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T _____ 412 _____

BALLOT NO. _____ 02 - SARG _____

DRAFT NO. _____ 01 _____

DATE _____ November 03, 2026 _____

WORKING GROUP
CHAIR _____ N/A _____

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 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.

Moisture in Pulp, Paper and Paperboard *(Five-year review of Official Method T 412 om-22)*

1. Scope and significance

1.1 The following procedure applies to pulp, paper, paperboard, and paper products, except those containing significant quantities of materials other than water that are volatile at lower than 107°C (224.6°F) or degrade above 103°C (217.4°F). Moisture is significant for economic reasons and for its effect on such properties as printability, shrinkage, dimensional stability, physical strength, and paper runnability.

1.2 This method should be followed to:

1.2.1 Determine the amount of moisture in a lot of pulp, paper or paperboard as an "as received" moisture.

1.2.2 Determine the amount of moisture in shipping containers.

1.2.3 Calculate results of analysis of the moisture content on the original weight of the specimen.

2. Apparatus

2.1 *Weighing container*, for small specimens, a wide-mouth, glass-stopper weighing bottle approximately 65 mm (2.56 in.) in diameter and 45 mm (1.77 in.) high. For larger specimens, use an airtight metal or other airtight container (non moisture responding), preferably equipped with a removable wire basket, and of such a size as to accommodate the specimens without their being tightly packed. The container used shall be of a material that is not affected by heat.

2.2 *Drying oven*, constant-temperature, with means of ensuring adequate temperature control at $105 \pm 2^{\circ}\text{C}$ ($221 \pm 3.6^{\circ}\text{F}$) and free access of air.

NOTE 1: There is danger of local overheating if the specimens are exposed to direct rays of unshielded heating elements.

2.3 *Balance*, accurate to 1 mg (0.000035 oz), for weighing specimens of 2 g (0.000071 oz) and less; for larger specimens, accurate to 0.05% of the original weight of the specimen.

3. Safety precautions

Employ proper personal protective equipment for removing items from hot ovens.

4. Sampling

4.1 For pulp, sample in accordance with TAPPI T 210 "Sampling and Testing Wood Pulp Shipments for Moisture."

4.2 When sampling a shipment for moisture, take extreme care to avoid any change in the moisture content. For paper and paperboard, sample in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product."

4.3 For moisture in containers, cut specimens from unsealed and unprinted sections.

5. Test specimens

5.1 For moisture in a lot of pulp, paper or paperboard, obtain duplicate test specimens.

5.2 *General precautions:* Do not use bare hands to handle specimens. Handle specimens and weighing containers with clean, dry, rubber or polyethylene gloves or tools and place each specimen as soon as obtained in the tared container and close it immediately. If there is a delay of even a few seconds in making the transfer, keep the specimen covered on both sides with several of its adjacent layers until it is ready for placement in the container. Unless the specimen is to be spread out later in the oven, avoid filling the container tightly.

6. Procedure

6.1 For large specimens [*larger than 2 g (0.071 oz)*]

6.1.1 Weigh each specimen to the nearest 0.02 g (0.00705 oz) in a closed container. Unless the container has a removable basket, remove the specimen from the container, spread it on a tray preferably made of wire mesh to enable free circulation of air around it and place it and its container in the oven. Heat for 60 ± 5 min at $105^{\circ} \pm 2^{\circ}\text{C}$. If grammage is greater than 224 g/m^2 , heat for 120 ± 5 min. If grammage in basis weight is needed to determine the needed time, convert to g/m^2 according to T 410 "Grammage of Paper and Paperboard (Weight per Unit Area)."

6.1.2 Replace the specimen in its container and close it, doing this in the oven if possible. Allow the closed container and contents to cool to room temperature in a desiccator containing a charged drying agent such as anhydrous calcium sulfate. When cool, open the container momentarily to allow air to enter before reweighing and reweigh to the nearest 0.02 g (0.00705 oz).

6.2 For small specimens [*2 g (0.071 oz) or smaller*]

6.2.1 Weigh the specimen in the tared weighing bottle to the nearest milligram, place it in the drying oven, remove the stopper and heat for 30 ± 3 min; for grammages greater than 224 g/m^2 , heat for 60 ± 5 min.

6.2.2 Restopper the bottle, remove it from the oven, cool to room temperature in a desiccator, loosen the stopper momentarily to allow air to enter, and reweigh. Carry out this weighing step within 30 min after removal of the bottle from the oven to prevent reabsorption of water vapor by the specimen.

6.3 *For all specimens:* after an initial drying period as specified in 6.1.1 and 6.2.1 use a second drying period, at least equal to the first and subsequent drying periods, each of which is at least one-half the total of all previous drying periods, until two successive weighings do not differ by more than 0.1% of the weight of the specimen. During these periods do not put any new test specimens in the oven.

7. Report

Calculate the moisture for each specimen as the percentage loss of the original weight of the specimen, to the nearest 0.1%.

$$\text{Percent moisture content} = \frac{(W_1 - W_2)}{W_1} (100)$$

where:

W_1 = initial specimen weight
 W_2 = dry specimen weight

Report as moisture the average of the values for the two specimens. Any variations from the recommended method should be stated in the report.

8. Precision

8.1 The values of repeatability and reproducibility provided below have been calculated for test results each of which is the average of two replicate test determinations. The values are based on data obtained from the CTS Collaborative Interlaboratory Proficiency Testing Program for Paper and Paperboard, Reports 164G through 192G in which the range of test results was 4 to 6%. The terms are in accordance with the definitions in TAPPI T 1200 "Interlaboratory Evaluation of the Test Methods to Determine TAPPI Repeatability and Reproducibility."

8.2 Repeatability (within a laboratory) = 0.075% moisture (not % of percent moisture).

8.3 Reproducibility (between laboratories) = 0.93%.

8.4 Note that these are for paper and paperboard only. The user of these precision data is advised that it is based on actual mill testing, laboratory testing, or both. There is no knowledge of the exact degree to which personnel skills or equipment were optimized during its generation. The precision quoted provides an estimate of typical variation in test results which may be encountered when this method is routinely used by two or more parties.

8.5 The precision and accuracy of test results will be affected by: (a) variations in moisture content throughout a reel; (b) handling and atmospheric exposure; and (c) the ambient relative humidity of the drying oven. A difference of up to 0.3% moisture content in bleached paperboard has been noted between cases where the oven has been located in a low relative humidity (less than 15%) or at standard (50%) humidity. Where possible, it is suggested to locate the oven in the test laboratory environment of 50% R.H.

9. Keywords

Pulp, Paper, Paperboard, Moisture content

10. Additional information

10.1 Effective date of issue: To be assigned.

10.2 Related methods: ISO 287; Canadian PAPTAC G-3; Australian Standard AS1301.457s.

10.3 This method was issued in 1926, corrected in 1935, revised in 1941, 1942, and 1953, issued as a suggested method in 1969, and made official in 1983. In 1990 the method was split into two methods, the alternate for equilibrium moisture content can be found as TAPPI T 550 “Determination of Equilibrium Moisture in Paper and Paperboard for Chemical Analysis.”

10.4 In 1993 the method was altered to include pulp moisture measurement.

10.5 In 2011 a safety section, English units, and some tolerances were added.

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

