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T 537

DRAFT NO. 02-SARG

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WORKING GROUP CHAIRMAN NA

SUBJECT CATEGORY Physical Properties

RELATED METHODS See "Additional Information"

CAUTION:
This Test Method may include safety precautions which are believed to be appropriate at the time of publication of the method. The intent of these is to alert the user of the method to safety issues related to such use. The user is responsible for determining that the safety precautions are complete and are appropriate to their use of the method, and for ensuring that suitable safety practices have not changed since publication of the method. This method may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this method, the user must determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, must follow strictly the procedures specified by both the manufacturer, as well as local, state, and federal authorities for safe use and disposal of these chemicals.

Dirt count in paper and paperboard (optical character recognition – OCR)

(Five-year review of Official Method T 537 om-16)

(No changes from previous draft: Standard reaffirmed)

1. Scope

1.1 This method is suited for the numerical estimation of cleanliness for optical character recognition (OCR) purposes of paper and paperboard in terms of the frequency of dirt, specks, or marks. For other dirt count methods, see TAPPI T 437 "Dirt in Paper and Paperboard," TAPPI T 213 "Dirt in Pulp," and TAPPI T 563, "Equivalent Black Area (EBA) and Count of Visible Dirt in Pulp, Paper and Paperboard by Image Analysis."

1.2 This method may be used in applications where the number of specks per unit area rather than the equivalent black area is required.

1.3 In this method, each dirt speck is counted individually regardless of size, shape, or color. This differs from TAPPI T 437 where the dirt is expressed in terms of equivalent black area and is a function of its color, contrast with the background, and shape.

2. Significance

The method provides a measure of the frequency of dirt specks in white or colored paper, that can affect the performance of paper in an OCR application.

3. Definitions

A dirt, speck, or mark in paper or paperboard is defined for the purpose of this method as foreign matter imbedded in or on the surface of a sheet, having a contrasting color to the rest of the sheet and having an area of 0.02 mm^2 or more. (In this method, the word "speck" means any foreign matter).

4. Apparatus

4.1 *Illuminant*, lighting arrangements to give about 1400 – 1600 lumens/m^2 (130 – 150 ft-candles) of white light or daylight on the specimens. The distance from the observer to the specimen shall be that normally required to read 10-point type size. The eyesight of the observer shall be adequate to allow him or her to distinguish a speck size of 0.02 mm^2 on the dirt estimation chart.

4.2 *Dirt estimation chart*[1] a photographic print as described in TAPPI T 437 (Fig. 1). The information on the TAPPI chart relates to its use in TAPPI T 437 and should be ignored when used with this method.

5. Test specimens

5.1 If a lot of paper is being tested, sample the paper in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product."

5.2 From each test unit select duplicate test specimens, each specimen consisting of a set of 10 or more sheets and having a total one-side area of at least 1 m^2.

[1] Due to the reproduction process of printing this test method, the dirt estimation chart shown here is not accurate. An accurate photographic print is available from the TAPPI Member Connection Department (1-800-332-8686 U.S. or 1-800-446-9431 Canada).

NOTE 1: There may be instances where an area different from 1 m^2 must be examined to achieve an acceptable level of counting precision [see Section 9.5]. Choose a consistent target of counting precision and measure enough paper surface to reach that precision. This area must contain a quantity of dirt that exceeds the minimum required to reach the chosen level of counting precision and must be representative of the manufacturing process.

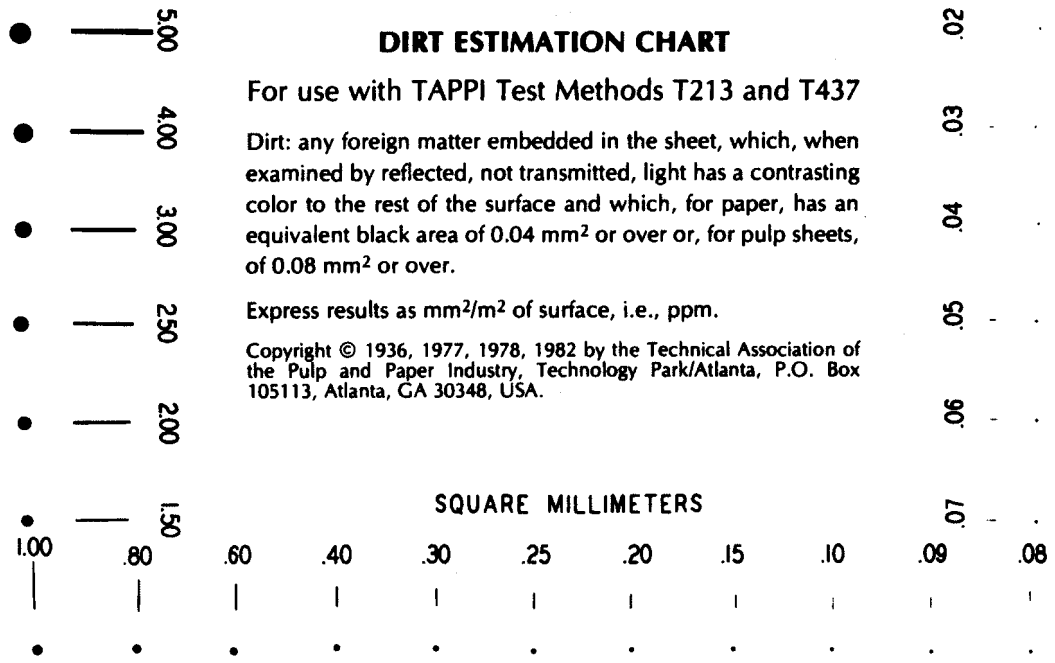

Fig. 1. Dirt Estimation Chart (do not use this copy of the chart to reproduce this chart for use; size of spots can be altered in copy machine; use only the printed opaque chart available from TAPPI).

6. Procedure

6.1 Make sure that the hands are clean before examining the paper. Examine the felt side (or top side) or the side of special interest of each sheet in a dust-free place, unless special instructions require that both sides be examined. Refer to TAPPI T 455 "Identification of Wire Side of Paper" for determination of wire and felt sides. Place the paper on a white background.

6.2 Using the dirt chart to determine the size of 0.02 mm^2 speck, count all specks of size 0.02 mm^2 or larger. While counting, identify each speck with a colored pencil mark of contrasting color of the sheet and dominant specks. Repeat visual scans of the sheet until all visible specks of marked contrasting color of the minimum size have been marked and counted.

6.3 If the dirt count exceeds 300 specks per m^2, the areas of the test specimen may be reduced, providing the number of dirt specks counted does not go below 300.

6.4 Examine duplicate sets of sheets.

7. Calculation

Measure the examined area of each sheet of the test specimen. Total and record the number of dirt specks observed in the examined area. Calculate for each specimen the number of dirt specks per square meter, on one side. If the paper has been examined on both sides, calculate separately for each side.

8. Report

8.1 For each test unit, report the average number of dirt specks per square meter of the two specimens on the felt side or on felt and wire sides separately when so instructed.

8.2 Report the counting precision for each averaged count per unit area.

8.3 To report the results as number of dirt specks per 1000 in.^{2}, multiply the value obtained in 8.1 by 0.65.

8.4 Report the area and the number of specimen sheets examined.

8.5 Note the presence of any unusual number of large or tiny specks.

9. Precision

9.1 The repeatability and reproducibility were determined according to TAPPI T 1200 “Interlaboratory Evaluation of Test Methods to Determine TAPPI Repeatability and Reproducibility.”

9.2 Repeatability = 16%.

9.3 Reproducibility = 31%.

9.4 The precision statement is based on a study involving three observers examining duplicates from each of three test lots having a dirt count varying from 42 to 102 specks/m^2. The test lots were 1 m^2.

9.5 The size distribution of naturally occurring dirt particles is log-normal and is approximated by a Poisson like distribution where the counting precision P is given by:

$$P = 100\% / N^{½}$$

and where N is the total accumulated speck count. This implies that the precision of the count is dependent on the number of specks counted. For example: If a judge examines two samples, of equal area, where Sample A has a total speck count of 100 ($P = \pm 10.0\%$) and Sample B has a total speck count of 107 ($P = \pm 10.3\%$), then the counts are different by less than one standard deviation (i.e. 1 sigma) and would not be considered significantly different at 66%, or higher, confidence.

10. Keywords

Dirt count, OCR, Paper, Paperboard.

11. Additional information

11.1 Effective date of issue: To be assigned.

11.2 OCR scanners may have spectral responses varying from the near ultraviolet to the infrared; hence, some colors of specks that are detectable by one scanner may not be detected by another. However, practical aspects of this test dictate that any speck greater that 0.02 mm^2, regardless of color, be counted.

11.3 The minimum dirt size considered to be significant will vary depending upon the particular OCR scanner and application. It therefore may be appropriate to select a larger minimum speck size; if this is done, it should be appropriately noted on the report.

11.4 Cleanliness of paper and paperboard is frequently specified using the equivalent black area method as determined by TAPPI T 437.

Your comments and suggestions on this procedure are earnestly requested and should be sent to the TAPPI Standards Department. ■