Pipeline and Hazardous Materials Safety Administration, DOT § 178.606

§ 178.606 Stacking test.

(a) General. All packaging design types other than bags must be subjected to a stacking test.

(b) Number of test samples. Three test samples are required for each different packaging. For periodic retesting of packagings constructed of stainless steel, monel, or nickel, only one test sample is required. Exceptions for the number of aluminum and steel sample packagings used in conducting the stacking test are subject to the approval of the Associate Administrator. Notwithstanding the provisions of §178.602(a) of this subpart, combination packagings may be subjected to the stacking test without their inner packagings, except where this would invalidate the results of the test.

(c) Test method—(1) Design qualification testing. The test sample must be subjected to a force applied to the top surface of the test sample equivalent to the total weight of identical packages which might be stacked on it during transport; where the contents of the test sample are non-hazardous liquids with specific gravities different from that of the liquid to be transported, the force must be calculated based on the specific gravity that will be marked on the packaging.

For periodic retesting of packagings constructed of stainless steel, monel, or nickel, only one test sample is required. Exceptions for the number of aluminum and steel sample packagings used in conducting the stacking test are subject to the approval of the Associate Administrator. Notwithstanding the provisions of §178.602(a) of this subpart, combination packagings may be subjected to the stacking test without their inner packagings, except where this would invalidate the results of the test.

(2) Periodic retesting. The test sample must be tested in accordance with:

(i) Section 178.606(c)(1) of this subpart; or

(ii) The packaging may be tested using a dynamic compression testing machine. The test must be conducted at room temperature on an empty, unsealed packaging. The test sample must be centered on the bottom platen of the testing machine. The top platen...
must be lowered until it comes in contact with the test sample. Compression must be applied end to end. The speed of the compression tester must be one-half inch plus or minus one-fourth inch per minute. An initial preload of 50 pounds must be applied to ensure a definite contact between the test sample and the platens. The distance between the platens at this time must be recorded as zero deformation. The force A to then be applied must be calculated using the formula:

\[
\text{Liquids: } A = (n - 1) [w + (s \times v \times 8.3 \times .98)] \times 1.5;
\text{Solids: } A = (n - 1) (m \times 2.2 \times 1.5)
\]

Where:
- \(A\) = applied load in pounds
- \(m\) = the certified maximum gross mass for the container in kilograms.
- \(n\) = minimum number of containers that, when stacked, reach a height of 3 meters.
- \(s\) = specific gravity of lading.
- \(w\) = maximum weight of one empty container in pounds.
- \(v\) = actual capacity of container (rated capacity + outage) in gallons.

And:
- 8.3 corresponds to the weight in pounds of 1.0 gallon of water.
- .98 corresponds to the minimum filling percentage of the maximum capacity for liquids.
- 1.5 is a compensation factor that converts the static load of the stacking test into a load suitable for dynamic compression testing.
- 2.2 is the conversion factor for kilograms to pounds.

(d) **Criteria for passing the test.** No test sample may leak. In composite packagings or combination packagings, there must be no leakage of the filling substance from the inner receptacle, or inner packaging. No test sample may show any deterioration which could adversely affect transportation safety or any distortion likely to reduce its strength, cause instability in stacks of packages, or cause damage to inner packagings likely to reduce safety in transportation. For the dynamic compression test, a container passes the test if, after application of the required load, there is no buckling of the side-walls sufficient to cause damage to its expected contents; in no case may the maximum deflection exceed one inch.


§ 178.607 Cooperage test for bung-type wooden barrels.

(a) **Number of samples.** One barrel is required for each different packaging.

(b) **Method of testing.** Remove all hoops above the bilge of an empty barrel at least two days old.

(c) **Criteria for passing the test.** A packaging passes the cooperage test only if the diameter of the cross-section of the upper part of the barrel does not increase by more than 10 percent.

§ 178.608 Vibration standard.

(a) Each packaging must be capable of withstanding, without rupture or leakage, the vibration test procedure outlined in this section.

(b) **Test method.** (1) Three sample packagings, selected at random, must be filled and closed as for shipment.

(2) The three samples must be placed on a vibrating platform that has a vertical or rotary double-amplitude (peak-to-peak displacement) of one inch. The packages should be constrained horizontally to prevent them from falling off the platform, but must be left free to move vertically, bounce and rotate.

(3) The test must be performed for one hour at a frequency that causes the package to be raised from the vibrating platform to such a degree that a piece of material of approximately 1.6 mm (0.063 inch) thickness (such as steel strapping or paperboard) can be passed between the bottom of any package and the platform.

(4) Immediately following the period of vibration, each package must be removed from the platform, turned on its side and observed for any evidence of leakage.

(5) Other methods, at least equally effective, may be used, if approved by the Associate Administrator.

(c) **Criteria for passing the test.** A packaging passes the vibration test if there...