



Standard Practice for Determining the Quality of the Text, Line- and Solid-Fill Output Produced by Ink Jet Printers¹

This standard is issued under the fixed designation F1944; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes a procedure that can be used to determine the image quality of text, line- and solid-fill images produced by ink jet printers.

1.2 This practice can be used to evaluate black, process-black and primary ink, single-color images produced by ink jet printers.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[F909 Terminology Relating to Printers](#)

[F1125 Terminology of Image Quality in Impact Printing Systems](#)

[F1174 Practice for Using a Personal Computer Printer as a Test Instrument](#)

[F1623 Terminology Relating to Thermal Imaging Products](#)

[F1942 Practice for Creating Test Targets for Determining the Ink Yield of the Imaging Supplies Used in Ink Jet Printers](#)

[F1857 Terminology Relating to Ink Jet Printers and Images Made Therefrom](#)

3. Terminology

3.1 *Definitions:*

¹ This practice is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.07 on Ink Jet Imaging Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.1 See Terminology [F1125](#) for terms of image quality in impact printing systems.

3.1.2 See Terminology [F909](#) for terms relating to printers.

3.1.3 See Terminology [F1623](#) for terms relating to thermal imaging products.

3.1.4 See Terminology [F1857](#) for terms relating to ink jet printers and images made therefrom.

4. Significance and Use

4.1 This practice may be used to determine the image quality of text, line- and solid-fill images produced by ink jet printers.

4.2 This practice may be used to evaluate the image quality of black, process-black and primary ink, single-color images produced by ink jet printers.

4.3 This practice may be used to evaluate the interaction between ink(s) and various substrate types as it relates to image quality.

4.4 This procedure may be used for substrate (for example, paper, paperboard, film, labels, fabric, envelopes), printer and ink specifications-acceptance, research and product development.

4.5 Although this practice is suitable for the evaluation of all printer, ink and substrate combinations, it is not intended for use in the evaluation of color fidelity or continuous-tones.

5. Interferences

5.1 Ink jet substrates may be purchased from a variety of sources and may affect the image quality produced by a given system. The user should only use the grade and weight of substrates recommended by the printer manufacturer when evaluating printer image quality. When there is a difference in the performance between the two sides of the substrate, it is up to the manufacturer of the substrate to specify the print side.

5.2 All substrates should be from the same source and production lot. Some inherent variability may affect image-quality evaluations, as will certain unintentional defects. Some variability may be encountered from one ream of substrate to the next, or sometimes encountered within a ream. Both sides of evaluation substrates should be evaluated if a print side is not specified by the manufacturer of the substrate.

5.3 Many printers are subject to imaging-system variations due to fluctuation of line voltage. Voltage stabilizing devices may be used. If a stabilizing device is not used, sample prints should be produced when the line load is low or stabilized.

5.4 Fluctuations in temperature and humidity may affect the substrate used for image reception. Samples printed on different days could show variation in results. All print samples should be dated with temperature and relative humidity recorded.

5.5 The following evaluations of image-quality attributes are performed visually. All comparative evaluations should be performed under the same viewing conditions.

5.6 The following evaluations utilize digital test originals that are created using software. Always use the same originals when comparing printers, supplies and substrates.

5.7 Note that some print defects may be the result of clogged or malfunctioning ink jet nozzles. Solid fill print samples should be periodically examined for alternating high and low density horizontal bands. If this defect is noted, it is likely that a nozzle is clogged or has malfunctioned. In this case, the evaluation should be stopped, the nozzles cleaned or replaced and the evaluation restarted from the beginning.

6. Apparatus

6.1 *Ink jet printer.*

6.2 *Word processing or page layout (desktop publishing) software*, which allows the user to create, copy and place graphic elements on a page, as well as specify the size of these graphic elements.

6.3 *5X Magnifier or optical comparator.*

6.4 *Metric ruler*, graduated to 1 mm.

7. Calibration

7.1 Adjust the printer used to conduct the evaluation per the manufacturer's instructions or in accordance with Practice **F1174**.

7.2 Skew and nozzle misalignment may be an irreparable aspect of a particular printer. It is recommended that if these weaknesses are predisposed, that it should be determined before the evaluation commences (refer to Sections **12** and **14**).

8. Conditioning

8.1 Condition the printer, supplies and substrates to be evaluated for 24 h in the same atmospheric conditions as those present where the evaluation is to be conducted.

8.2 All comparison evaluations should be run under the same conditions of temperature and humidity.

9. Text-Quality Evaluation

9.1 *Feathering*—Feathering is a common characteristic of ink jet imaging and causes poor text quality. Feathering occurs when ink flows along substrate fibers causing protrusions from the image. The length of the feather, as well as their frequency and optical density, have an effect on the print quality. A severe form of feathering is called “wicking” and occurs when the

feather is long enough to form a bridge to adjacent images. Feathering should not be confused with spray (**14.1**).

9.1.1 *Feathering Evaluation:*

9.1.1.1 Using a word processor or text editor, create several lines of text.

9.1.1.2 Print the text using the conditioned printer, imaging supplies and substrate.

9.1.1.3 Using the magnifier or optical comparator, examine all of the text in the printed sample. Compare to the following references and report the results.

(1) No feathering observed.

(2) Some feathering is observed.

(3) Frequent feathering distorts the outline of text image.

(4) Wicking is observed.

10. Solid-Fill Evaluation

10.1 *Mottling and Coalescence*—Mottling is an image-quality defect that results in non-uniformity of the image density of a “solid fill” area (for example, thick lines, letters or blocks). Mottling defects follow patterns in the substrate or are caused by the interaction between ink and substrate. Coalescence defects are caused by pooling of the ink before it has time to dry or be absorbed into the substrate.

10.1.1 *Mottling Evaluation:*

10.1.1.1 Using Practice **F1942**, create a document consisting of solid-fill areas sufficiently large enough to visually evaluate. Several 1 in. square (25.4 mm) solid fill elements located around the page should suffice.

10.1.1.2 Print the document using the conditioned printer, imaging supplies and substrate.

10.1.1.3 Use a magnifier or optical comparator and examine all of the solid-fill areas in the printed sample for non-uniform density. Compare to the following references and report the results.

10.1.1.4 If apparent density defects follow patterns in the substrate, they are mottling defects. If apparent density defects are caused by pooling of the ink on the surface of the substrate, it is a coalescence defect.

(1) No mottling or coalescing observed.

(2) Some mottling or coalescing is observed.

(3) Severe mottling or coalescing is visible to the naked eye.

10.2 *Banding*—Banding is a image-quality defect that results in alternating high and low density bands across solid-fill areas. Note that this defect may occur even though the quality of the text is acceptable and may be caused by clogged or malfunctioning nozzles.

10.2.1 *Banding Evaluation:*

10.2.1.1 Using Practice **F1942**, create a document consisting of solid-fill areas sufficiently large enough to visually evaluate. Several 1 in. square (25.4 mm) solid fill elements and several lines of text located around the page should suffice.

10.2.1.2 Print the document using the conditioned printer, imaging supplies and substrate.

10.2.1.3 Using the magnifier or optical comparator, examine all of the solid-fill areas in the printed sample. Compare to the following references and report the results.

(1) No banding observed.