



Designation: D5639/D5639M – 20

Standard Practice for Selection of Corrugated Fiberboard Materials and Box Construction Based on Performance Requirements¹

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1. Scope

1.1 This practice provides information on corrugated fiberboard for the prospective user who wants guidance in selecting attributes of materials and box construction based on performance requirements. These attributes should be part of specifications which establish levels of the qualities a shipping container shall have achieved in order to be acceptable to the purchaser or user. The attributes and qualities should be testable, using standard methods that are recognized by both the buyer and seller. This practice will assist users in developing specifications for corrugated containers through an analysis of performance requirements and subsequent relationships to fiberboard materials and box construction attributes. This practice is meant to complement the box buyer–box manufacturer relationship by having the buyer (user) better understand, discuss, and negotiate needed elements of box design and specification. The full box design process is complex, and it is beyond the scope of this standard.

1.2 The attributes and their levels should be based on the intended use of the box, including the handling and environment it will encounter. Many packaging rules include detailed descriptions of the materials that may be used and style, closure, or other construction details of allowed shipping containers. These rules are presented as minimum requirements; they may be exceeded for functional reasons, but there is no regulatory reason to do so. Rail and motor freight classifications applicable for surface common carrier transportation have established minimum requirements for certain attributes of corrugated packaging. These may or may not be appropriate for application in the complete distribution system, as they encompass only containerboard or combined corrugated board — not finished boxes — and are not intended to provide for the distribution and storage system beyond the transportation segment.

¹ This practice is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.27 on Fiberboard Shipping Containers, Containerboard and Related Structures and Materials.

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1.2.1 The attribute levels contained herein are based on U.S. practice and specifications. Some attributes such as flute dimensions and basis weights may be defined differently in other countries.

1.3 There are four common methods used for specifying boxes.

1.3.1 A common approach is to examine boxes currently in use for the specific application and to make a similar or modified version of that box, given that it has a proven performance record. This method, while quite efficient, and fast, does not lead to box optimization based on characterization by end use. This method can lead to overdesign.

1.3.2 A second common approach is to estimate the compression strength necessary for a box at the bottom of a stack of boxes to totally support the anticipated load. A safety factor, F , is calculated from the expected environmental hazards that are anticipated in storage and shipping. A minimum initial box compression, as measured by Test Method D642 is determined using the weight on the bottom box and the F factor, see 8.3. Then engineering principles are used to select material combinations based on material characteristics such as caliper, edge crush value, and flat crush to meet that requirement.

1.3.3 The third approach may be used when the box application has product support sufficient to meet anticipated compression requirements, therefore the board structural requirements are focused on protection and containment. Mullen burst values can be one of these measures for this category of box if the user has determined that a minimum burst value is the main metric required in their distribution system. In this case, total weight per box allowable per carrier rules may be higher than would be expected based on expected predicted compression strength, safety factor, and board combination used. See 7.2 – 7.2.2.2 and 8.2.1.

1.3.4 The fourth approach may be used when the box is intended for single parcel shipment of high value or hazardous materials, where there can be a compression requirement but most often the performance attributes required are toughness as measured by drop and impact resistance, see 8.2. A means of gaining confidence that a box in this category will function properly in its intended distribution environment is to test the