Designation: F 1174 – 01

Standard Practice for Using a Personal Computer Printer as a Test Instrument[1]

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1. Scope

1.1 This practice covers a standardized procedure utilizing a printer of the type normally associated with a personal computer as an imaging device when the performance properties of paper and imaging system components are measured. Both impact and nonimpact systems may be tested.

1.2 Impact printer technologies include full character and dot matrix.

1.3 Nonimpact printer technologies include laser printers, direct thermal printers, thermal transfer printers, and ink jet.

1.4 Printers not included are those associated with large computer systems commonly known as high-speed printers. See Practice F 1175 for testing involving those systems.

1.5 *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:*

D 685 Practice for Conditioning Paper and Paper Products for Testing[2]

D 5039 Test Methods for Identification of Wire Side of Paper[2]

F 221 Terminology Relating to Carbon Paper and Inked Ribbon Products and Images Made Therefrom[2]

F 909 Terminology Relating to Printers[2]

F 1125 Terminology of Image Quality in Impact Printing Systems[2]

F 1175 Practice for Using the Computer Impact Print-Out Unit as a Test Instrument for Manifold Comparison[2]

2.2 *ANSI Standards:*

PH 2.17 Density Measurements-Geometric Conditions for Reflection Density

PH 2.18 Density Measurements-Spectral Conditions

3. Terminology

3.1 *Definitions*—Refer to Terminology F 909.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *direct thermal printer*—a thermal printer in which the heated dots in the printhead form the image on a coated paper containing the imaging materials, producing a color formation corresponding to the dot pattern on the printhead.

3.2.2 *printer speed*—the rate at which a printer operates, measured in characters per second (CPS), lines per minute (LPM), pages per minute (PPM), or inches per second (IPS).

3.2.3 *thermal printer*—a printer in which a pattern of dots in a thermal printhead are heated, causing image forming reactions on chemically treated ribbon or paper.

3.2.4 *thermal transfer printer*—a thermal printer in which the heated dots in the printhead softens the ink on a ribbon or paper, causing it to transfer to paper much like an impact printer. An alternate process involves the use of a resistive ribbon and a printhead with dots that are electrically activated, causing current to flow through a resistive ribbon with an image-forming coating. The heat generated with the current flow causes the coating to soften and transfer to the paper.

4. Summary of Practice

4.1 This practice consists of using a printer, of the type normally associated with personal computers, under specified conditions, to prepare images that are used to evaluate paper or other imaging system components.

4.2 Care should be exercised in making comparisons, in that only one variable at a time should be evaluated. An example would be comparing several papers in one laser printer.

4.3 This practice includes nonimpact printers having imaging technologies including laser, direct thermal, thermal transfer, or ink jet L.E.D., L.C.S., and magnetography. It also includes impact printers involving technologies such as full character or dot matrix types.

4.4 This practice may also be used to compare the image quality of printers that are capable of being operated at more than one speed.

4.5 This practice does not include computer printers using imaging technology provided by raised images on belts, chains, or drums. Practice F 1175 addresses those imaging systems.

5. Significance and Use

5.1 This practice is intended to provide a means of evaluation of comparative image quality relative to paper, imaging system components, printer speeds, and printer models.

6. Interferences

6.1 Many printers are subject to imaging system variations

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

due to fluctuation of line voltage. Voltage-stabilizing devices can be used. If a stabilizing device is not used, tests shall be run at periods where the line load is low or stabilized.

6.2 The densitometer or reflectometer readings will also vary with voltage fluctuations. Use the same procedures as in 6.1.

6.3 In visual comparison, care should be taken not to confuse width of line or area with intensity.

6.4 Fluctuations of temperature and humidity will affect the paper used for image reception. Tests run on different days could show variation in results. All tests shall be dated with temperature and relative humidity recorded (see 10.1).

6.5 Certain characteristics are common to all imaging systems. Other characteristics are peculiar to the individual imaging systems. The technicians should apply their knowledge of the imaging system when evaluating images.

6.6 To ensure the best results when evaluating the image quality of ink-jet and thermal printers, use the paper recommended by the manufacturer or a suitable substitute.

7. Apparatus

7.1 *Printer*—In normal use for the application.

7.2 *Densitometer*—An instrument meeting the requirements of ANSI PH 2.17 and PH 2.18 shall have an aperture diameter that shall be greater than two times the height of a line of type.

8. Materials and Manufacture

8.1 *Paper*—If a variable other than paper is to be evaluated, the paper used should be one in common use in the facility where the printer is used. Tests should be run on the wire side of the paper (see Test Methods D 5039).

8.2 *Imaging System Components*—When an imaging system component is to be evaluated, a sufficient amount of the imaging material should be available in the printer so that replenishment or change in component would not be necessary while the test is being conducted. Examples would be the ink reservoir of an ink jet printer, and toner supply in a laser printer, or ribbon in a thermal transfer printer.

9. Calibration and Standardization

9.1 Adjust the printer to be used to prepare the images in accordance with the manufacturer's recommendations.

9.2 For image evaluation using visual means (see 12.1), either use a test program integral to the printer which produces all characters in upper and lower case, or program the computer associated with the printer so that the full set of characters is produced.

9.3 For the reflection density test (see 12.2), develop a program utilizing graphic pattern spacing so as to give a continuous overall image that does not involve any overlapping printing.

NOTE 1—ASCII Character #219 provides a suitable block pattern.

10. Conditioning

10.1 Testing shall be conducted in an environment with stable conditions of temperature and relative humidity. The paper, printer, and supplies should be conditioned for 24 h in the area in which the test will be conducted. If available, Method D 685 standard conditions 50.0 ± 2.0 % relative humidity and 23.0 ± 1.0°C (73.4 ± 1.8°F) should be used.

11. Procedure for Preparing Image

11.1 *Paper Evaluation*:

11.1.1 Check that the imaging system is performing satisfactorily and that it contains sufficient imaging material to complete the test without replenishment or change.

11.1.2 Insert the paper to be tested, in accordance with the printer manual, but avoid printing on watermarks or imperfections in the paper.

11.1.3 Operate the printer at a constant speed and produce a minimum of ten characters horizontally across the sheet and ten lines of characters down; three built-in test patterns; or a test pattern appropriate to the component being tested. If the printer speed is adjustable, repeat the procedure at those speeds as appropriate. Note the printer speed in the margin adjacent to the copy.

11.1.4 Remove the test paper. Be careful to avoid any smudging of the pattern of printed images.

11.1.5 Produce identical image and test patterns on control paper and other papers to be evaluated in accordance with 11.1.2 through 11.1.4 with the same imaging system components and printer setup. Note side of paper imaged.

11.2 Imaging Material Evaluation:

11.2.1 Follow essentially the same procedure as described in 11.1.1 through 11.1.5, except the variable to be changed and evaluated shall be a component of the imaging system. Examples would be a change in ink for an ink jet printer, in toner for a laser printer, or a ribbon for a thermal transfer or impact printer. The same lot of paper should be used throughout the test, and printer speed should be adjusted if appropriate.

11.3 *Printer Evaluation*:

11.3.1 Use of original equipment and manufacturer-recommended imaging materials and paper is suggested for printer comparison evaluation.

11.3.2 Use essentially the same procedure described in 11.1.1 through 11.1.5 except make a comparison on different printers.

11.3.3 If the printers evaluated will not accept the same imaging system components, use one designed for the printer or from the same component manufacturer and so indicate. If the imaging system components are changed, the method evaluates the printer-component combination and not the printer alone.

11.3.4 If the printers being evaluated do not have the same type size, style, pitch, etc., to produce the pattern described in 11.1.3, the evaluation of the image by reflection density as described in 12.2 cannot be conducted. Further, the visual evaluation may be compromised because of the differences in the image and should be so noted in the report.

12. Evaluation of Comparative Image Quality

12.1 *Visual Means*:

12.1.1 Visually compare the test and control product images. Image evaluation may be improved by using magnification, such as 10× hand lens, a binocular microscope, or by production and examination of photomicrographs. When using any magnified or photographic techniques, care should be taken to make certain that magnification and illumination are

the same for all images. Report magnification used. A small aperture densitometer may be used to aid in image evaluation.

12.1.2 The images should be compared for relative value of the following examples:

12.1.2.1 Intensity,

12.1.2.2 Sharpness,

12.1.2.3 Cleanliness,

12.1.2.4 Legibility,

12.1.2.5 Character fill-in, and

12.1.2.6 Other characteristics as appropriate to different technologies.

NOTE 2—The user of the method should be familiar with the features and characteristics of the imaging technology of the images being evaluated in 12.1.2.6. The other five characteristics are common to all printing.

12.2 *Reflectance Measurement*:

12.2.1 *Apparatus*—Reflectometer or reflection densitometer shall meet the requirements for daylight luminous reflectance in accordance with ANSI PH 2.17 and PH 2.18. The light source and receptor of the reflectometer shall be as described in ANSI PH 2.17 and PH 2.18, namely Illuminant *C*, and observed by illuminosity (*y*) function.

12.2.2 *Calibration*—The densitometer or reflectometer should be calibrated using primary and secondary standards described in ANSI PH 2.17 and PH 2.18.

12.2.3 *Measurement*:

12.2.3.1 Place the test specimen on a black backing as described in ANSI IT 2.17–1995 (ISO 5-4) Annex A1.

12.2.3.2 Place the printed test specimen produced in Section 11 under the viewing head of the instrument, and read the value of percent reflectance or optical density obtained on the specimen. A reading should be taken from five or more different areas of the imaged material. The average and range of the readings are recorded.

12.3 *Evaluation of Character-Forming Mechanism*—Examine the individual characters produced in 11.4 for any evidence of broken images.

13. Report

13.1 *Visual Means*:

13.1.1 Establish a ranking order for the characteristics evaluated in 12.1 by comparing paired samples on the basis of equal to, above, or below.

13.1.2 The ranking order may be different for the various characteristics evaluated.

13.1.3 Some personal judgment will be required in equating merits of the various characteristics. For example, a low-density image of high sharpness may be preferred to a high-density image with ragged edges.

13.2 *Reflectance Density*:

13.2.1 Establish a ranking order based on reflectance density.

13.2.2 Use the ranking order to supplement the visual ranking order.

13.3 An overall ranking order based on the combined ranking of 13.1 and 13.2.

13.4 Conditions of test (10.1).

14. Keywords

14.1 image quality; impact printer; nonimpact printer; personal computer printer