



Standard Practice for Determination of the Quality of Monochrome Images Produced from Non-Impact Personal Computer Printers¹

This standard is issued under the fixed designation F 1423; 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 utilizes a standard test target that is intended for use as a means of comparing the graphic and text output quality from non-impact personal computer printers. The output may be from ink jet, thermal transfer, or electrostatic imaging devices.

1.2 This target can be used by the end-user as a means of determining the suitability of a non-impact printer for use with commercially available software and a predetermined application.

1.3 *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 the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

F 909 Terminology Relating to Printers²

F 1125 Terminology of Image Quality in Impact Printing Systems²

F 1174 Practice for Using a Personal Computer Impact Printer as a Test Instrument²

3. Terminology

3.1 *Definitions:*

3.1.1 *hairline*—the thinnest line a particular printer will print.

3.1.2 *jitter*—deviation in a printed test pattern that is caused by: erratic rotation of the photoreceptor or erratic paper feeding (noticeable in the vertical plane); or erratic scanning or alignment, or both, of the imaging device (noticeable in the horizontal plane). The imaging device can be either a laser diode, ink-jet nozzle(s), or a thermal printhead.

3.1.3 *point*—a typographical term describing the height of a character from top to bottom. One point equals approximately 1/72 in.

3.1.4 *stairstepping*—the tendency of a printer to produce angular or circular lines, or both, in a series of dots that, when examined closely, resemble stair steps. Ideally a printer should produce angular or circular lines, or both, with a smooth, unnoticeable transition from dot to dot.

3.2 See Terminologies F 909 and F 1125 for additional definitions related to this practice.

4. Significance and Use

4.1 This test target can be used for control or evaluation of the graphic and text output of imaging products or as a research and development tool.

4.2 This test target can be produced by most non-impact personal computer printers.

5. Interferences

5.1 This test target was generated using commercially available software. Consequently, the quality of the printed test target may not be indicative of the absolute resolution or image quality, or both, that a printer may produce (direct programming of the printer may produce the best results).

5.2 Paper supplies can be purchased from several sources and can affect the image quality of a given system. The user should use only the grade and basis weight of paper recommended by the printer manufacturer when evaluating image quality. All paper supplies should be from the same source and production lot. Some inherent variability within the paper may affect image quality evaluations as will certain unintentional paper defects. Some variability may be encountered from one ream of paper to the next or sometimes encountered within a ream.

6. Apparatus Required to Produce Test Target

6.1 *IBM or IBM Compatible Computer*, running MS-DOS or Windows.

6.2 *PC Compatible Non-impact Personal Computer Printer*.

6.3 Test targets will be available from ASTM³ for HP LaserJet (PCL), PostScript, IBM Quietwriter, and HP DeskJet printers or compatibles. The printer may be equipped with serial or parallel ports; Test Target may be output from one to

¹ This practice is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.04 on Electrostatic Imaging Products.

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² *Annual Book of ASTM Standards*, Vol 15.09.

³ Test target available from ASTM Headquarters. Order Stock #: ADJF1423.

ten times to either LPT1, LPT2, LPT3, COM1, COM2, or COM3.

6.4 PCL printers require a minimum of 1.5 megabytes of memory.

6.5 *Magnifier or Optical Comparator*, the power of which is judged acceptable by the evaluator.

6.6 *Paper*, recommended for use by the printer manufacturer, paper in common use in the facility where the printer is used.

7. Printing the Test Target

7.1 Set up the PC and printer in accordance with Practice F 1174 and follow the manufacturer's instructions.

7.2 Load the paper into the feed tray so that the image is produced on the side designated by the paper or equipment manufacturer.

7.3 Follow the instructions included with the test target diskette. The program may take several minutes to load into the printer's memory.

7.4 Run the desired number of test targets.

8. Evaluation of Test Target

8.1 Use of a magnifier or optical comparator for evaluation of the printed target is at the discretion of the evaluator. Examine the entire target for extraneous markings or spots. See Fig. 1.

8.2 Items 1A, 1B, 1C, and 1D are positioned to the outermost edges of the original test target and serve a threefold purpose:

8.2.1 Since these items are positioned on the edge of the page, the white space around the perimeter of the printed target represents the "void" area—that is the area on the page where the printer will not image. The remaining printed area represents the maximum print area allowable by the printer. Examine and record the void area or the maximum print area from the printed target.

8.2.2 Items 1A and 1B can also be used as scales to aid in making a rough estimate of the void or maximum print area. Items 1A and 1B are graduated in increments of $\frac{1}{8}$ in.

8.2.3 Items 1C and 1D can also be used as "jitter" scales. Any deviation of the pattern (inconsistent spacing of the lines) is easily distinguished by the human eye. Examine the patterns for any irregularities.

8.3 Items 2A, 2B, 2C, and 2D are solid black images that can be used to determine the density of the image on different areas of the target. These images may be inspected or measured, or both, using a densitometer. Examine the images for edge fill and voids. Compare the density of each of the boxes to the others on the page.

8.4 Items 3A, 3B, 3C, and 3D are intended to demonstrate how accurately the printer can produce an unfilled circle. Examine the circle for appearance, line width, and "stairstepping" effect.

8.5 Items 4A and 4B consist of seven concatenated boxes with various levels of halftones (10 %, 20 %, 30 %, 40 %, 60 %, 80 %, and 100 %). These items are intended to demonstrate how accurately the printer can produce each level. Inferior imaging systems will show disproportionate changes between levels. For example, some printers may saturate an

80 % halftone while others may show little discernible difference between a 10 % and a 20 % halftone. Examine the degree of shading in each box. Variations in shading within individual halftones may be indicative of excessive "jitter."

8.6 Items 5A and 5B are intended to demonstrate how accurately the printer can produce closely spaced diagonal lines. Some printers may produce 5B so that it resembles a halftone while others may produce easily distinguishable diagonal lines. Examine each item for appearance, line width, and stairstepping effect. Variations in shading within individual halftones may be indicative of excessive "jitter."

8.7 Items 6A and 6B are intended to demonstrate how accurately the printer can produce a long diagonal line from corner to corner on the test target. Examine the lines for appearance, straightness, and stairstepping effect. Examine the width of the lines and the appearance of their intersection at the center of Item 7. Note that some printers may alleviate the stairstepping effect by producing a thicker line, the quality of which is determined by the preference of the evaluator (also refer to 8.11). The intended width of the lines are "hairline" (a desktop publishing term), which is the thinnest line a particular printer will print. A comparison of the measured length of each diagonal line indicates the "squareness" of the image.

8.8 Item 7 is intended to demonstrate how accurately the printer can reproduce a series of concentric boxes. Examine the boxes for consistent spacing from one box to the next and ensure that the lines are parallel in both planes. Examine the line width and the corners of each box for appearance. Also, examine the appearance, placement, and accuracy of the centermost box—it should be nearly quartered by Items 6A and 6B.

8.9 Items 8A and 8B are a series of negative and positive lines. The thinnest line is hairline width and the remaining lines are in point sizes (0.5, 1, 2, 4, 6, 8, and 12 point). These items are intended primarily to compare line widths produced from different printers. Since these items are expressed in a unit of measurement, there should be no difference in line width from one printer to the next. Examine the lines for appearance and line width. Compare the differences in width between negative and positive lines of the same width. Note that because of the nuances in the addressable resolution of some printers, horizontal or vertical lines, or both, of incorrect width may be produced.

8.10 Item 9 is a series of characters in Courier typeface with a point size of 12. These characters represent decimal values 033 to 175 from the IBM character set. Examine the characters for appearance, spacing, and consistency of line width. Note that the Courier typeface may vary from printer to printer.

8.11 Items 10 and 11 are composed of hairline width lines of varying shallow angles. Examine each line for stairstepping effect, straightness, and consistency of line width. Note that some printers may alleviate stairstepping effect by producing a thicker line, the quality of which is determined by the preference of the evaluator. The degree of thickening of the angled lines can be determined by comparing their thickness to the thickness of the horizontal and vertical lines.

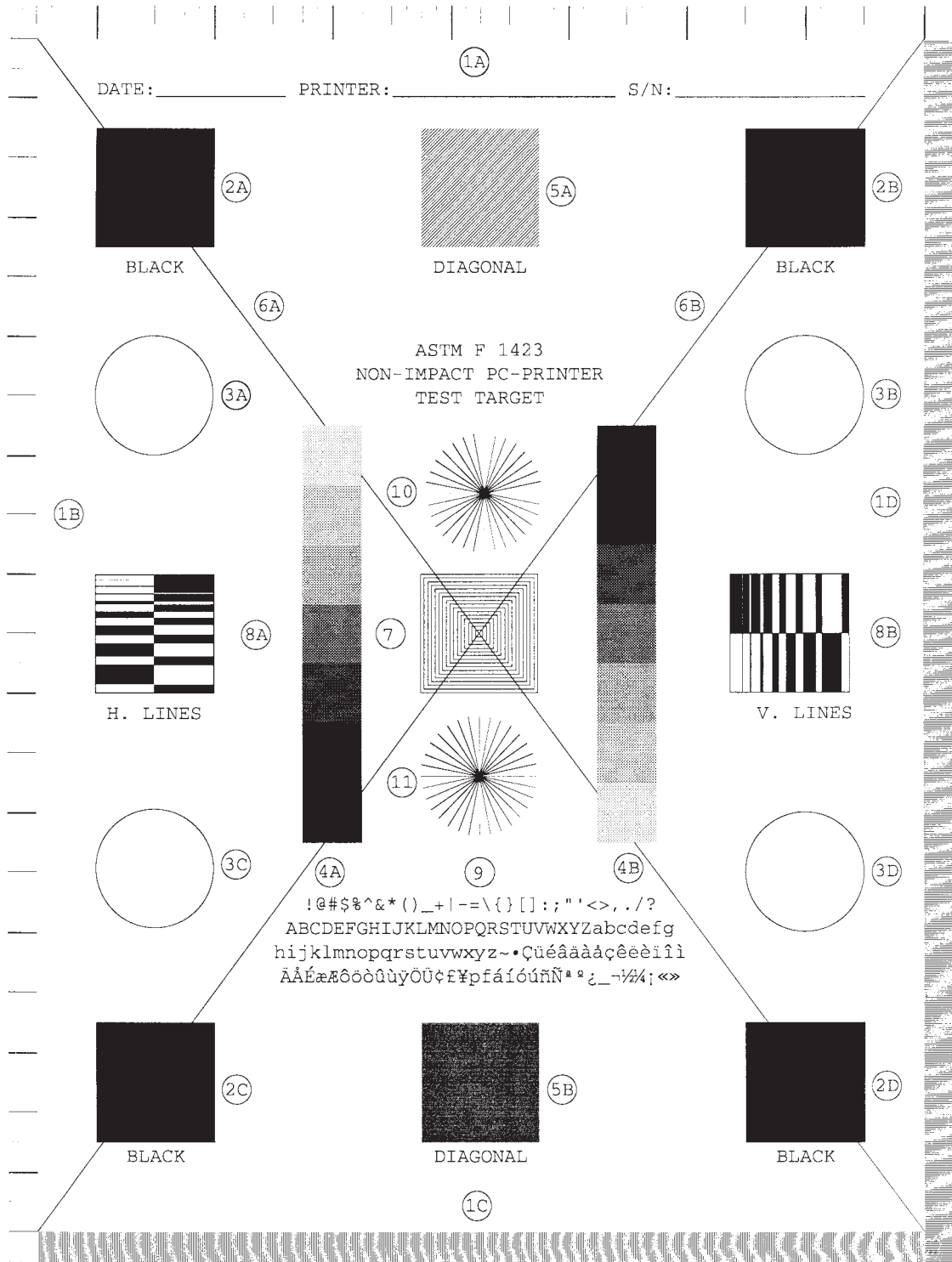


FIG. 1 Image Quality Test Target

9. Report

9.1 Interpretation of the results should be made by one evaluator.

9.2 Suitability of the maximum print area is determined by the application required by the end user.

9.3 Any evidence of jitter may be indicative of the quality of construction or the amount of use on the printer.

9.4 The density of the image may be adjusted by means of

the print contrast control of the printer. The absolute density is indicative of the capabilities of the imaging process or the printer, or both.

9.5 The degree of stairstepping may be indicative of the resolution of the printer. Note that some printers may alleviate stairstepping by producing a thicker line, the quality of which is determined by the preference of the evaluator.

9.6 Proportionate and discernible changes in the levels of

halftones are indicative of the resolution, effectiveness of the imaging process, or the quality of the printer. Note that changes in the contrast control on some printers may affect the quality of reproduction of halftones.

9.7 Differences in the density of one of the boxes (in the four corners of the target) to the next may be indicative of poor printer/print cartridge quality or faulty manufacturing tolerances. For example, differing density of boxes in the same horizontal plane may be indicative of poor photoreceptor quality for electrostatic printers or inconsistent platen or printhead clearances for thermal transfer or ink-jet printers.

Differing density of boxes in the same vertical plane may be indicative of poor toner refresh rate or photoreceptor quality for electrostatic printers or inconsistent platen or printhead clearances for thermal transfer or ink-jet printers.

9.8 The amount of spots or extraneous marks on the printed target may be indicative of the quality of the printer, supplies, or the amount of usage already on the printer.

10. Keywords

10.1 computer printers; image quality; test target

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