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T 808

BALLOT NO. 02 - SARG

DRAFT NO. 01

DATE May 29, 2025

WORKING GROUP
CHAIR N/A

SUBJECT
CATEGORY Fiscotec (Fiberboard Shipping Container Testing)

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.

Flat Crush Test of Corrugated Board (Flexible Beam Method)

(Ten-year review of Classical Method T 808 cm-15)

1. Scope

The flat crush test (*1*) is a measure of the resistance of the flutes in corrugated board to a crushing force applied perpendicular to the surface of the board under prescribed conditions. The test is satisfactory for single-faced or single wall (double-faced) corrugated board, but not for double-wall or triple-wall corrugated board or other complex corrugated structures, because of lateral motion of the central facing or facings.

2. Significance

2.1 Flat crush is a measure of the flute rigidity of corrugated board. A high flat crush value indicates a combination of good flute formation and at least adequate strength medium. Low flat crush can indicate a number of conditions. Among these are low strength medium, leaning flutes, crushed flutes, or poorly formed flutes.

2.2 This method generally does not simulate the reaction to crushing forces exerted on a container during actual use. Therefore, the correlation may be low between flat crush and the ability of a box to perform in the field. However, this method does provide a measure of medium strength available for keeping the two liner facings apart.

2.3 Boxes made from crushed corrugated board may have low flat crush and may not perform well. Board with leaning flutes may have low flat crush, but this may not affect box performance. For leaning flutes to cause low flat crush, there must be lateral movement between the two liners during the tests. After the board is formed into a box, lateral movement between the two liners is restricted by the geometry of the box, and the low flat crush cannot become operative. Also, this test method does not take into account the effect of linerboard stiffness in resisting crushing forces.

3. Safety precautions

3.1 The circular cutter used to prepare the samples has sharp blades and is often unguarded or improperly guarded. Proper Personal Protection Equipment (PPE) (cut-proof gloves) should be worn at any time one is working around the blades. A warning label should be on each cutter advising of the proper PPE. The motorized cutter blade is moving whenever the unit is powered. Any time the hands reach under to retrieve a sample they are exposed to the blade. The hand driven cutter uses sharp pointed spikes to puncture the board and hold it steady while being cut. These holding spikes, along with the blades, can cause severe injury.

3.2 Care should be taken when changing the flat crush cutter blades. The blades are thin and must be bent around the holder as they are secured. A blade can fracture during this process and send off shards. It is recommended that safety glasses be worn as well as cut-proof gloves during this operation.

4. Apparatus

4.1 *Compression machine*[1] consisting of upper and lower platens held rigidly parallel and free from lateral movement within 0.05 mm (0.002 in.). The platens must be parallel to within 1 part in 2000 when measured diagonally across the bare platens. To prevent slippage of the specimens, the platen surfaces must have sufficient friction by themselves or by facing them with fine emery cloth or 400+ wet and dry sandpaper, free of ridges, by means of double-sided tape. The facing cloth should be changed after every 2000 tests. Means are provided for compressing a specimen placed between the two platens at a uniform rate.

4.1.1 The capacity of the tester may be 2224 N (500lbf) or 4448 N (1000 lbf). The rate of applying the load is 111 ± 22 N/s (25 ± 5 lbf/s), and the pulley ratio should be such as to achieve this rate.

4.1.2 Means are provided for measuring and indicating the applied load within 5 N (approximately 1 lbf) and such that the indicator can be accurately calibrated with dead weights. The accuracy required is 0.5% or 2.5 N (approximately 0.5 lbf), whichever number is greater.

NOTE 1: See Appendix for calibration procedures.

4.2 *Specimen cutter*, consisting of a device capable of cutting through the corrugated combined board structure without crushing areas of the body of the sample or at the cut edges. This may be circular, square, or rectangular.

[1] Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list in the set of TAPPI Test Methods, or may be available from the TAPPI Standards Department.

5. Sampling and test specimens

5.1 From each test unit of a sample obtained in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product," select a minimum of 10 specimens free of abnormalities so that a representative sample of the combined board is tested. Cut each specimen, preferably in circular form, so that each is either 32.3 cm^2 (5.00 $in.^2$) or 64.5 cm^2 (10.00 $in.^2$) in area. Cut all specimens at least 38 mm (1.5 in.) away from printed matter, scores, and die-cuts.

5.1.1 If the specimens are not circular, exercise special care to accurately maintain the desired area.

5.2 Avoid crushing areas at the cut edges, and, where possible, avoid fractional flute counts.

6. Procedure

6.1 Precondition, condition, and test the board in an atmosphere in accordance with TAPPI T 402 "Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products."

6.1.1 After cutting to size, position the specimen centrally on the lower platen with the corrugations parallel to the front of the machine. Apply the crushing load to the specimen until the side walls of the corrugations collapse completely. Failure is defined as the maximum load sustained before complete collapse.

NOTE 2: Normally, a preliminary end point or end points occur when the tips of the corrugation flatten on one or both sides of the specimen. This should not be confused with the final end point when the corrugations collapse completely. If the collapse of the corrugations is so gradual that no such peak load is distinctly registered, note this fact.

7. Report

7.1 Report the flat crush test results, in kilopascals or pounds per square inch, as the average of ten determinations, to three significance figures [kPa = (psi)(6.895)].

7.2 Include for a complete report:

7.2.1 The standard deviation.

7.2.2 The total number of specimens tested.

7.2.3 The number of specimens exhibiting rolling failure. (see note 3)

7.2.4 The testing machine used, flute identity A, B, or C, etc., and the flute count.

NOTE 3: Rolling failure is defined as an irregular skewed pattern or leaning type of collapse of the flutes.

8. Precision

8.1 Repeatability (within a laboratory) = 5%.

8.2 Comparability (between materials) = 7%.

8.3 Reproducibility (between laboratories) = 10%.

8.4 These terms are in accordance with the definitions in TAPPI T 1200 "Interlaboratory Evaluation of Test Methods to Determine TAPPI Repeatability and Reproducibility."

8.5 These data were obtained in a round-robin among three laboratories, with six different testers, using 10 specimens of 64.5 cm^2 (10 $in.^2$) in area.

9. Keywords

Corrugated boards, Flat crush tests, Compressibility, Compression strength, Flutes.

10. Additional information

10.1 Effective date of issue: To be assigned.

10.2 This method was first published in 1965 as a suggested method, and it became an official method in 1971. The 2013 version made some housekeeping changes to the Scope, Sections 4.1 and 5.1, and Note 4, and also added a Safety Precautions section. In 2015, the method was reclassified as a Classical Method because flexible beam procedures are no longer in common use in referee testing laboratories, being superseded by load cell testing devices. It has been found that T 808 produces significantly lower flat crush values than those obtained from TAPPI T 825 "Flat Crush of Corrugated Board (Rigid Support Method)."

10.3 Related methods: TAPPI T 825 “Flat crush test of corrugated board (rigid support method)”; APPITA P 429 “Flat Crush Resistance of Corrugated Board,” Technical Association of the Australian and New Zealand Pulp and Paper Industry, Parkville, Australia; PAPTAC D.20 “Flat Crush Test of Corrugated Board,” Pulp and Paper Technical Association of Canada, Montreal, Canada; ISO 3035 “Determination of Flat Crush Resistance - Single-Faced and Single-Wall Corrugated Fiberboard,” International Organization for Standardization, Geneva, Switzerland; SCAN P-32 “Flat Crush Resistance of Corrugated Fiberboard,” Scandinavian Pulp, Paper, and Board Testing Committee, Stockholm, Sweden.

10.4 It has been found that this test method produces significantly lower flat crush values than those obtained from TAPPI T 825 “Flat Crush of Corrugated Board (Rigid Support Method).”

Appendix A. Calibration procedure for the flexible beam type of crush tester

A.1 *Lateral movement of the lower platen.* Remove the weighing beam and lower platen from the tester. Securely clamp the ends of the beam on a horizontal plane surface. Manually move the platen to its full extent towards the front and back and note the displacement on a dial micrometer. Repeat a similar procedure to determine the amount of motion parallel to the beam length.

A.2 *Platen parallelism*. With no load, this may be checked conveniently by means of the inside micrometer. Remove the facing cloth or paper, separate the platens 25 to 50 mm (1 to 2 in.) and measure the clearance at each corner of the platens. For a 100 x 100 mm (4 x 4 in.) platen, the difference in clearance is not to exceed 0.05 mm (0.002 in.) at the extreme edges.

NOTE 4: Determining the parallelism under conditions of normal loading is difficult. One suggested procedure is to load the platen through a centrally positioned metal ball and measure the platen edge clearances at various intensities of load over the normal testing range. Another procedure is to apply the load to a 6.0-6.5-mm (0.24-0.26 in.) thick piece of wood or metal with parallel faces, covered by a sheet of paper and with a soft carbon paper. A uniform carbon imprint should be obtained after slightly rotating the piece under pressure.

A.3 *Loading rate*. With the platens in contact, measure the time required to attain selected load levels, up to 90% of the capacity of the beam.

A.4 *Test specimen area*. As a precaution against eccentricity of the liners of a specimen, or deflection, or distortion of the knife blade used for cutting the specimen, check the size of the specimen on both sides by measuring its diameter at right angles.

A.5 *Calibration of the beam (dead weight method)*. Remove the motor and top pulley and place the tester on a narrow table or bench. At right angles across the platen at its central point, extend a narrow rigid bar, arranged with a pan or hook at each end to support pairs of balanced dead weights which, with the added weight of the beam and their supports, do not exceed the calibrated capacity of the beam. Check the accuracy of the load-indicating mechanisms to within the prescribed limits, throughout the range of interest. If necessary, prepare a calibration curve.

NOTE 5: Calibration should be performed in ascending weight increments.

Reference

1. Nelson, H. G., and Maltenfort, G. G., report of TAPPI Flat Crush Study, *Tappi* **44** (9): 614 (1961).

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

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