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Standard Practice for Comparative Evaluation of the Imaging Properties of Dry Electrostatic Toners[1]

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INTRODUCTION

This practice is a pragmatic test for the user who can obtain meaningful results without the need for sophisticated instrumentation.

1. Scope

1.1 This practice covers a method of testing by which the user can prepare a test for dry electrostatic toners used in copiers, which has significance to their specific copying needs and suggests ways in which test prints may be made and used for each evaluation.

1.2 Additional evaluation of image characteristics are covered in Practice F 807 and Test Method F 875.

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.* See Section 8 for specific hazards statements.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

F 335 Terminology Relating to Electrostatic Copying

F 360 Practice for Image Evaluation of Electrostatic Business Copies

F 470 Practice for Caking Temperature of Dry Electrostatic Toner

F 807 Practice for Determining Resolution Capability of Office Copiers

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

3. Terminology

3.1 *Definitions:* Refer to Terminology F 335.

4. Summary of Practice

4.1 This practice involves the comparative evaluation of one or more toner supplies by subjectively rating a number of significant characteristics of imaged copies made under controlled conditions on a dry toner electrostatic copier.

5. Significance and Use

5.1 Subjective comparative evaluation of copies made from the same test original (or originals) can be used to determine the usefulness of a given dry toner supply in a specific user application.

6. Interferences

6.1 Many copy systems are subject to variations due to fluctuation of line voltage. It is conceivable that such fluctuations may cause a normally useful system to give poor results. It is recommended that a stable and dedicated electrical line be used for testing purposes or the manufacturer of the equipment should be consulted regarding the need for voltage-stabilizing devices, which can usually be installed easily.

6.2 Results from a copy system can vary, depending upon the length of time the system has been operating. The first print after a system has been shut down for a prolonged time period can be of different quality than subsequent imaged copies made after some time of operation.

6.3 Variations in copy system performance after continuous copying over relatively long periods, for example several hours or more, can occur. It is recommended that the test procedure be repeated if significant variation in the copy system performance occurs.

6.4 Variations in copy system performance can occur as a result of copier adjustments, for example, before and after service calls.

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

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

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.

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6.5 Excessively high or low relative humidity can also cause variation in performance not encountered under normal conditions.

6.6 All tests should be conducted in the same copier, during the same relative time period and environmental conditions.

6.7 Dry toner supplies are often purchasable from several sources and can affect the results of a given copy system. If the sample of dry toner selected shows evidence of caking (see Practice F 470) which cannot be easily broken up with a soft brush, it should be rejected and another sample used.

6.8 Paper supplies can be purchased from several sources and also can affect results of a given copy system. The user should use only the grade and weight of paper recommended by the copier manufacturer when evaluating one or more dry toner supplies. All paper supplies utilized should be from the same manufacturing source, and the user should try to use all paper supplies from the same production number (provided one is listed). Some inherent variability within the paper may affect image quality evaluation as will certain unintentional paper defects. Some variability may be encountered from one roll to the next or from one package of sheets to a second package, and sometimes within a package.

6.9 Variations in toner concentration in those copiers where mechanical adjustment of toner flow rate is available strongly affect copy quality and should be minimized to the extent made available by the mechanics of the copy system.

7. Apparatus

7.1 This practice requires the use of a specifically designed vacuum cleaner suitable to removing every speck of toner and carrier from bond copying equipment which requires high-powered cleaning.[3]

8. Hazards

8.1 This practice is intended to orient the user toward observing meaningful and significant characteristics of imaged copies obtained from a limited number of imaged copies. It does not encompass those defects which the user should be aware of such as deterioration, abrasion or scratching, or other adverse actions which could reduce the effectiveness of the operation of the copier with the test toner supplies. The manufacturer of the test toner supplies should be consulted prior to the evaluation of the supplies in order to ascertain what long-term functional testing (including compatability results with the copier and current reference toner supplies used by the user) has been performed by the test toner supplier on that particular model copier the user possesses. The manufacturer of the copier should also be contacted prior to any test should any question of consequential damages to the copier be involved.

8.2 Many dry toner copier manufacturers require that only trained service people should be permitted access to specific internal copier components. Prior to any testing, the manufacturer of the copier should be consulted as to which components or copier areas, or both (if any), the consumer may have access to for visual evaluation of toner build-up and use of the vacuum cleaner. It may be necessary for the user to require the copier manufacturer's service people to perform all necessary component clean-up. Should this step be required, the user should be present to observe and record all observations regarding this maintenance step.

9. Sampling

9.1 Sampling is not applicable to this practice.

10. Procedure

10.1 Before beginning this practice comparison, read, understand, and follow the manufacturer's instructions on the operation of the copier. The toner being evaluated is best tested in a copy system at the site of its proposed installation under the line voltage conditions that would normally apply. The test target should be prepared as described in Practice F 360, Section 6.

10.2 Clean the copier using the vacuum cleaner. Refer to 8.1 and 8.2. Cleaning should encompass all transport systems, corona wires (using a recommended brush), the developer unit, etc. Follow all of the copier manufacturer's instructions pertaining to cleaning and maintenance.

10.3 Once the copier and toner developer system is visually clean and reassembled into the copier, the user should image several copies using any test target. If an image or any extraneous toner deposits are visible on either the front or back sides, repeat 10.2 and 10.3 until the imaged copies show no images.

10.4 Load the reference supplies into the copier. Follow the manufacturer's directions for adjustments of the various controls, if any are present.

10.5 Turn on the copier and if required, allow several minutes for warm-up.

10.6 Set the exposure control, if one is provided, to either end of the exposure range.

10.7 Using the prepared test target, make a copy. Record the exposure setting, time (if desired), and date on the copy.

10.8 Image copies at various exposure settings. Record the setting, time, environmental conditions, sequence number, and date on each copy. The operator each time should move the exposure setting in the same direction on the exposure control device when preparing a sequence of imaged copies. The starting point on the exposure control device should always be at the same point for each set of copies.

10.9 Determine the copier setting that, in your opinion, is the one yielding the best appearing copy. This is referred to as the "optimum copy."

10.10 At this optimum setting, image the number of copies that would constitute a normal length of run. This will allow comparison of toner uniformity as well as the toner replenishment system. Place or set the test original into the copier in the same orientation each time.

10.11 At the optimum setting, reverse the orientation of the test subject placed or set into the copier and make a copy. This copy can then be compared to previous copies to determine the effect of subject orientation variations. Record all pertinent information on this copy such as exposure setting, time, date, and test target orientation for possible future reference.

[3] A Copy Vac Model 999-21 Dry Vacuum Cleaner is available from Copylite Products, 2890 Griffin Road, Fort Lauderdale, FL 33312.

10.12 Image a sufficient number of copies at the optimum setting, that would constitute a very large copy run, for example 500 to several thousand. Care should be taken during this test by the user to follow any recommended maintenance steps by the copier manufacturer, for example changing electrostatic masters, etc. if this step is part of the copier mechanics. During the course of this long-range test sequence, the user should note and record the following observations:

10.12.1 Any jamming encountered including the number of and location,

10.12.2 Cleanliness of the copy on both the imaged and back sides,

10.12.3 Odor from the fusing section of the copier, and

10.12.4 The user if possible, should inspect the toner in the developer unit at random intervals to ascertain any formation of caking or hard lumps. Should any build-up of toner caking be observed that cannot be easily broken up with a light brushing using a soft brush, this result is considered unsatisfactory.

10.13 During this large copy run, the special features that are included on the test copier should be operated to determine the range of toner capability. These special features may include light document control, colored background control, image reduction or enlargement control, duplexing control, etc.

10.14 At the end of the large copy run, the user should inspect the accessible copier internal components and record any tone buildup, deposits on the various copier components. The user should record the location of any buildups and should rate any observations using the following recommended rating scale: 5–light, 3–medium, and 1–heavy.

10.15 To test a different lot or type of toner from the same or from another supplier (see 8.1) remove the toner system in the copier using the cleaning technique outlined in 10.2 and 10.3.

10.16 When the copier and the toner developing system is clean, add the supplies to be tested according to the supplier's recommendation, and make a set of copies for comparison to the previously made reference set (10.1 through 10.13).

11. Interpretation of Results

11.1 In evaluating the short and long run results from a toner under test in a copying machine, examine the following points (or those the user anticipates are pertinent to their particular copying needs) and compare to the reference toner. In the long-copy run evaluation, the user may want to only inspect either every 50th, 100th, 200th, etc., imaged copy.

11.1.1 Density, apparent optical contrast, or relative blackness of characters.

11.1.2 Development of large solid image areas; are they filled in evenly, or is there a density variation?

11.1.3 Color and cleanliness of background.

11.1.4 Freedom from objectionable face or backmarking characteristics when compared to the reference toner supplies.

11.1.5 Uniformity of the imaged copy compared to the test target.

11.1.6 Fidelity of the imaged copy to the test target.

11.1.7 Distortion of characters.

11.1.8 Smudge characteristics upon removing the imaged copy from the copier or in a stack of copies. To evaluate this characteristic, lay a single imaged copy face up on a suitable flat surface. The evaluator should gently but firmly, slide either the palm of the hand or the fingers across the imaged surface. Movement across the imaged surface should cover letter imaged areas, solid black-filled areas, and gray areas on the copy. Both the reference and the test toner supplies should be evaluated in the same manner and relative time frame.

11.1.9 Freedom from feathering (blasting) of the images.

11.1.10 Reproduction of colored lines and characteristics.

11.1.11 Reproduction of pictorial illustrations.

11.1.12 Freedom from objectionable odor, particularly in those copiers employing heat-fusing techniques.

11.1.13 Any black-density variation of imaged letter characteristics or solid black areas during the long-imaged copy run.

11.1.14 Sharpness or freedom from bridging.

11.1.15 Resolution. The user should be aware that resolution is not related solely to toner. Although the copier optical system and photoconductor are vitally important factors, it is possible for the user to measure toner contribution to resolution by holding copier conditions constant.

11.1.16 Toner build-up, deposits, or any bead or granular carry-out, etc., on the various copier components and beneath, around the copier. If the copier is a table top version the user should also inspect the table top for any toner, bead, or granular deposition.

11.1.17 Jamming of the copy paper. The user should be aware that this defect may be a result of toner throw-out depositing in critical transport pathways or to deposits on feed rollers due to duplexing.

11.1.18 Variations may exist from copier to copier with identical model designations, and from one copier to another due to run lengths, a possible variety of test originals, customer preference in contrast, etc. These parameters, coupled with the difficulty of measurement techniques, make quantification of yield (number of copies per weight of toner system) highly complex and are therefore not included in this practice.

11.2 The results of the test may be interpreted or expressed in terms of a rating scale or system. A recommended rating scale would include a five-step scale of values or rankings of merit as follows: 5–good, 3–middle, and 1–bad.

12. Precision and Bias

12.1 When this practice is used to compare two or more toners within a laboratory, the rating scale and comparative ranking order is repeatable. Because the interpretation of results is dependent upon the subjectivity of the observations and varying preferences from one consumer to the next, this repeatability is not necessarily anticipated between laboratories.

13. Keywords

13.1 copiers; dry toner; image quality; toner

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