

Filled corrugated fibreboard containers - Vibration test at fixed low frequency

This test is one of a series of performance tests for filled corrugated fibreboard containers and may be selectively applied as specified, either singly, or in combination with other tests.

1 Object

To define the apparatus and test procedure to be used to determine the ability of a complete filled corrugated fibreboard container or a stack of complete filled corrugated containers with or without a superimposed load, to withstand vibration within the stated range.

2 Scope

The test is applicable to all types of corrugated fibreboard containers, complete with internal fittings and the actual or dummy contents, or a stack of filled containers.

3 Normative references

EN 22 206 : Packaging – complete, filled transport packages – identification of parts when testing.

EN 22 233 : packaging - complete, filled transport packages, conditioning for testing.

4 Principle

The test provides an accelerated simulation of transportation vibration effects.

A specimen container or a stack of containers with actual or dummy contents is subjected to controlled vibration for a specified period of time or until a defined failure occurs.

Dummy contents : where the use of the actual contents is prohibitive, because of excessive cost or danger, or for other reasons, an artificial load may be used provided that it has similar dimensions, centre of gravity, etc, and adequately represents the item it replaces.

Amplitude : the amplitude is the maximum distance in mm, which the table of the vibration tester makes in the direction of vibration measured from the zero position of the table.

Attitudes : for the purpose of specifying the attitude in which the specimen is tested the faces should be identified according to EN 22 206 as follows :

Facing one end (with the manufacturers' joint vertical on the right side) the top of the container is numbered as 1, the right side 2, the bottom 3, the left side as 4, the near end 5, and the far end 6 (see fig. 1).

Containers not having or having more than one manufacturers' joint will be dealt with on the same principle by arbitrarily selecting one end as face 5.

Thus, the edges will be identified by the numbers of the two faces which make the edge and corners by the numbers of the three faces which meet to form the corner e.g. 2-3-5 will designate the corner at the bottom of the manufacturers' joint in fig. 1.

5 Apparatus

5.1. Type of vibration tester : a motorised and movement controlled table type vibration tester shall be used.

5.2. Table : the table shall be a rigid, horizontal plane surface of adequate weight-carrying capacity with dimensions to accept test specimens without overhang. The table shall be supported on a mechanism that will maintain the surface horizontal during vibration.

The table may be equipped with :

5.2.1. Low fences to restrict sideways and endways movement during testing.

5.2.2. High fences or other means of maintaining a superimposed load in position on the package during testing.

5.2.3. A device to enable a superimposed load to be applied to the specimens throughout the test.

5.3. Mechanism : the mechanism on which the table is supported shall be designed to vibrate the table with a vertical component motion which is approximately sinusoidal. A rotary movement of the table is acceptable. Existing apparatus, not complying with this clause, may be used but the type of motion and the maximum acceleration applied shall be stated in the report.

5.4. Weight capacity : the functional weight-carrying capacity of the apparatus shall exceed the weight of the test specimen plus any additional superimposed loading which may be specified for the test.

5.5. Frequency and amplitude : the vibration frequency shall be adjustable over the range 2 Hz to 7 Hz, and the amplitude shall be adjustable over the range 5 mm to 12,5 mm (total throw = 2x amplitude). The amplitude will vary with frequency ; see clause 7.3.

- 5.6.** Calibration : an accelerometer should be fixed securely to the table in the area where the test specimen is to be placed, and the frequency then varied until the required acceleration is indicated.

The acceleration head should be placed in this sensitive direction parallel to the direction of motion. When there is a combined motion, acceleration heads shall be used perpendicular to each other and parallel to directions of motion to be measured.

6 Conditioning

The packages to be tested shall be conditioned in accordance with one of the conditions specified in EN ISO 22 33. Unless otherwise specified condition "G" (23°C ± 2°C, 50 % rh ± 3 % rh) shall be used.

Note : For packaging tests, FEFCO recommends 23°C ± 2°C, 50 % rh ± 3 % rh, but draws the attention that ISO sets ± 2 % rh, which is quite strict for plants that cannot condition a big room.

7 Procedure

- 7.1.** Test specimen : a test specimen shall consist of a representative container or a stack consisting of a given number of containers with actual or dummy contents, closed and sealed in the manner intended for shipment.

- 7.2.** The test should be carried out in the same atmosphere used for conditioning. Alternatively the test should be commenced within 5 minutes of removal of a specimen from the conditioning atmosphere.

- 7.3.** Individual tests : the test specimen or a stack of test specimens, with or without additional top loading, is placed on the table and the fences put in position.

To avoid overloading, start the apparatus at a low frequency. Then increase it at a steady rate as quickly as possible so that the acceleration of specified G value is attained.

The acceleration factor (G) is dependent on frequency as well as amplitude. Theoretically this is given in the following formula :

$$G = x \cdot \omega^2 = \text{actual acceleration in m/s}^2$$

x = amplitude in m

$$\omega = 2 \cdot \pi \cdot f$$

f = frequency in Hz

$$(G) = \frac{\text{actual acceleration}}{g} = \text{acceleration factor}$$

$$g = 9.81 \text{ m/s}^2 = \text{gravity acceleration}$$

For tests in excess of acceleration factor 1.0 - 1.1 g, the required acceleration shall be determined, using an accelerometer capable of sensing up to 2.0 g under the required conditions.

Continue the test for the specified period of time or, if so specified, until failure occurs. When the specification requires testing to failure, it must give a clear definition of failure.

- 7.4.** Number of tests : unless otherwise specified a minimum of three identical tests shall be carried out.

8 Test report

The test report shall contain the following :

- a** date and place of testing
- b** description and identification of the specimens tested, including internal fitments and contents.
- c** test climate used (if other than 23°C 50 % rh).
- d** relative humidity, temperature and duration of conditioning and the atmospheric conditions during test.
- e** angle of motion relative to the horizontal ; frequency and amplitude, applied.
- f** if the vibration test is carried out as part of a series of tests, reference to that series.
- g** duration of test
- h** observations for each test specimen indicating as necessary :
 - 1) damage sustained by the container and fitments and other packaging material
 - 2) damage to contents
- i** details of any deviation from this testing method or apparatus used
- j** any other information which may assist in the interpretation of the test results.