapping, and archiving applications.

1.3 Overview of the Certification Process

The main steps of the certification process are summarized below.

- The submission process begins with an Application Form that is completed online and submitted to PRINTING United Alliance, along with the certification fee. The fee is payable irrespective of the outcome of the testing.
- The online form is copied internally to the Evaluation Contractor for the new submission.
- The Submitter must also provide information to create an Application Data Sheet (ADS). ADS provide system details such as DFE, print engine, substrate, and printing settings, etc. The information provided in ADS must be sufficient for a skilled operator to replicate the press output. ADS will be reviewed by the Evaluation Contractor.
- Submitters must ensure that they have appropriate licenses for using any ISO SCID (12640) CMYK images that constitute the test forms.
- The Submitter is to download and print the supplied test forms. Generally, the files are provided as PDF/X-1a or PDF/X-3 files of print size 12” × 18”. The Submitter is also required to submit a blank, unprinted substrate sample of the same stock as used to produce the printed samples.
- Colorimetric targets are based on measurement data generated per ISO 12647 from the following targets – IT8.7/4 and Idealliance ISO 12647-7 3-Row Control Wedge 2013. All colorimetric measurements are done using an X-Rite i1iO with i1Pro2 spectrophotometer.
- The reference printing condition target CIELAB values are specified and take the form of an established and published reference condition. The current Wide Format Inkjet Certificate Program does not use a single characterization data. The Submitter may choose the reference data set which fits their application the best.

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- The submitter is to print the specified test forms and ship to the Evaluation Contractor.
- A visual examination of press sheets will be undertaken to ensure that the press sheets have not been damaged during shipping. Formal visual examination is also part of the certification process. This may include but not be limited to physical abrasions, image artifacts, such as moiré or banding, etc.
- A number of test procedures and colorimetric measurements will be conducted using specified instruments and measurement geometry.
- ***A system must pass every required test in order to achieve certification***. In other words, failure in a single test represents a failure to achieve certification.
- The printed samples will be retained by PRINTING United Alliance and will not be returned.
- The Evaluation Contractor will provide a report to the Submitter by email. The report must include a description of each test, the results of each test, and conclusion of pass or failure of each test.
- Submitters who have achieved successful certification will be provided with the certification logo and intellectual property rights for using the logo and text on their websites and in marketing materials.
- PRINTING United Alliance will maintain a list of Wide Format Inkjet Certified Systems on the official website and will update the site with details of newly certified systems within seven days of successful certification.

2. Conditions

This part describes the test conditions that will be set-up for the certification program. The conditions include file format, substrates choices, reference data set, related standards, and measuring conditions

2.1 Test files

Test files will be provided as PDF/X-1a or PDF/X-3 or PDF/X-4. No output intent ICC profile is described in the PDF files. No output intent is specified.

The Submitter can use a customized profile for output in the specified test items.

2.2 Media

In wide format inkjet printing, the interaction between media and inks play a very important role in color reproduction and many application qualities such as cracking, lightfastness, etc.

In the certificate program, the Submitter is able to submit print samples printed with the media of their choice. The media must be specified in the Application Data Sheet (ADS) at submission.

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Only one media type is to be used for one system for all the tests. The media used for the certification program should be commercially available in North America. The media should be representative of the media being used for typical production environments and common products.

There is no specific white point for the substrate or media provided for the certification program.

2.3 Reference data set for color reproduction

The draft standard, ISO/DIS 15339-2:2013-09 Graphic technology - Printing from digital data across multiple technologies - Part 2: Characterized reference printing conditions, characterizes reference printing conditions is used for the certificate program. The Submitter may choose the reference data set listed in the standard as the active reference data set for the submission. Only one reference data set is chosen for one submission..

All colorimetric testing is conducted with reference to the chosen data set.

2.4 Related ISO and ASTM standards

This program will follow the general scope of the following standards.

ISO/DIS 15339-1.2
Graphic technology -- Printing from digital data across multiple technologies – Part 1: Principles

Draft Standard ISO/DIS 15339-2:2013-09
Graphic technology - Printing from digital data across multiple technologies – Part 2: Characterized reference printing conditions

ISO 12647-7:2007
Graphic technology – Process control for the production of halftone color separations, proof and production prints – Part 7: Proofing processes working directly from digital data

ISO/DTS 15311-1
Graphic Technology – Requirements for printed matter for the commercial and industrial production -- Part 1: Parameters and measurement measures

ASTM D3424
Standard Practice for Evaluating the Relative Lightfastness and Weatherability of Printed Matter (covers indoor fading and outdoor fading)

2.5 Measurement configuration

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Colorimetric values are based on measurement data generated using measurement condition M1 (UV included) of ISO 13655. The X-Rite i1iO is used for system certification. Measurement data will be acquired using iProfiler.

2.6 Use of Delta E (2000)

The measurements in the certification program are based on Delta E (2000), abbreviated as ΔE^*_{00}. This is a "weighted" Delta E equation that provides better correlation between measured and perceived color differences.

The certificate program is based exclusively on ΔE^*_{00} unless otherwise stated.

3. Description of tests

The printed test forms will be evaluated colorimetrically using a traceable spectrophotometer. The measurements will be compared to the chosen reference data set. Submitters are responsible for choosing their own workflow, calibration, quality control methods, and ICC profiles.

The Submitter is not allowed to change any of the system components (no change of printer model, RIP, chosen media and ink set), but the Submitter can alter the local printer settings/print mode for each of the following tests.

The print head resolution (dpi) may be determined by the Submitter based on their common applications. This resolution should be kept the same for all the tests.

The supplier can use any ink set of their choosing – CMYK, light inks, expanded gamut inks (e.g. orange, green). A system cannot be modified or customized, it must be a normal, commercially shipping configuration readily available to North American customers.

A system must pass every required test in order to achieve certification. The tests and reports will be categorized as three different groups, print quality, application quality, and production capability.

3.1 Application Date Sheet (ADS) review and approval

Each ADS will be reviewed by the Evaluation Contractor. The ADS should include well-defined operating procedures and workflow settings as listed below.

1. Manufacturer.
2. System or model
3. Print engine or RIP used for producing the samples for the submission
4. Media and ink set used for producing the samples for the submission
5. Profile(s) used for color management

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6. Print configurations for producing the samples for the submission, such as ink savings, curve compensation, etc. that can impact printing results when set up differently
7. Additional information

Any discrepancies or omissions will be reviewed with the Submitter. Generally, the level of detail in the ADS should enable a skilled user to replicate the results produced by the supplier.

3.2 Print quality

In this category, the tests include color accuracy, color gamut, uniformity across the width of the printer, day-to-day repeatability, and registration.

It is the Submitter's responsibility to choose the appropriate print configuration, media, and reference data set to represent the common product the submitted system targeted.

3.2.1 Color accuracy

This test is to evaluate the accuracy of the supplier's color management system. Color management accuracy refers to the ability to achieve the expected color on printed samples.

Test forms 1A and 1B (Figure 1, 2) which contain IT8.7/4 target are used for this. For this test, the Submitter is required to print the IT8.7/4 target such that when measured, matches the chosen reference data. The Submitter may choose to use ink limiting and linearization and/or ink channel splitting. The supplier may choose to create a custom ICC profile for this test or may use a generic media profile. The print mode and settings such as rendering intent are not stipulated and are left to the supplier to determine.

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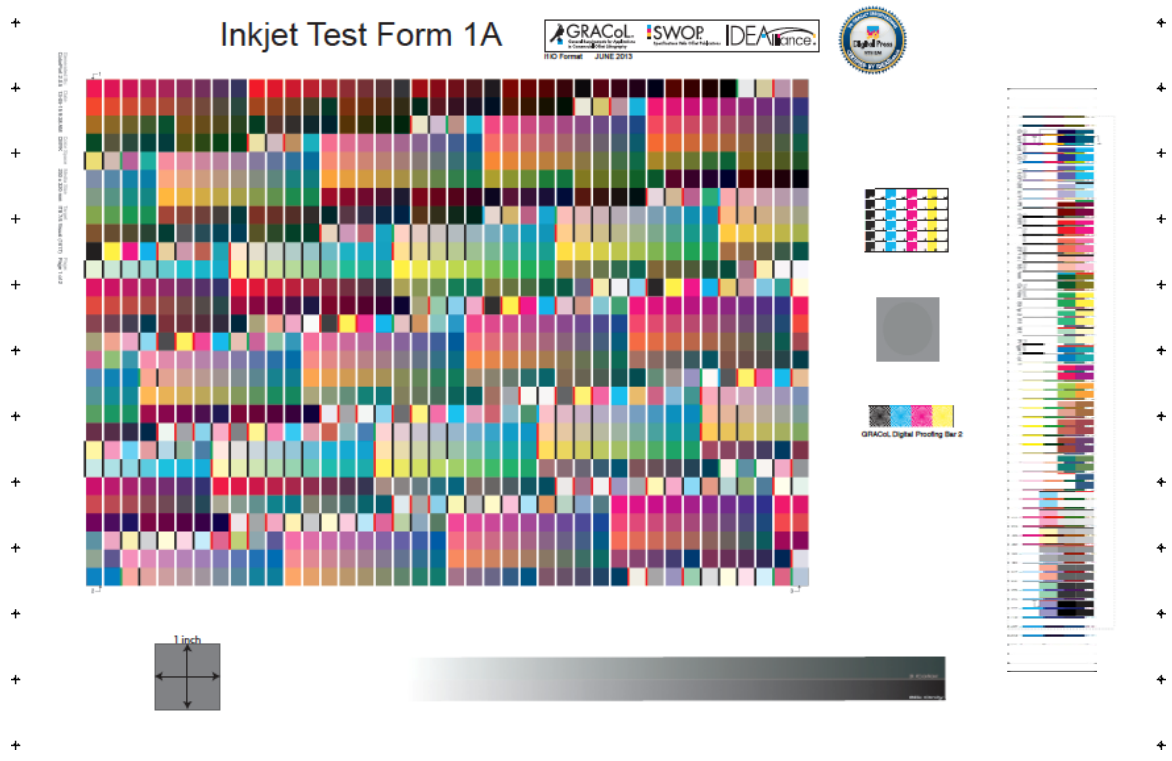


Figure 1: Test Form 1A for color accuracy and color gamut test for rigid media.

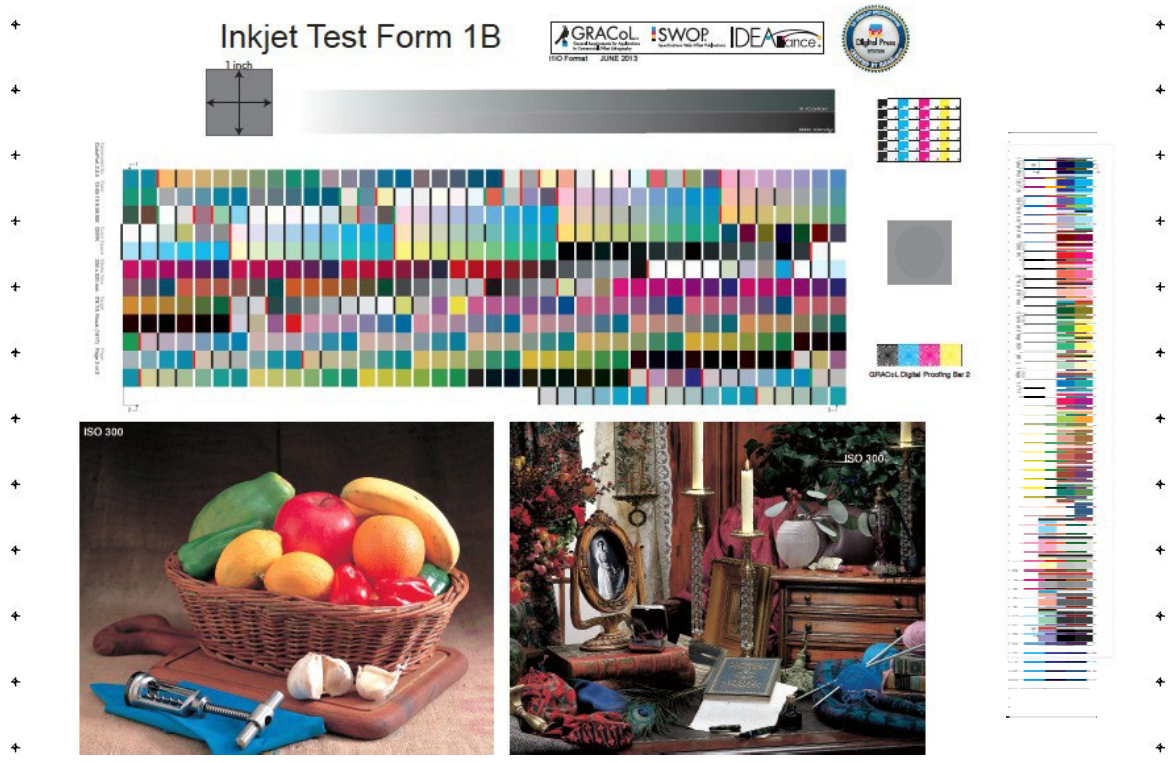


Figure 2: Test Form 1B for color accuracy and color gamut test for rigid media.

The IT8.7/4 targets will be measured with i1iO i1Pro2.

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Color difference is reported in term of ΔE^*_{00}. The report of color accuracy in ΔE^*_{00} will include (i) Overall Average and (ii) 90th percentile. The 90th percentile makes allowances for paper white differences and some out of gamut colors.

The numerical criteria described in Table 1 must be met in order for a system to be deemed to have passed certification and to be labeled as "Certified."

Evaluation of printing of the IT8.7/4	Tolerance
All patches of the IT8.7/4 target	Average $\Delta E^*_{00} \leq$ than 3
90th percentile	90th percentile $\Delta E_{00} \leq$ than 3

Table 1: Tolerance for color accuracy test.

3.2.2 Color gamut

This test is to examine the widest possible color gamut of a system could possibly produce.

It is done by printing the IT8.7/4 target (Figure 1 and 2, or 3) without applying any ICC profile. The Submitter may choose to use ink limiting and linearization and/or ink channel splitting.

The patches on the IT8.7/4 target without profile will be measured. An ICC profile will be generated. A 3-D CIELAB color gamut will be plotted in Chromix ColorThink to compare the supplied device profile with the CRPC 7 data set (Universal Extra Large Color Gamut defined in ISO/DIS 15339-2:2013-09.

The visualization will be included in the report. This is an ***informative*** test. There is no pass or fail criteria for this test.

3.2.3 Uniformity across the width of the printer

This test is to evaluate the uniformity of the printer across the width of the printer.

Idealliance ISO 12647-7, 3-Row Digital Control Wedge 2013 is required to be printed at nine positions. The Control Wedge is to be placed by the operator at the left-center-right of the printing area. This arrangement is repeated to create three rows. The Control Wedge should be aligned vertically, i.e., parallel to the direction that the sheet moves. The targets at the edge of the sheet should be no more than 1" from the edge. The corner targets should reach the edge of the printable area.

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ΔE^*_{00} between the first target and all remaining eight targets will be calculated for all 84 patches. The highest ΔE^*_{0} value among the 84 patches will be reported. This test is relevant to printing tiles/panels that must be abutted on assembly.

Test Form 5 (Figure 3) is used for this test.

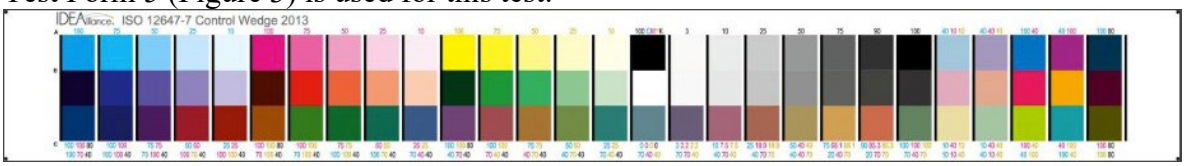


Figure 3: Test Form 5, Idealliance ISO 12647-7, 3-Row Digital Control Wedge 2013, for uniformity test.

The test form will be printed at nine locations as shown in the following figure (Figure 4).

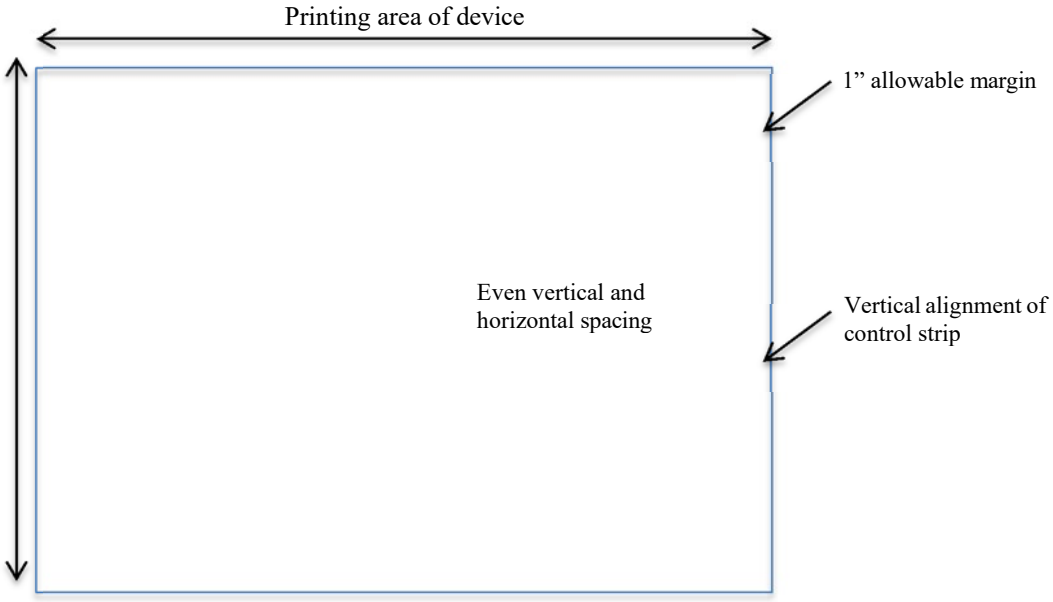


Figure 4: Nine locations of Control Wedge for uniformity test.

The tolerance for uniformity test is listed in Table 2.

Evaluation of printing of the Control Strip	Tolerance
All patches	The highest ΔE^*_{00} value among the 84 patches (first Control Wedge is compared to other 8 Control Wedges) ≤3

Table 2: Tolerance for uniformity test.

3.2.4 Day-to-day repeatability

This test evaluates the consistency of print quality over time.

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The repeatability of the printing system will be evaluated by the Idealliance ISO 12647-7, 3-Row Control Wedge (Figure 4) with ΔE^*_{00}.

Test Form 4 (Figure 5) is printed at different time intervals to examine the consistency of printing over a short and medium time period.



Figure 5: Test Form 4 for repeatability test.

The Submitter is required to provide print samples corresponding to three press runs, at time = 0, time = 0 + 1 hour, time = 0 + 24 hours. The date/time stamp should be in the slug line imprinted via the RIP or as indicated on a cover page as appropriate.

The ΔE^*_{00} values between all patches over all three instances will be calculated. The maximum ΔE^*_{00} of all patches will be reported.

The tolerance is listed in Table 3.

Evaluation of printing of the Control Strip	Tolerance
All patches	The highest ΔE^*_{00} value among the 84 patches (first Control Wedge is compared to other 2 Control Wedges) ≤ 3

Table 3: Tolerance for repeatability test.

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3.2.5 Registration

This test is to evaluate the registration capability of a system. Test Form 2 (Figure 6) is used for this test. Separate registration marks for black to cyan, black to magenta, and black to yellow registration are included in this test form..

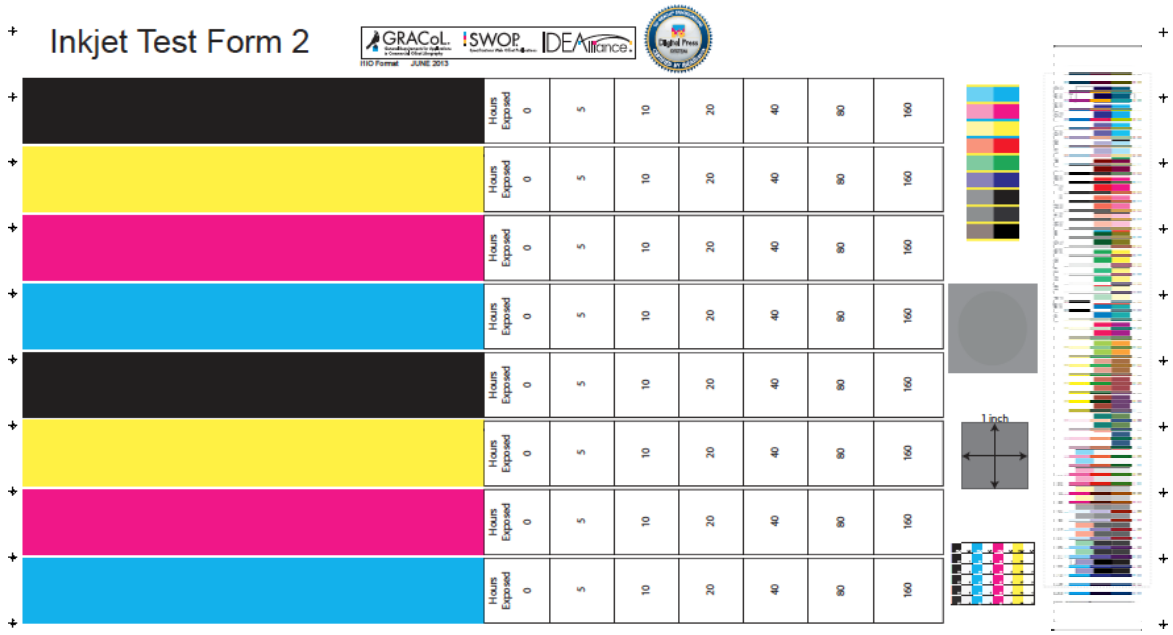


Figure 6: Test Form 2 for registration test.

The registration marks will be examined using a calibrated microscope. The registration mark should not offset more than 0.1 mm from one color to another. The offset includes clearly off of registration to the other colors and significant satellite drops around the registration mark.

The tolerances are list in Table 4.

Evaluation of registration	Tolerances
Cross hairlines	The distance between the edges of two hairlines (complete solid with no satellite drops) from one color to another is ≤ 0.1mm. The distance between edges of the hairline of one color (complete solid with no satellite drops) to the border of 90% of satellite drops of the same color is ≤ 0.1mm.

Table 4: Tolerances for registration test.

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3.3 Application quality

The application quality is related to the product and installation requirements. Due to the complexity of the substrates and ink systems are used in wide and grand format inkjet printing, there is no universal test could be applicable to all media and ink combinations.

Almost all wide and grand format inkjet printings are used for some forms of indoor or outdoor display. For the certification program, only lightfastness is required for this group of test.

The application qualities are strongly related to the interaction between ink and media. The Submitter will submit the samples printed on the media of their choice.

The test form for this group of test contains solid color patches with the dimension of 2 by 4 inches for each patch. Only standard color set of colors is tested. Test Form 2 (Figure 6) is used for this group of testing. It is important that each color patch is "clean", i.e. each patch should not be color managed and should contain only C or M or Y or K ink respectively.

3.3.1 Lightfastness

This test is to evaluate the permanency of the color printed under certain lighting and weather conditions. Test Form 2 (Figure 6) is used for this test.

Weathering will be evaluated in two categories: indoor and outdoor. Only one category will be included in the certificate. This test will follow the following standard: ASTM D3424 Standard Practice for Evaluating the Relative Lightfastness and Weatherability of Printed Matter (covers indoor fading and outdoor fading).

The samples will be prepared and sent to an external facility by the Evaluation Contractor for the weathering test. On receiving the samples back from the external facility, the exposed samples will be measured for ΔE^*_{00} by the Evaluation Contractor. The tolerance is listed in Table 5.

Evaluation of Lightfastness	Tolerance
Solid blocks	ΔE^*_{00} is ≤ 5 before and after exposure.

Table 5: Tolerance for weathering test.

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3.4 Production Parameters

Printing speed and ink consumption are very important parameters for evaluating the overall system and in making purchase decisions. These factors are set as self-reported following predefined instructions. The pass or fail of this group of parameters is determined by whether or not the parameters are reported accurately. In these tests we do not seek to require that your device, for example, must operate at a minimum print speed of 300 sqft/hr, rather we merely seek to confirm that if you claim a print speed of 100, 200 or 300 sqft/hr in your spec sheet, that this is an accurate claim.

3.4.1 Printing speed

For printing speed report, Test Form 6 (Figure 7) is used for reporting this parameter.

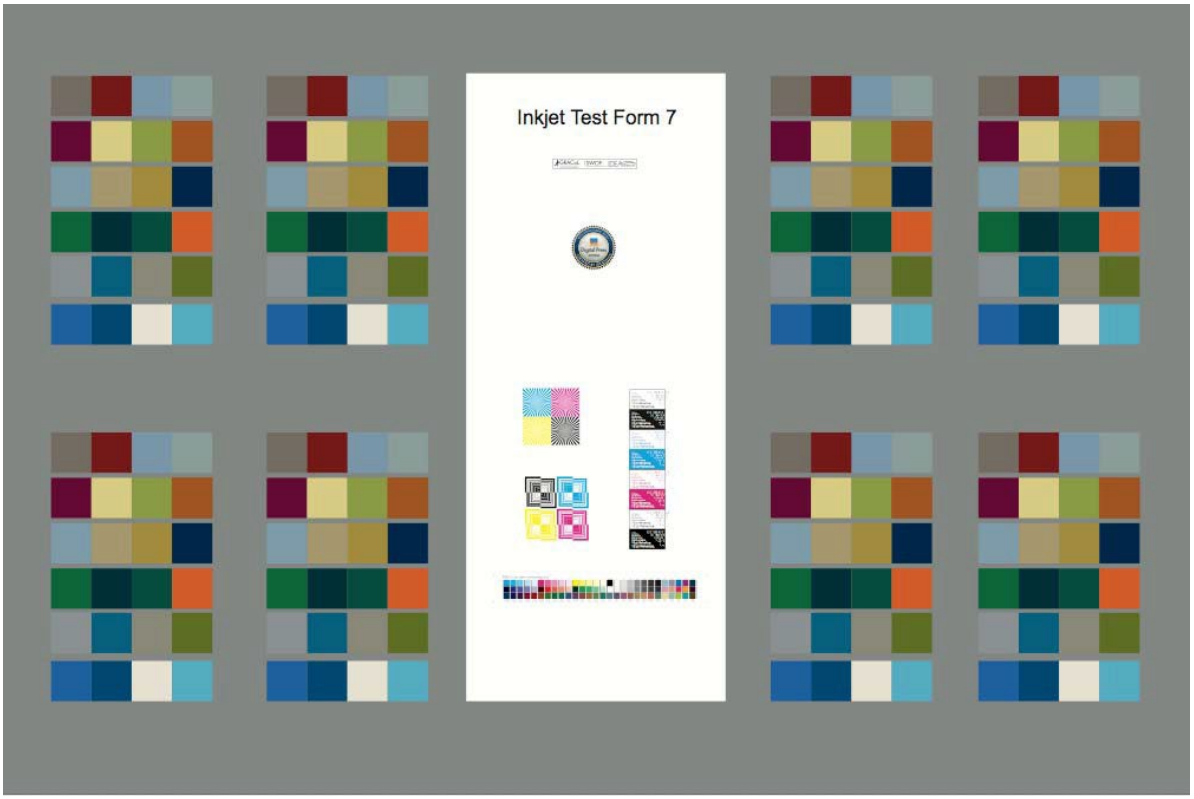


Figure 7: Test form for reporting print speed

In this test, there is no specific level of printing speed set as a standard. For example, there is no requirement for a system to print at a specific speed (m^2/hr, or ft^2/hr). What is required to pass this test is the accuracy of the print speed published in the technical specifications for the system.

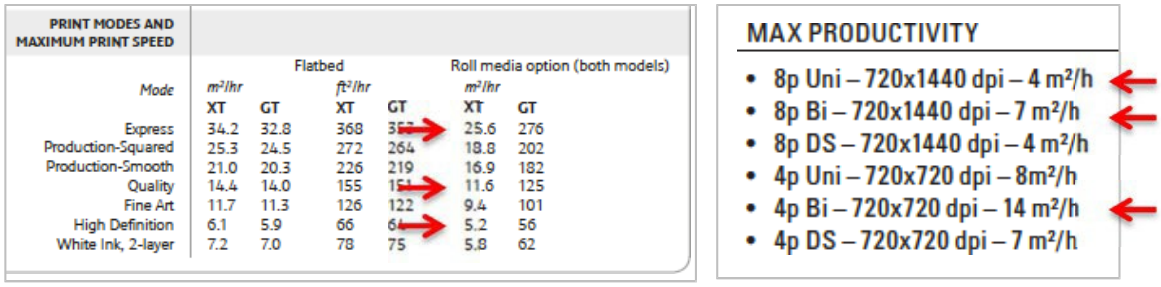
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The Submitter will be asked to print a job with known image content and pixel content. The test form (Figure 7) is provided with the dimension of 1.5m x 1m. The form is intended to be printed landscape, though it can be printed portrait. The Submitter may seek to duplicate the form to fill the printing platen or scale the form to fit the print width.

The Submitter should print the image and note the time for printing. Different systems may have different definitions of printing speed. The print speed may include the movement of the gantry or print head, or the print speed may be measured for the duration of the actual print time of the first and last printed pixel. The Submitter should provide physical evidence of the printing speed which is evaluated by the same method as the speed listed in the specification sheet. The print speed could be reported in the following two ways:

1) Reporting via RIP report, or user interface dialog window, i.e., capture of the start and finish job log.
2) A video or other recording made of the complete process and uploaded to YouTube (Figure 9).

The actual print time is compared to supplier published specifications. The Submitter should submit an appropriate technical specification sheet as shown below (Figure 8). The printing parameters should be appropriately selected so that the printing test matches an identified maximum print speed as listed in the technical specifications.



PRINT MODES AND MAXIMUM PRINT SPEED

Mode	Flatbed m^2/hr XT	Flatbed m^2/hr GT	Flatbed ft^2/hr XT	Flatbed ft^2/hr GT	Roll media option (both models) m^2/hr XT	Roll media option (both models) m^2/hr GT
Express	34.2	32.8	368	353	25.6	276
Production-Squared	25.3	24.5	272	264	18.8	202
Production-Smooth	21.0	20.3	226	219	16.9	182
Quality	14.4	14.0	155	151	11.6	125
Fine Art	11.7	11.3	126	122	9.4	101
High Definition	6.1	5.9	66	64	5.2	56
White Ink, 2-layer	7.2	7.0	78	75	5.8	62

MAX PRODUCTIVITY

- 8p Uni – 720x1440 dpi – 4 m²/h
- 8p Bi – 720x1440 dpi – 7 m²/h
- 8p DS – 720x1440 dpi – 4 m²/h
- 4p Uni – 720x720 dpi – 8m²/h
- 4p Bi – 720x720 dpi – 14 m²/h
- 4p DS – 720x720 dpi – 7 m²/h

Figure 8: The test must be performed to prove that the actual speed matches the published speed.

Only one printing speed mode (with specific ink and media combination) needs to be submitted for certification. The images should be printed on the same media that is used for all other tests.

The actual print speed will be compared to the specified print speed. Systems that are within ±5% of the specified value pass this test.

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The form should be printed/processed in the same configuration as for Color Accuracy test which means the CMYK should be printed accurately to match the CIE L*, a*, and b* values required by the chosen reference data set.

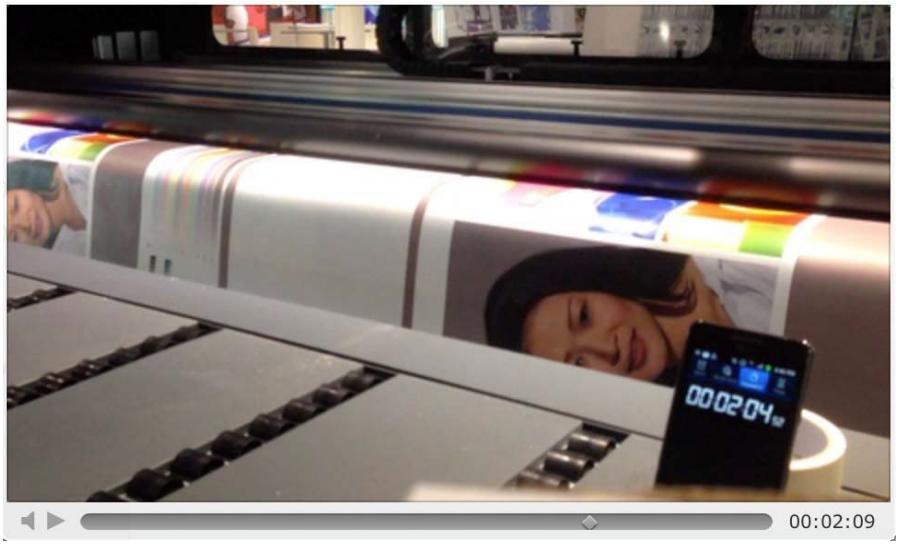


Figure 9: The Submitter should provide video or other physical evidence that clearly shows the elapsed print time for the provided test image.

3.4.2 Ink consumption

For ink consumption report, Test Form 6 (Figure 7) will be used.

In this test, the specific level of ink consumption is not evaluated. For example, there is no requirement for a system to use 50, 60 or 70 ml to print the provided test form. What is required to pass this test is accurate reporting of the ink consumption.

Only one media which is the same as for all other tests is needed for this test.

The Submitters are required to process/print the test form and then provide a screen snapshot of the RIP and/or GUI that indicates the amount of ink consumed during printing with the chosen ink set. The Submitters should print the test form (Figure 10) and supply a screen snapshot of the RIP and/or GUI showing ink consumption. The Submitter should also provide evidence to prove the actual ink consumption by weighting the ink cartridges, press sheets or show other direct, empirical measurement methods.

The ink volume shown in the RIP and/or GUI should be accurate to within ± 10% of the ink used in practice.

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Inks can sometimes have different price points (black ink can be less expensive), and the system may have different levels of GCR/UCR, so individual (C-M-Y-K) channels should be specified as shown below (Figure 10) when reporting ink consumption.

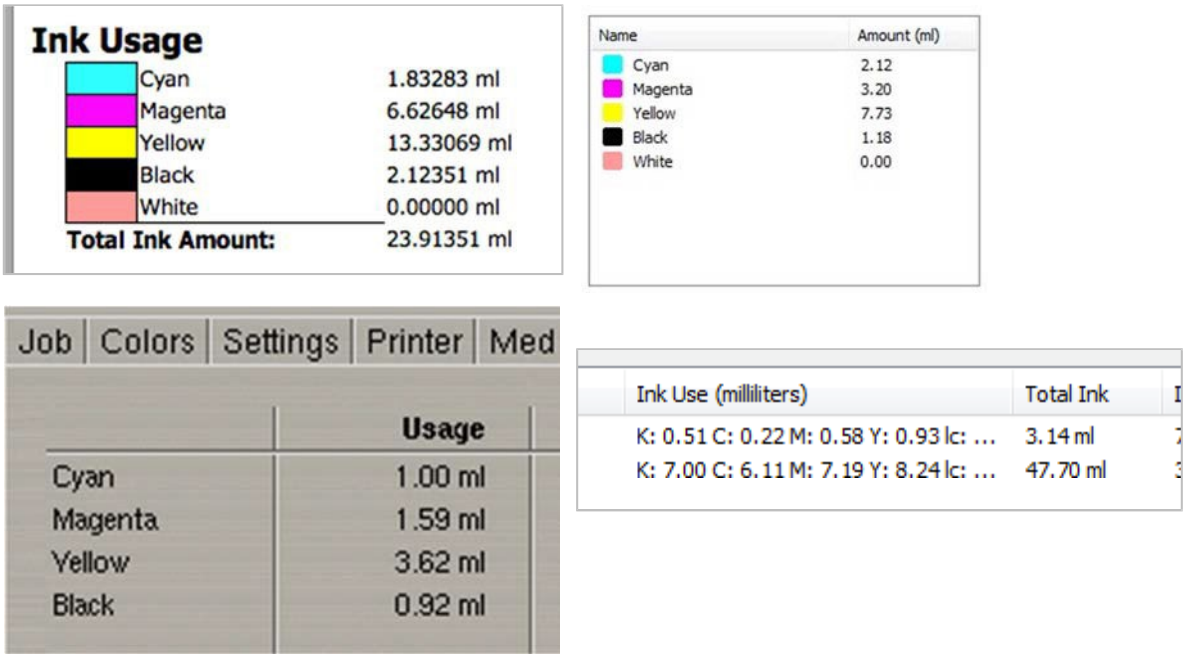


Figure 10: Submitters are required to provide a screen snapshot for the GUI of their chosen RIP.

NOTES:

1) PRINTING United Alliance may conduct empirical measurements to confirm that the software reporting is accurate to within the specified tolerance. Submitters are obliged to make available a suitable device at their location or a customer site and cover the cost of any materials used in the verification.

2) MSDS sheets may be used to convert weight (grams) to volume (ml) based on the specific gravity of the liquid ink.

3) Software reporting refers to the RIP or GUI and not to the user interface/printer dialog/controller on the print engine.

4) The RIP or GUI dialog must be from the product (and version) of the software for which this certification is being sought.

5) If software RIP or GUI is unable to provide this reporting, then the system cannot be certified.

6) Maintenance procedures are not included in this test. “Keep wet spitting,” nozzle purging, cleaning cycles, etc. are not included in this reporting unless they occur as a normal part of the printing process.

7) Test form (Figure 7) is provided at print size of 2m x 1m. The orientation of the print can be portrait or landscape depending on the printer system. The form should be

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printed/processed such that the CMYK solid patches are printed accurately to match the CIE L*, a*, and b* values required by the chosen reference data set.
8) It is understood that some systems may use grayscale printing (variable dot size printing), while other systems may use light and normal inks, e.g., light cyan, cyan.

Certification program checklist

Test Items	Test Form	Pass or Fail Criteria
Color Accuracy	IT8.7/4	Reference data set – CRPC#7 Overall ΔE^*_{00} is ≤ 3 90^{th} $\Delta E^*_{00} \leq 3$
Color Gamut	IT8.7/4	***Informative***, no pass or fail Color gamut plot against CRPC#7 color gamut
Uniformity	Idealliance 3-Row Control Strip	Maximum ΔE^*_{00} is ≤ 3
Repeatability	Idealliance 3-Row Control Strip	Maximum ΔE^*_{00} is ≤ 3
Registration	Registration marks	The distance between the edges of two hairlines (complete solid with no satellite drops) from one color to another is $\leq$ 0.1mm. The distance between edges of the hairline of one color (complete solid with no satellite drops) to the border of 90% of satellite drops of the same color is $\leq$ 0.1mm.
Lightfastness	Solid patches	ΔE^*_{00} is ≤ 5 before and after exposure.

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Printing speed	Provided test form with specific images	Recorded printing speed is within ±5% of the printing speed specified in system specification sheet.
Ink consumption	Provided test form with specific images	Recorded ink consumption is within ±10% of the ink consumption reported by RIP or UI.

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