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Grammage of paper and paperboard (weight per unit area)

1. Scope

1.1 In the United States the customary or commercial term for expressing the “weight” per unit area (more properly “mass per unit area”) of paper has been “basis weight,” “ream weight,” or “substance.” These are defined as the mass in pounds of a ream of a given sheet size and number of sheets (usually 500 sheets, occasionally 480 sheets). In most other countries the mass per unit area is expressed in grams per square meter, g/m^2 . The French term for mass per unit area, “grammage,” is recommended by ISO Committee TC 6 on Paper for use in English as well as in French because of its convenience and clear relationship to g/m^2 .

1.2 The mass per unit area of paperboard has been expressed in the customary system as the mass in pounds per thousand square feet, and in the metric system as grams per square meter (g/m^2).

1.3 The SI metric units, in which grammage (mass per unit area) is expressed in g/m^2 , are the preferred units for TAPPI Test Methods.

2. Summary

The area of several sheets of the paper or paperboard is determined from linear measurements and the mass (commonly called “weight”) is determined by weighing. The grammage is calculated from the ratio of the mass to the area after conversion to metric units when necessary.

3. Significance

Most paper is bought and sold in accordance with its mass per unit area, and therefore the grammage has great

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significance both to the consumer and the producer in defining price. The values of many physical properties such as bursting strength, thickness, and bulk are interpreted and specified with regard to grammage. The grammage is also used to calculate the index properties of many strength properties and thus the proper measurement of basis weight is critical for the correct calculation of these indexes.

4. Apparatus¹

4.1 *Scale*, readable and accurate to within 0.25% of the applied load, and shielded from air currents.

4.1.1 Special sheet-weighing devices designed to weigh test specimens of a given size may be used, provided that the above conditions are fulfilled and that the total area of each test specimen (see 6.3) in a single weighing is not less than 500 cm² (80 in.²).

4.1.2 For a test specimen of smaller total area, an analytical balance is essential to obtain the required accuracy.

4.2 *Cutting device*, such as a “four square” cutter, circular cutter, precise puncher or other device for ensuring parallelism of the opposite edges, normally capable of repeatedly cutting out test specimens whose area, in at least 95 instances out of 100, falls within $\pm 0.5\%$ of a known area, as determined by the method specified in 5.2.1.

4.2.1 When a template is used for preparing test specimens, the specimen shall be cut accurately as described in 4.2 with a sharp knife on a hard surface, such as a hardwood board.

4.3 *Scale*, a steel rule graduated in 0.5 mm ($1/50$ or $1/64$ in.) increments, capable of measuring the dimensions of the test specimen to an accuracy of 0.2%.

5. Calibration

5.1 *Checking of weighing device.*

5.1.1 Check the accuracy of the weighing device frequently (5.3) by applying accurately measured masses with both increasing and decreasing loads. If a sheet-weighing device is used, properly calibrated ~~it~~ to the required accuracy (4.1).

5.1.2 Ensure that frictional effects are sufficiently minimal and the zero reading is sufficiently correct so as to attain the required weighing accuracy.

5.2 *Checking of cutting device.*

5.2.1 Frequently (5.3) check the specimen area cut by using the scale (4.3) to measure 20 test specimens. The cutting accuracy specified in 4.2 is attained when the standard deviation of the individual areas is less than 0.25% of the mean area, in which case this mean area may be used for calculating grammage in subsequent tests.

5.3 *Frequency of checking.*

5.3.1 Base the frequency of checking in 5.1 and 5.2.1 on experience. Check a new device several times before being put into use. Then, if in continuous use, check it twice daily until stability is established, then weekly, monthly, or less frequently as indicated by its stability, unless moved or unduly disturbed. Because of wear, the cutting device may require more frequent checking than the weighing device.

6. Sampling

6.1 For conformance testing, obtain the sample of the paper or paperboard to be tested in accordance with TAPPI T 400 “Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product.” Otherwise, select a sample that will meet needs for testing.

6.2 After conditioning each test unit of the sample, cut a sufficient number of representative sheets for a total area per test unit of at least 5000 cm² (800 in.²). The dimensions and hence the area of each sheet will depend on the sheet cutting device available. If a template is used, a minimum dimension of 20.0 × 25.0 cm (8 × 10 in.) is recommended.

6.3 Select the number of sheets composing a test specimen (total area of each test specimen at least 500 cm²) to give the required weighing accuracy.

¹ Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list, available as part of the CD or printed set of Standards, or on the TAPPI website general Standards page.