

### ***Corrugated fiberboard boxes***

Corrugated fiberboard boxes are well known for their good stacking strength (when dry), easy availability and inexpensive cost. Corrugated fiberboard is the most common material used for shipping containers, and the regular slotted container (RSC). In a well-designed box, the load bearing panels have their flutes parallel to the direction of the anticipated load: for stacking strength the flutes should run vertically. When side-to-side strength is more important (in clamp handling, for example), it may be better for the flutes to run horizontally.

Corrugated fiberboard is easy to recycle, both from a technical and a logistical point of view. Used boxes are generally discarded in large, homogenous piles by factories, warehouses and retail stores – businesses which have an incentive to reduce their disposal cost by recycling. As a result, corrugated board has a very high recycling rate. Corrugated fiberboard has been used to make shipping containers for almost 100 years. A series of standard grades have been adopted by most countries. It is categorized in three ways: by the thickness and spacing of the fluted *medium*, by the weight of the *facings*, and by the quality of paper used.

The most widely used flute configurations are known simply as A, B, C, and E. The first corrugated materials were either coarsely fluted A-flute or fine B-flute. The intermediate grade, C-flute has now become the most commonly used type, being a compromise of the best qualities of the other two. E-flute has very small flutes, and there are even finer grades called microflute, which are used as alternatives to solid fiberboard.

Dimension of commonly used flutes

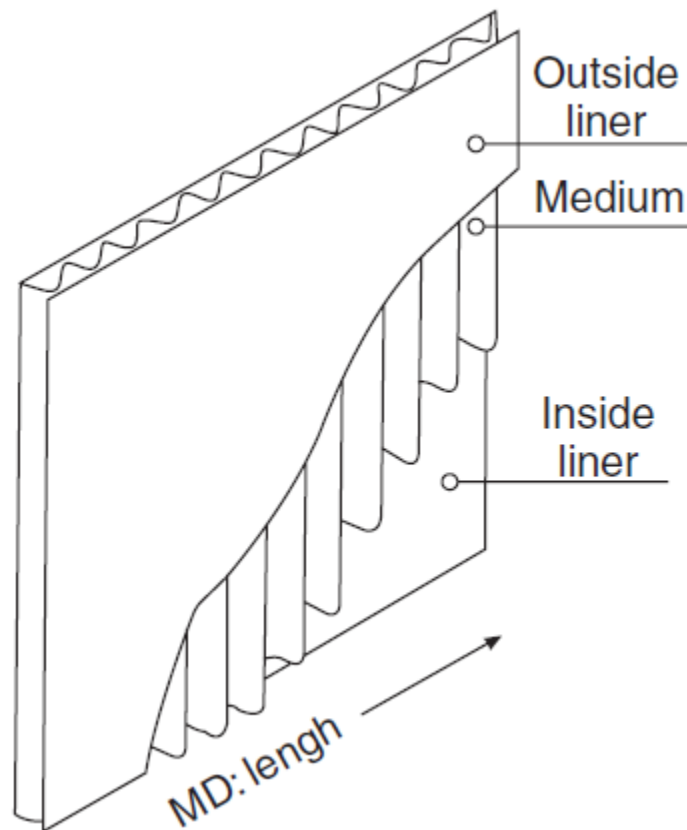
<b>Flute</b>	<b>Flutes/meter</b>	<b>Flutes/ft</b>	<b>Flute height</b>
A	105 – 125	36 ( $\pm$ 3)	4.8mm or 3/16"
B	150 – 185	50 ( $\pm$ 3)	2.4mm or 3/32"
C	120 – 145	42 ( $\pm$ 3)	3.6mm or 9/64"
E	290 – 320	94 ( $\pm$ 4)	1.2mm or 3/64"

Single wall board (with 2 facings) is the most common form used for cases and trays. Double and triple wall boards are used for palletload-sized intermediate bulk containers, used for some dry ingredients in the food industry. At one extreme, single face board is soft and used for wrapping items like light bulbs and glass bottles. The other extreme is multi-wall laminated structures made into lightweight pallets.

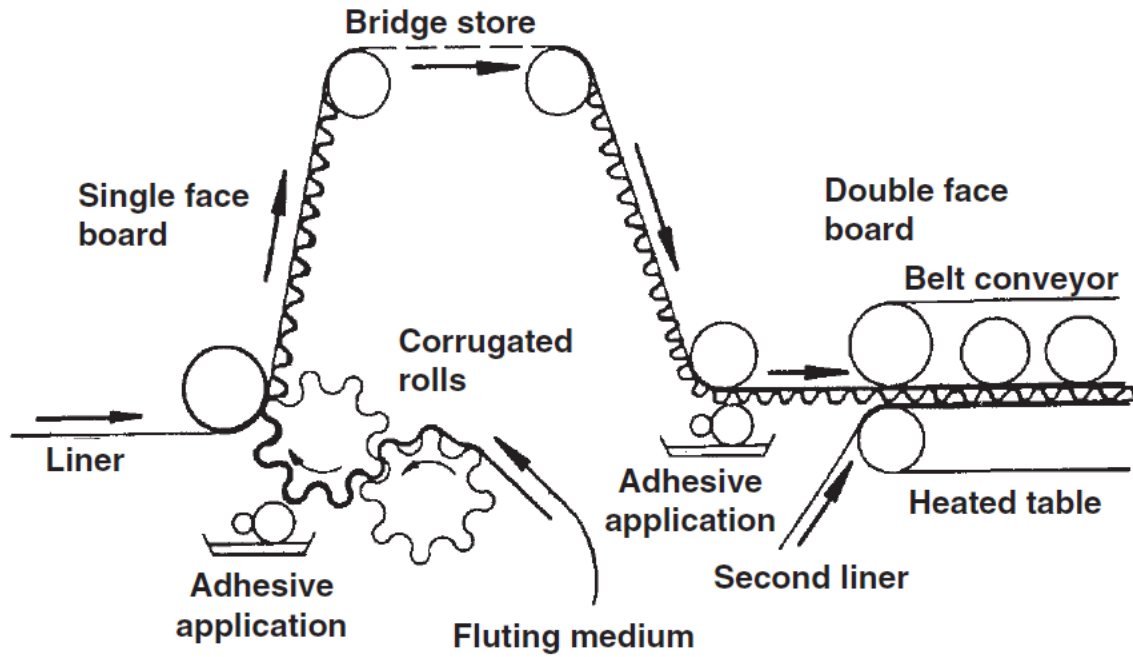
Corrugated board has an important drawback: it can lose much of its strength (indeed, all of its compression strength) when it is wet. Further, the commonly used starch-based adhesives are also moisture sensitive. It makes good design sense, where possible, to design the box with minimal head space, allowing the inside products to help support the load. This will prevent the uneven collapsing of containers which can topple a palletload. Wax dipping or coating has been used for particularly wet contents, like broccoli which is shipped with ice, but this practice is diminishing because the wax causes problems during recycling.

Corrugated fiberboard boxes are increasingly being used as advertising media in point-of-purchase displays, and so higher quality printing is demanded. There are three options: direct

printing, preprinted liners and litho lamination. The uneven surface of the board limits direct printing to relatively simple one or two color flexography. Ink jets can also print directly on a box, and ink jet printing is particularly well suited for variable short-run information like lot codes. Preprinted liners – high quality flexo printed facing materials –can be built in to the corrugated board at the point of manufacture. Litho lamination can produce the highest quality printing, including full color halftones. It is made by laminating lithograph printed paper to the already converted board.



Components of single wall corrugated fiber board (Courtesy – The Packaging Society)



Production of corrugated fiber board (Courtesy – The Packaging Society)