July 1985 (improved version of 1971)

# Determination of the adhesion strength of the glue bonds of corrugated fibreboard (pin method)

## 1 Scope

To define the apparatus and procedure to be used to determine the strength of the adhesion between the flutes and liners of corrugated board. This method is applicable to all types of corrugated fibreboard.

## 2 References

FEFCO testing method n° 1 : sampling procedure

EN 20 187 : paper, board and pulps - Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples.

## 3 Principle

Two assemblies of metal pins are introduced into spaces between the flutes of the adhesive joints to be tested, in such a way that by means of a holder and a crush tester the sets of joints are separated by the application of a force applied perpendicularly to the surface of the board. The force needed to separate the liner from the fluting is measured and reported.

## 4 Apparatus

### 4.1. *Crush tester* [1]

A power-driven type crush tester shall be used. (When a tester operating on the principle of beam deflection is used, results are valid only if they occur between 20 % and 80 % of the normal range of deflection).

#### 4.1.1. *Platens*

The platens must meet the following conditions :

- *deviation from parallel not greater than 1:1000*
- *lateral play not exceeding 0.05 mm*
- *minimum size large enough to take test specimens of 100 mm length.*

#### 4.1.2. *Compression speed*

The relative speed of the two platens shall be 12.5 mm ± 2.5 mm per minute (with testers working on the principle of beam deflection this is equivalent to an increment of force of 67 N/s ± 23 N/s when the platens are in contact with each other).

[1] As an alternative to the crush tester specified at 4.1., other suitable apparatus operating at the speed given at 4.1.2. and meeting the requirements of clause 3 may be used. Full particulars of alternative apparatus used shall be reported under 9.

### 4.2. *Cutting equipment*

This shall ensure that the cut edges are clean, straight and perpendicular to the facings of the board.

4.2.1. A bandsaw or knife and cutting jig may be used.

### 4.3. *Pin holder assemblies*

The apparatus to be used shall be of any suitable type permitting the perpendicular force to be applied selectively to the liner/flute lines to be tested. Annexe 1 shows the points at which the pins shall be inserted to enable the test to be effected on the selected liner and fluting.

The pins shall be sufficiently rigid so that they are not bent during the test and of a diameter and arrangements that will not distort or deform the flute profiles of the board tested. Unless otherwise specified it is recommended that a combination of 6 and 7 pins shall be used.

The following pin diameters are normally suitable :

*A flute = 3 mm*

*B flute = 2 mm*

*C flute = 2.5 mm*

*Note: Flute distance may vary with corrugator manufacturer. Thus, to make appropriate apparatus use pin diameter and tolerance for each flute size, and adjust pin spacing (distance between pins).*

## 5 Sampling

Sample in accordance with FEFCO Testing Method N° 1.

## 6 Conditioning

Samples shall be conditioned in accordance with EN 20 187 (i.e. 23°C ± 1°C, 50 % ± 2% r.h.).

## 7 Preparation of test pieces

### 7.1. *Sample*

The samples must be taken from board of sufficient area to permit the cutting of the required number of test specimens which shall be free from machine marks, or other damage.

### 7.2. *Test specimens*

Test pieces shall be cut from the samples, avoiding finger lines.

They shall be rectangular, with a dimension parallel to the flute tips of 30 mm unless otherwise specified. The length of the test pieces shall be N x Y where N equals the number of pins employed plus one and Y equals the distance between the glue line centres.

Glue lines in a test piece in excess of the required amount shall be carefully cut along the fluting at approximately the middle of the flute walls before testing.

**7.2.1.** Unless otherwise specified, at least ten specimens for each set of lines to be tested shall be used.

## 8 Procedure

The tests shall be carried out in the standard atmosphere specified above.

After introducing the sets of pins in the required positions in the test piece and assembling the test set described in 4.3., the latter is placed in position centrally on the crush tester platen. The machine is then operated to apply force to the test until separation of the liner/fluting occurs. The force needed to separate the liner from the fluting of the test piece is recorded to the nearest 5N (or 0.5 kgf) [2].

The Pin Adhesion Strength is calculed according to the formula:

$$PAT = \frac{F}{L}$$

where:
PAT = Pin Adhesion Strength in N/m
F = Force for separation in N
L = total length of the glue lines in m [eq. (number of pressure pins) x 2 x (width of the sample)]

## 9 Test report

The test report shall contain the following details :

- **a** *Date and place of test*
- **b** *Description and identification of the material tested*
- **c** *Number of individual tests stating liner/flute bond tested*
- **d** *Number of pins employed*
- **e** *Total length of glue lines tested on each test piece*
- **f** *Results in N/m (or kgf)* [2] *per m for each test piece*
- **g** *Arithmetic mean and standard deviation of the results*
- **h** *The extent of fibre tear expressed as a percentage of the total glue line length*
- **i** *Details of any deviation form this test method*
- **j** *Any other information which may assist in the interpretation of the test results.*

[2] 1 N = 0.1019 kgf