



Designation: F 1531 – 94

Standard Test Method for Comparing Printer or Copier Cartridges¹

This standard is issued under the fixed designation F 1531; 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 test method covers information and techniques for evaluating the quality and performance of single unit electrophotographic copier toner cartridges or electrophotographic printer toner cartridges (see section 3.4) on a comparative basis for general office use. Comparisons may be made against a database, against a standard or reference cartridge, or the test method may be used to build a database. This test method is intended to be comprehensive in that it will cover a large number of attributes of the cartridge and the print it produces. However, the user may select any or all the tests or observations depending on the situation, intent, or other circumstances involved. The attributes to be considered are as follows:

1.1.1 The condition of the carton containing the cartridge and the external labeling.

1.1.2 Internal packaging, literature, and carton contents.

1.1.3 The condition and appearance of the cartridge and the markings on the cartridge.

1.1.4 Presence of toner leakage from the cartridge and a test for toner leakage from the cartridge.

1.1.5 The condition of the component parts of the cartridge which may include by are not limited to the following: corona wire, charge roller, developer roller, toner transfer device, photoreceptor, waste toner bin, cleaning blades, fuser roller wiper blade or wand, and other parts.

1.1.6 Operation and print quality evaluation, including but not limited to resolution where possible, deterioration of print quality over the life of the toner charge, the copy or print yield, image smear and rub, extraneous spots, etc., and unusual odors or noises from the machine.

1.1.7 The reliability of a product source can be established by repeated use of this test method. Print quality on various media can also be tested.

1.2 *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:

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process²

F 335 Terminology Relating to Electrostatic Copying³

F 807 Practice for Determining Resolution Capability of Office Copiers³

F 875 Test Method for Evaluation of Large Area Density and Background on Office Copiers³

F 909 Terminology Relating to Printers³

F 974 Test Method for Determination of the Color Response of an Electrostatic Copying System, Black and White Output³

F 995 Test Method for Estimating Toner Usage in Copiers Utilizing Dry Two-Component Developer³

F 1319 Test Method for Determination of Abrasion and Smudge Resistance of Images Produced from Business Copy Products (Crockmeter Method)³

F 1351 Practice for Determination of the Effect of Hard Creasing Paper on Images Produced by Business Imaging Systems³

F 1571 Test Method for Determination of Abrasion and Smudge Resistance of Images Produced from Business Copy Products (Sutherland Method)³

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, see Terminologies F 909 and F 335.

3.1.2 *cleaner blade*—a phenolic or plastic blade which rides on the surface of the photoreceptor or other item to mechanically remove excess toner; sometimes also called wiper blade, in which case it is ambiguous with 3.1.13.

3.1.3 *developer roller (also magnetic roller or mag roller)*—a cylinder built into the copier toner cartridge or printer toner cartridge intended to transfer the toner from the toner reservoir to the charged areas of the photoreceptor.

3.1.4 *electrophotographic printer (or copier) toner cartridge*—an assembly made up of a toner compartment, corona wire or charge roller, photoreceptor, and other related

¹ This test method is under the jurisdiction of ASTM Committee F-5 on Business Imaging Products and is the direct responsibility of Subcommittee F05.04 on Electrostatic Copy Products.

Current edition approved June 15, 1994. Published August 1994.

² Annual Book of ASTM Standards, Vol 14.02.

³ Annual Book of ASTM Standards, Vol 15.09.



parts for use in certain laser printers or small xerographic copiers. (Examples are the cartridges used in the Canon CX and SX systems, the HP IIP system (LX engine), and the IBM 4019 printer toner cartridge.)

3.1.4.1 *Discussion*—In the text of this test method, the words printer toner cartridge, copier toner cartridge, printer cartridge, copier cartridge, toner cartridge, or cartridge are used to mean electrophotographic printer (or copier) toner cartridge. Printer or copier being used or implied as appropriate.

3.1.5 *photoreceptor*—a cylinder built into the copier toner cartridge or printer toner cartridge made of a base cylinder with a photoconductor coating intended to develop the latent image into a toned image.

3.1.6 *refilled cartridge*—electrophotographic printer (or copier) toner cartridge which has been used at least once and the expended toner has been replenished.

3.1.7 *reloaded cartridge*—a term used interchangeably with the term *refilled cartridge*.

3.1.8 *remanufactured cartridge*—electrophotographic printer (or copier) toner cartridge which has been refilled and the other parts replaced, refurbished, or cleaned.

3.1.9 *toner reservoir shipping seal*—a flat piece of plastic, cardboard, or similar material which seals the toner reservoir and is intended to prevent the toner from leaving the toner reservoir before the cartridge is installed in the copier or printer.

3.1.10 *toner transfer device*—a roller (developer roller) or other component or set of components built into the copier toner cartridge or printer toner cartridge, intended to transfer the toner from the toner reservoir to the image areas of the photoreceptor.

3.1.11 *waste toner bin*—a compartment or container on the cartridge which receives the waste toner removed by the cleaner blades.

3.1.12 *wand (or fuser wand)*—a felt or fiber-covered blade which is separated from the toner cartridge, and is installed in the printer or copier so that it can wipe toner from the fuser roller surface and provide fuser oil for the fuser roller.

3.1.13 *wiper (or wiper blade)*—ambiguous terms used interchangeable with the term *cleaner blade*.

4. Summary of Test Method

4.1 This test method covers testing and examining new, remanufactured, or reloaded copier toner cartridges and printer toner cartridges, under actual and simulated use conditions.

4.2 The cartridge and its packaging is examined for appropriate markings, toner leakage, replaced or reconditioned components, and quality of workmanship. The cartridge is tested in a printer or copier for print quality, uniformity of print quality throughout its life, output volume, odors and noise while operating, and for ease of insertion and removal. The weight of the toner used is determined.

4.3 The test cartridge may be compared to a reference cartridge. All samples are to be similarly conditioned before testing and are to be tested under identical conditions so as to obtain comparable results.

5. Significance and Use

5.1 This test method may be used to record and evaluate the various attributes of new, remanufactured, or reloaded copier toner cartridges and printer toner cartridges. Both physical properties and performance qualities are considered.

5.2 This test method is suitable for comparative service evaluation and may be useful in research and development as it applies to comparative service evaluation. This test method may be used for manufacturing control, but only on a limited basis due to the time span required for some of the procedures.

5.3 This procedure consists of several tests which are used to evaluate a number of cartridge properties. The operator may use any one of these tests, any combination of them, or all of them.

6. Interferences

6.1 Many printers and copiers are subject to imaging system variations due to fluctuations in line voltage. This problem can be overcome by the use of a voltage stabilizing device or by conducting the test during the time periods when the line voltage is most stable.

6.2 Temperature and humidity have an effect on paper and toner properties, as well as equipment performance. Tests should be conducted in a stable environment consistent with proper equipment operation. All supplies and equipment should be conditioned before use.

6.3 Comparative tests must be run on the same machine by the same operator under the same conditions of temperature and humidity. Darkness settings, focusing of optics, type font construction, and fusing temperature and pressure may all cause differences in image quality and toner consumption. These conditions are not necessarily the same from machine to machine.

6.4 In comparative yield tests, the same target pattern must be used. The number of copies produced by a 4 % coverage “k” pattern will not necessarily be the same as the number produced with a 4 % coverage of some other pattern or letter.

7. Apparatus and Materials

7.1 *Electrophotographic Printer and Printer Control System*.

7.2 *Electrophotographic Copy Machine*.

7.3 *Balance*, with the capacity and accuracy required in 10.6.

7.4 *Dental Mirror*.

7.5 *Paper*, which meets the requirements of the printer or copier and is satisfactory to the tester. The supply should be large enough so that all test cartridges and comparison samples will be tested with the same lot of paper.

8. Test Specimens

8.1 *Sample Toner Cartridge*, preferably in an unopened carton as it comes from the manufacturer, remanufacturer, or reloader.

8.2 *Reference Toner Cartridge*, preferably in an unopened carton. It should be from a reputable source acceptable to all parties interested in the test method.





9. Conditioning

9.1 All equipment, supplies, and samples are to be conditioned in the atmosphere where the test is to be conducted for at least 24 h.

10. Procedure

10.1 This procedure is given in a logical time sequence. That is, it starts with the unopened shipping carton and proceeds to the final use test listing observations to be made as the carton is opened. The cartridge is unpacked and then is installed and used. The importance of each section of the procedure will depend on the intent of the user of this test method. However, since the ultimate objective of most users is to determine the actual usability of the test cartridge, and to determine its print quality, yield, and reliability, the tests in Section 11 are of prime importance. Appendix X1 contains a suggested reporting form, with the various results arranged in order of significance.

10.2 Examine the outside of the carton before opening it.

10.2.1 If the carton has serious external damage, the test should be stopped or a new sample obtained.

10.2.2 Record all relevant markings on the outside of the carton. They may include the identity of the original manufacturer, remanufacturer or the reloader, or both, the machine in which the cartridge is to be used, the date of manufacture or reprocessing, the number of times the cartridge has been refilled, the shelf life, the weight, and expected yield.

10.2.3 Examine the carton for toner leakage. Record whether the outside of the carton is clean, slightly smudged, heavily stained with toner, has a small amount of toner seeping from the box when it is handled, or has toner obviously leaking from it. Also, examine the carton for minor damage. Make a record of any dents, punctures, slits, or crushes and whether or not they may be deep enough to damage the cartridge.

10.3 *Packaging and Carton Contents:*

10.3.1 Open the carton. Note the orientation of the cartridge relative to carton markings. That is, if the carton or cartridge are marked, “This side up” (or the like), check if the marks or the logical position of the cartridge, or both, agree, or if needed marks are missing. Remove the cartridge from the carton, and remove any other packaging. Do not remove any strips, tabs, or tapes which the instructions say are to be removed after the cartridge is in the printer or copier. Make a record of the packaging used. Particularly, note whether or not the carton or inside packaging provide electrostatic and light protection to the cartridge. Place the cartridge on a flat surface which has been covered with white paper.

10.3.2 Examine the inside of the carton and the inside packaging material for loose toner or toner stains. Also look for detached parts. Record whether the carton and packaging are free from toner, have slight toner smudges, have heavy toner smudging, have small amounts of loose toner present, or have large amounts of loose toner present. If there are detached parts, the cartridge may be damaged, and the testing of that cartridge should be discontinued.

10.3.3 If a test or print sample was included in the package or attached to the carton, record the fact that it was present, and examine it for print quality, general appearance, and other relevant qualities.

NOTE 1—Because this print sample has been shipped and its history is unknown, it may not be a good indicator of actual conditions. Therefore, use this print sample as a guide to possible problems, rather than an indicator of actual performance.

10.3.4 Note and record the terms of the warranty if any. Also note how conspicuously or inconspicuously the warranty was presented.

10.4 Examine the outside of the cartridge.

10.4.1 Record all relevant markings on the outside of the cartridge, which may include the identity of the original manufacturer, the machine in which the cartridge is to be used, the shelf life, the weight, and expected yield. If the cartridge is a reloaded one, also record the name of the refiller or remanufacturer, the refill date, and the number of times the cartridge has been refilled, if possible.

10.4.2 Note whether or not the cartridge toner compartment has a loading or refilling port. If there is a port, examine the seal or cap. Partial disassembly of the cartridge may be necessary. If that is the case, it may be advisable to leave this examination until after the operational tests in Section 11. Record how well the cap is seated, and if there are signs of toner leakage. On a cartridge without a port which has been reloaded or remanufactured, note and record if the cartridge had to be drilled, breached, or punctured in order to be refilled. If so, then record how the breach was sealed and the condition of the seal.

10.5 Test the cartridge for toner leakage.

10.5.1 Lift the cartridge from the white paper on which it has been placed. Record the degree to which, if any, the cartridge has leaked toner onto the paper.

10.5.2 If there are no restrictions on the orientations which the cartridge may assume, proceed with 10.5.2.1 and ignore 10.5.2.2. However, if the manufacturer has given restrictions on the way the cartridge may be positioned or tipped, then go to 10.5.2.2.

10.5.2.1 Holding the cartridge so that it is approximately 12 in. above the paper with its long axis parallel to the paper, rotate the cartridge through one complete revolution along its long axis. Then rotate the cartridge end-over-end one complete revolution along the short axis, which is parallel to the surface of the paper. Record the degree to which, if any, the cartridge has leaked toner onto the paper.

10.5.2.2 If the manufacturer’s instructions specifically state that the cartridge is not to be inverted, or its orientation is otherwise restricted, tilt, tip, or turn the cartridge only to the maximum extent allowed. Record the degree of movement and the amount of toner residue on the paper as a result of the limited movement.

10.6 Weight the cartridge. Use a laboratory balance which is sufficiently accurate, so that when the cartridge is later weighed empty (See 11.1.12 or 11.2.14) on the same balance, the difference between the two weights will be known to at least two significant figures. This weight taken here is the “full weight.”

