



Designation: **D685 – 12 D685 – 17**

An American National Standard
Technical Association of Pulp and
Paper Industry Standard Method T 402

Standard Practice for Conditioning Paper and Paper Products for Testing¹

This standard is issued under the fixed designation D685; 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-~~Scope~~*

1.1 This practice defines the standard atmospheres for normal preconditioning, conditioning, and testing of paper and paper products, paperboard, fiberboard, and containers made from them. It also specifies procedures for handling these materials in order that they may reach equilibrium with the respective atmosphere.

1.2 This practice does not include special conditioning and testing atmospheres, such as those that attempt to simulate tropical or arctic environments.

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.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ~~ASTM Standards:~~²

~~D585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product (Withdrawn 2010)~~³

~~D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing~~

~~E171/E171M Practice for Conditioning and Testing Flexible Barrier Packaging~~

2.1 ~~ISO Standards:~~²

~~ISO 187 Paper, board and pulps -- Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples~~
~~Board and Pulps—Standard Atmosphere for Conditioning and Testing and Procedure for Monitoring the Atmosphere and Conditioning of Samples~~

2.2 ~~TAPPI Standard:~~³

~~TAPPI T400 Sampling and Acceptance of a Single Lot of Paper, Paperboard, Containerboard or Related Product~~

~~TAPPI/TAPPI/ANSI T402-sp-03 Standard Conditioning and Testing Atmosphere for Paper, Board, Pulp Handsheets and Related Products~~

3. Significance and Use

3.1 The preconditioning requirement is important because physical properties of a sample at 50 % relative humidity depend upon whether the sample is brought to 50 % from a higher or lower relative humidity. A detailed discussion of the importance of preconditioning may be found in **Annex A1**.

3.2 The conditioning and testing atmospheres are important because both temperature and relative humidity have significant effects on the physical properties of paper and board. A more detailed discussion of the importance may be found in **Annex A2**.

¹ This practice is under the jurisdiction of ASTM Committee **D10** on Packaging and is the direct responsibility of Subcommittee **D10.21** on Shipping Containers and Systems - Application of Performance Test Methods.

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² Available from American National Standards Institute (ANSI), 25 W. 43rd St., W43rd St, 4th Floor, New York, NY New York 10036, <http://www.ansi.org>.

³ Available from Technical Association of the Pulp and Paper Industry (TAPPI/TAPPI) 15 Technology Parkway South, Norcross, Norcross GA 30092, <http://www.tappi.org>.

*A Summary of Changes section appears at the end of this standard

3.3 This standard is technically identical to TAPPI T-402.

4. Standard Atmospheres

4.1 *Preconditioning Atmosphere*—10 to 35 % relative humidity and 22 to 40°C (see Annex A1 and Annex A2).

4.2 *Conditioning Atmosphere*— 50.0 ± 2.0 % relative humidity and 23.0 ± 1.0 °C.

4.3 *Testing Atmosphere*—Same as 4.2.

NOTE 1—It is important to distinguish between the overall limits of the temperatures within which conditioning and testing may be carried out and the limits within which the temperature must be maintained in order to maintain the specified relative humidity limits; that is, the close temperature tolerance of $\pm 1^\circ\text{C}$ required in Average values must fall within these limits. Momentary fluctuations 4.2 and 4.3 will not in itself ensure the close relative humidity requirement of ± 2 % relative humidity, as a sudden change of 1°C when at 23°C and 50 % relative humidity will change the relative humidity about 5 to 6 %; measurement limitations may cause individual measurements to vary up to $+2^\circ\text{C}$ ($+3.6^\circ\text{F}$) and $+5$ % relative humidity without significant impairment of test precision.

5. Apparatus

5.1 *Preconditioning Chamber*—A room or cabinet in which sample sheets or specimens may be individually exposed to circulating air at the preconditioning relative humidity and temperature.

NOTE 2—For smaller sheets or specimens, the required preconditioning may be achieved easily with a simple cabinet, if no other means are available. If this cabinet is operated in a room maintained at 50 % relative humidity and 23°C and so designed that room air is drawn through it, and if the air entering and in the cabinet is heated to a temperature of $39 \pm 1^\circ\text{C}$, the relative humidity in the cabinet will be in the required range (that is, 20 ± 3 % relative humidity). Commercially available forced-ventilation “ovens” should prove satisfactory. Input air to the oven should be drawn from the standard room, output should be vented outside of the standard room.

5.1.1 For many papers and boards, approximately the same preconditioning moisture content obtained by the above procedure may be achieved by using a sealed cabinet operated in a room maintained at $23 \pm 1^\circ\text{C}$ and using a saturated solution of lithium chloride (LiCl) to obtain a relative humidity of about 12 to 13 %.

5.1.2 For larger rooms needed for preconditioning sealed containers and large sheets, the required low relative humidity may be achieved by drawing air over a refrigerator expansion coil operating at a few degrees above freezing temperature.

5.2 *Conditioning and Testing Chamber*—One or more rooms or cabinets in which sample sheets or specimens may be individually exposed to circulating air at the conditioning relative humidity and temperature, and then tested under the same conditions.

NOTE 3—The required relative humidity (50.0 ± 2.0 %) and temperature ($23.0 \pm 1.0^\circ\text{C}$) are difficult to achieve and therefore careful attention must be given to the design, evaluation, and maintenance of the “standard room.”

5.3 *Hygrometer*—Any instrument that can indicate directly or indirectly the relative humidity of the air with a calibrated accuracy of ± 0.5 % relative humidity.

5.4 *Thermometer*—Either the dry bulb of a psychrometer (that is, a hygrometer of the wet- and dry-bulb type) or a separate thermometer of any convenient design. If a separate thermometer, it should be graduated to 0.2°C or closer with scale errors not exceeding these values. (Psychrometer thermometers must be graduated and correct to 0.1°C or closer and carefully matched to each other to give the required accuracy and repeatability in the measurement of relative humidity.)

6. Procedure

6.1 Obtain and preserve the sample in accordance with Practice TAPPI D585-T400. In particular, avoid exposure of the sample to direct sunlight, to extremes of temperature, and, to relative humidities above 58 % (see Annex A1). If the sample is to be held for some time before testing, preserve it at a temperature below 25°C and relative humidity below 58 %, but not below 10 % as the paper may curl or cockle and change in other respects.

NOTE 4—It has been reported that low-temperature storage below 10°C slows aging effects. Samples should be protected against condensation.

6.2 Cut the specimens from a sample where critical dimensions are involved only after conditioning the sample. Where there are no critical dimensions, the specimens may be cut before preconditioning or conditioning.

6.3 If shipping containers are to be sealed with aqueous adhesives, make the seal prior to preconditioning.

6.4 Expose the sample sheets or specimens to the preconditioning atmosphere so that both surfaces of single sheets and exterior surfaces of laminated products or sealed containers are freely exposed. This is best achieved by suspending them from overhead or supporting them on a wire grid or rack.

6.5 Precondition the sample sheets or specimens by exposing them as specified in 6.4 to the preconditioning atmosphere. Precondition for a minimum of 24 h, unless a lesser time has been found to give satisfactory results.

NOTE 5—For preconditioning apparatus of ample capacity and air circulation, the following preconditioning times have usually been found satisfactory: single sheets of paper, less than 1 h; liners corrugating medium, chip board, box board, 1 to 2 h; corrugated and solid fiber board in sheet form, 5 to 10 h; sealed boxes and shipping containers, 12 to 16 h; specially treated water vapor resistant papers and boards, 24 h and more.