



The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

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 Material 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.

Pin adhesion of corrugated board by selective separation

1. Scope

This method is used to measure the force required to separate corrugated board between the flute tips of corrugated medium and its linerboard facings.

2. Significance

2.1 Good adhesion of the corrugated medium to its facings is important in obtaining high quality corrugated board and boxes. The pin-adhesion test provides a means of determining the nature and strength of the bond formed during the combining operation and may be used to detect some manufacturing defects, such as poor adhesive penetration, spotty adhesion, and containerboard with a low internal bond strength.

2.2 The test described in this procedure will measure the Z-direction force required to separate selectively either the inside or outside facing of corrugated board.

NOTE 1: A defect exists in this test which can cause low readings, especially with lightweight liners. When a liner is very flexible, it tends to bend around the pressure pins and a shear ~~type~~ failure occurs rather than a straight Z-direction ~~Z-direction~~ failure which results in lower readings. For further information on this phenomena, see sections 11.6.1 through 11.6.4.

3. Apparatus

3.1 *Pin-adhesion attachment*¹, consisting of pins of the proper diameter and length. The requirement is seven support pins, 76.2 mm (3 in.) long [69.8 mm (2.75 in.) inside dimension] when resting on supports and six pressure pins 63.5 mm (2.5 in.) [57.2 mm (2.25 in.) inside dimension] when resting on supports. One end of the support and pressure pins may be attached to a separate frame which will keep the pins in each set properly spaced according to the number of

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.

flutes per unit length for the board to be tested. Means for supporting the open ends (or other end of the pins) must be provided. This other support may consist of a series of holes in a frame into which the open ends of the pins are inserted. As an alternate, notches in the end of this frame are acceptable. Base plates are required to hold the frames and pins in fixed and rigid positions. All pins, when firmly engaged in the holder, must be parallel throughout their entire length within ± 0.05 mm (± 0.002 in.) to the base plate.

3.1.1 Illustrations of a commonly used instrument are shown in Figs. 1 and 2.

3.1.2 Because the radius of curvature is different for the various flute sizes, use the pin diameter as shown in Table 1.

3.1.2.1 There are no recognized flute pitch standards for corrugating rolls today. Those shown in Table 1 are still common for the designated flute profiles, but there are many others in use. There are many C flute profiles alone that require unique test fixtures. A change of as little as 3.3 flutes per meter (1 flute per foot) can cause flank interference to the extent that tests can be affected.

3.1.2.2 When ordering test fixtures, collect several samples of combined board for the flute profile being ordered. On each sample, measure the flutes per half-meter or per foot (note the most common reading, and order the pin spacing accordingly. Samples of the board may also be sent to the test fixture manufacturer for measurement at their site. This procedure should be repeated each time corrugator rolls are changed

3.1.3 Pins should be made from cold roll steel No. 1018 and should be checked before each test for straightness. Do not use test fixtures that have crooked or bent pins.

NOTE 2 4: The dimensions shown in Table 1 apply to distance between pins in a set of support or a set of pressure pins. Dimensions will vary for other flute counts per unit length.

3.2 *Compression machine* [see TAPPI T 808 “Flat Crush Test of Corrugated Board,” Section 3.1, or TAPPI T 825 “Flat Crush Test of Corrugated Board (Rigid Support Method),” Section 3.1].

3.3 Knife cutter, single knife device with guides, or twin-blade device with guides to cut the test pieces according to the specifications in Section 5. The knives must be sharp and arranged in the device at 90° to the specimen’s surface.

4. Safety

Take care using the knife cutter when preparing samples or changing blades. The blades are extremely sharp. Use cut-resistant gloves when operating the cutter and when replacing blades.

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,” cut a minimum of ten test specimens as follows: “A” and “C” flute board 50 mm × 150 mm (2 in. × 6 in.) and “B” flute 31.8 mm × 100 mm (1.25 in. × 4 in.) from firm, uncrushed areas of corrugated board so that the 50-mm (2-in.) or 31.8-mm (1.25-in.) direction is in the flute direction of the corrugation. There are a few small compression machines where a 150-mm (6 in.) long sample creates too tight of a fit, due to their small platen size and the workable area around the platens. In cases like this a 127-mm (5 in.) long sample with the pins properly centered seems to work better, and causes no negative effects. This does not affect the area of glue line being tested, and therefore no change in the conversion factor is needed.

5.2 Ensure that all cuts are parallel or perpendicular to the corrugation.

6. Conditioning

6.1 Condition the specimens in an atmosphere in accordance with TAPPI T 402 “Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products.”

6.2 For special testing, such as measuring bond strength of a water-resistant adhesive, specimens may be conditioned in a high-humidity atmosphere or immersed in water, depending on the type of test desired.