

NOTICE: This document is a TAPPI Standard in ballot. Although available for public viewing, it is still under TAPPI's copyright and may not be reproduced or distributed without permission of TAPPI. This document is current under review to be maintained as a TAPPI Standard.

WI 230308.02

T 824

BALLOT NO. 2 SARG

DRAFT NO. 1

DATE October 26, 2023

WORKING GROUP
CHAIR N/A

SUBJECT
CATEGORY Fiberboard Shipping Container

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.

Fluted edge crush of corrugating medium (flexible beam method)

Ten-year review of Classical Method T 824 cm-14: Proposed Reconfirmation of T 824

1. Scope

1.1 This test evaluates the ability of corrugating medium to contribute to the compression strength of a corrugated box. It is a procedure for measuring the edgewise compression strength of a laboratory-fluted strip of corrugating medium in a direction parallel to the fluted tips.

1.2 Fluted edge crush is also measured in TAPPI T 843 “Fluted edge crush of corrugating medium (rigid support method),” which uses a rigid platen compression machine instead of a flexible beam machine as used in this procedure.

2. Significance

2.1 Fluted edge rigidity relates to the edgewise compressive performance contribution of corrugating medium to the short column strength of corrugated board. For this purpose, a fluted specimen of corrugating medium is tested in edge crush; hence, this test is named the corrugated fluted crush test, cross direction (CFC).

2.2 This method offers an alternative to edge rigidity measured by the ring crush test in accordance with TAPPI T 818 “Ring Crush of Paperboard” or the STFI test in accordance with TAPPI T 826 “Short Span Compressive Strength of Paperboard.” Test values for CFC, Ring Crush and STFI are significantly different. Thus, formulas used to predict combined board edge crush (ECT) from the edge rigidity are different for each of the three measures of edge rigidity.

3. Apparatus

3.1 *Medium fluter*¹, in accordance with TAPPI T 809 “Flat Crush of Corrugating Medium (CMT Test).”

3.2 *Specimen cutter*, in accordance with TAPPI T 809.

3.3 *Compression machine*¹, having upper and lower platens.

3.3.1 The lower platen rests on a beam which flexes on loading.

3.3.2 The compressive force applied is developed at a rate equivalent to 111 ± 22 N/s (25 ± 5 lbf/s) when the machine is under load with the platens in contact.

3.3.3 The surfaces of the platens are smooth, flat, and parallel to each other to within one part in 2000 throughout the test (0.0125 mm/25 mm, or 0.005 in./1.0 in.) [see Appendix A].

NOTE 1: The use of emery or crocus cloth on the platens, as allowed in flat crush testing (TAPPI T 809), is not permissible.

3.3.4 The platens are held rigidly with a maximum permissible lateral movement of 0.05 mm (0.002 in.).

3.3.5 The beam, (having a capacity of at least 1112 N (250 lbf)), operates a scale which, when loaded, indicates a maximum deflection linearly related to the force applied to the beam's center via the platens. The scale is calibrated in units of force. The beam is supported so that it can be accurately calibrated with dead weights.

NOTE 2: For calibration procedures, see Appendix A of TAPPI T 808 “Flat Crush Test of Corrugated Board.”

¹Names 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.

3.4 *Fluted crush specimen holder.* This comes in two versions as shown in Figs. 1 and 2. One specimen holder consists of two surfaces parallel within 0.05 mm (0.002 in.) with the specimen in place and 6.35 ± 0.05 mm (0.25 ± 0.002 in.) height. A suitable stopping surface exists so that 6.35 mm (0.25 in.) width of the specimen is grasped by the holder. Automatic adjustment exists for the spacing between these two planes to allow for variations in caliper gage between specimens of the same gage and of different gages. Construction should be such to allow rapid loading of the specimen (see 6.2).

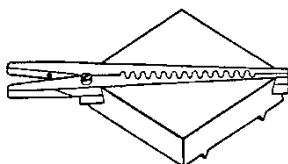


Fig. 1. Fluted crush specimen holder.

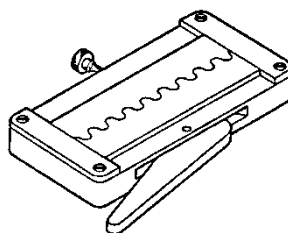


Fig. 2. Fluted crush specimen holder.

3.4.1 Another suitable holder consists of a pair of matched fluted jaws which are spring loaded and which are opened and closed by means of a hand lever. Fixture shall have tolerances and clamp area similar to fixture described in 3.4 above.

4. Sampling and test specimens

Sample in accordance with TAPPI T 400 “Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product.”

5. Conditioning

Precondition and condition the samples prior to fluting in accordance with TAPPI T 402 “Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products.”

6. Procedure

6.1 From each test unit of the sample, and using the specimen cutter (3.2), cut ten representative test specimens, each 152.4×12.7 mm (6×0.5 in.), with the longer dimension in the machine direction of the medium.

6.2 Perform the fluting operation as prescribed in TAPPI T 809 "Flat crush of corrugating medium (CMT test)," with the following exceptions:

6.2.1 Within as short a period as possible after the specimen emerges from the fluter, insert it into the holder, place the holder on the platen of the compression tester, and apply the load to the specimen until a maximum is reached. The time between the exit from the fluter and the onset of load should not exceed 20-25 seconds.

7. Report

Include in the report: (a) the average medium fluted edge crush (CFC) value, to the nearest 5 N (1 lb); (b) the standard deviation of CFC values; and (c) the number of specimens tested.

8. Precision

The following estimates of repeatability and reproducibility are based on an interlaboratory trial conducted in 2001 involving 10 different laboratories and a total of 12 flexible beam (Hinde & Dauche) type instruments. The samples were composed of randomized, pre-conditioned sheets of 26# and 33# medium. The precision statements are based on 10 determinations per test result and 3 test results for each instrument, per sample. A more detailed chart of results is included below.

Repeatability (within a lab) = 12 %

Reproducibility (between laboratories) = 21 %

Repeatability and reproducibility are estimates of the maximum difference (at a 95 % confidence level) that should be expected when comparing test results for materials similar to those described above under similar test conditions. These estimates may not be valid for different materials or testing conditions.

Table of detailed CFC results

<i>Material</i>	<i>Grand mean</i>	<i>Standard deviation between labs</i>	<i>Repeatability r and %r</i>		<i>Reproducibility R and %R</i>		<i>Instrument s included</i>
26# Medium	65.7	4.3	7.3	11.1 %	13.3	20.2 %	12
33# Medium	71.3	4.9	9.1	12.7 %	15.5	21.7 %	12

9. Keywords

Corrugating medium, Edge crush resistance, Compression tests, Corrugated fluted crush test, Flutes

10. Additional information

10.1 Effective date of issue: To be assigned.

10.2 Related methods: TAPPI T 843 “Fluted edge crush of corrugating medium (rigid support method)” and ISO 16945. Both use a rigid platen tester operating under a constant platen speed but in other respects are similar. Test results obtained during the collaborative studies to determine precision statements for the two TAPPI methods indicated that test results for 26# medium using either method are similar. However, test results on heavier-weight mediums generally yield higher test results when using the rigid-platen method. As can be seen in the precision statements for the flexible-beam and rigid-platen methods, the variability of the test results for the flexible-beam method is significantly greater than for the rigid-platen method.

10.3 Revision history:

10.3.1 This method replaced UM 811 “The Concora Fluted Crush Test (CFC) for Corrugating Medium” and UM 805 “Stiffness Test for Fluted Corrugating Medium.”

10.3.2 The 2009 revision modified the platen parallelism statement with wording to match similar procedures using flexible beam crush testers, but did not change the actual requirements; this was for clarification only. In addition, minor wording changes were made throughout the document to provide for improved accuracy or completeness.

10.3.3 The 2014 revision made minor editorial changes, adjusted the time of the method (cited in 6.2) in line with round robin work done as part of ISO 16945, and converted the method to a Classical Method.

Appendix A. Calibration

A.1 The procedure for calibrating the medium fluter outlined in TAPPI T 809 is also applicable to this method.

A.2 The fluted crush specimen holder should conform to the same parallelism requirements as the crush tester itself.

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

