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Compression test of fiberboard shipping containers

1. Scope

1.1 This method is used for measuring the ability of corrugated or solid fiber shipping containers to resist external compressive forces.

1.2 The method may be applied in a number of ways. For quality studies, it is usually desirable to test the empty container. For the study of compression resistance where inner packing (corner posts, etc.) is involved, tests may be made with the interior packing in place.

1.2.1 If overall performance of the entire pack is to be studied, the test may be conducted with the container loaded with its contents and all inner packing. In many packs the contents and inner packing share in carrying a portion of the load.

1.2.2 The container may be positioned in the machine so as to test the compressive resistance in a direction that is relevant to the container's use including top-to-bottom, end-to-end, or side-to-side.

2. Summary

In essence this method describes how to determine the resistance of a fiberboard shipping container to compressive forces. This is accomplished by placing the container between two flat platens, one of which is mechanically or hydraulically driven to compress the container. A recording device is incorporated to indicate the force and deformation (deflection) required to compress the container.

3. Significance

These compressive forces are related to some of those exerted on containers in stacks or encountered in transportation. The method may be used to compare the compressive resistance of different lots of similar containers or to compare containers of different grades. It may also be used to compare the compression characteristics of containers differing in construction or design. In addition, the information gained may be used to provide an indication of the load that a particular container may be able to withstand in service.

Approved by the Standard Specific Interest Group for this Test Method



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4. Apparatus

4.1 *Compression tester*¹, having the following:

4.1.1 Two platens which move together to compress a container placed between them. The platens are of sufficient size so that the test container does not extend beyond the edges of the platens. The platens shall be flat with deviations less than ± 0.5 mm (0.02 in.) from the median plane of the platen. The platens may move no more than 1.3 mm (0.05 in.) in the directions perpendicular to the direction of compression. The platens are either held parallel throughout the test or one platen may be allowed to pivot around its center. If the platens are rigidly held they must remain parallel to at least within 1 mm (0.04 in.) per 305 mm (12 in.) in the length and width directions. The fixed platen type of compression testers should be used for all refereed testing. Compression testers with floating or swivel platens provide an alternative to evaluate compression strength from a real world perspective, but may produce different compression values.

NOTE 1: Recent testing indicates that this parallelism specification may allow the generation of meaningfully different (lower) BCT values for boxes tested at the limit of the specification and for boxes tested under conditions where platens are significantly more parallel.

NOTE 2: Compression testers with floating or swivel platens provide an alternative to evaluate compression strength from a real world perspective, but may produce different compression values (Appendix C). Platen stiffness may be more critical for this platen configuration.

NOTE 3: For machines where the platen configuration can be changed to accommodate different test approaches, it is critical to confirm and if necessary adjust the parallelism each time the configuration is changed, to assure the parallelism and flatness in the system satisfies the requirements in 4.1.1.

4.1.2 Means of driving the movable platen at a uniform speed of 13.0 ± 2.5 mm/min. (0.5 in./min. ± 0.1 in./min.) during the test.

4.1.3 Means of recording or indicating the applied load to within $\pm 1\%$ of the measured value.

4.1.4 Means of recording or indicating the resultant deformation within $\pm 2.5\%$ of the measured value or within ± 0.5 mm (0.020 in.), whichever is greater.

4.2 Compression testers, like all laboratory testing equipment, need to be calibrated on a regular basis. Obtain a calibration procedure from the compression tester manufacturer, which should be posted at the machine. Prior to performing compression tests for fiberboard shipping containers, assure the instrument has been calibrated according to the manufacturer's procedure.

5. Test specimens

5.1 Samples shall be obtained in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product."

5.2 Test at least five representative containers for each direction specified. Select only those containers that have not been damaged by previous handling.

6. Sealing

6.1 When this method is used as a quality control test or as a referee test, it is important that a consistent method of flap closure be used to insure consistent results in both average and variability data.

6.2 In preparation for sealing, square the box blank. Avoid distortions and "out-of-squareness," since this will affect the load-bearing ability of the containers.

6.3 The flaps may be bent directly to the sealing position or the flap scorelines may be pre-broken as follows. Bend each of the four bottom flaps backward 180° on the score line until the flap touches its side of the box. Insert a sealing board or place the box over a sealing device, whichever sealing method is used, then fold the inside flaps forward 270° to the normal closed position.

6.4 Consistent sealing of boxes is critical for comparison of test results. In top-to-bottom testing, the primary

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 Quality and Standards Department.