INTRODUCTION TO CORRUGATED PACKAGING

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MATERIALS USED IN PACKAGING- 1

• PAPER AND PAPERBOARD
  – Paper is made from cellulose fibers derived from trees, straws, linen, cotton, sugar cane
  – Pulping is separating cellulose fibers from the wood mass of the tree
  – The pulp is conditioned and then fed to paper making machine to make paper
• **PAPER TYPES:**
  – Greaseproof paper, parchment, glassine are used as primary packaging to wrap oily snack foods, cookies, candy bars
  – Natural Kraft paper used to paper bags
  – Pouch papers are super pressed virgin Kraft paper treated to make it softer
  – Container/liner board & medium is made of Kraft paper to make corrugated board
MATERIALS USED IN PACKAGING-3

• PAPERBOARD CARTONS
  – Folding Cartons. By far the largest and most important in paperboard packaging. Majority of folding carton designs are grouped into tube-style and tray-style type. Not all the shapes are box like (basket, tray)
  – Setup Boxes that are rigid and sturdy
  – Tubs, Trays & Liquid resistant boxes are used to store ice cream, frozen entrees & food products
WHAT IS CORRUGATED PACKAGING?

- It is secondary packaging (usually boxes) made of reinforced paper/container board.
- Two container boards are glued to a fluted or corrugated medium which reinforces.
- The liner boards are made of Kraft paper and medium is the corrugated fiber board.
- Made of hard wood pulps + recycled boxes.
MATERIALS USED IN PACKAGING-5

• DIFFERENT PACKGING LEVELS:
  – Primary package: holds product direct usually first wrap or containment
  -- Secondary package: containment of primary package to preserve content & appearance of the primary container
  – Functions of packages are to contain, protect/preserve, transport, inform/sell
MATERIALS USED IN PACKAGING-6

- Tertiary or distribution package: a wrap and containment to protect product during distribution and provide efficient handling

- Unit load: A number of distribution packages bound together(unitized) for mechanical handling, storage and shipping

- Packages are also defined for their intended destination- consumer/industrial
Example of use of various levels of packaging for Breakfast Cereal:

- **Primary package** of plastics or coated paper is to contain and to a lesser extent, to protect.
- **Secondary package**, a paper board carton is for protection, to inform customers.
- **Twelve cartons** are packed into corrugated shipping container to protect and transport.
- Finally, these are assembled into **united load** to facilitate transport and distribution.
CORRUGATED PACKAGING-1

CORRUGATED FIBERBOARD:

– It is the most common distribution container material, the RSC container is the workhorse of the corrugated industry
– It is made up of two boards (linerboards) bonded to a fluted or corrugated medium
– The facings are Kraft linerboards and bonded to the medium by adhesive (glue)
– Facings & medium can be made to any weight/thickness needed for an application
Corrugated Fiberboard

Single Face Corrugated
Corrugated Fiberboard - continued
HISTORICAL PERSPECTIVE:
- Railroads, the first mass mover of goods
- Had to standardize shipping quality (UFC)
- Specified board grades to use corrugated boxes based on size and weight
- Used Mullen’s bursts test to grade boards
- Over time, test was supplemented by more realistic Edge Crush Test (ECT)
CORRUGATED PACKAGING-3

- **FIBERBOARD GRADES**
  - Linerboard -Table 15.1 (OH)
  - Corrugating Medium -Table15.2 (OH)

- **CORRUGATING ADHESIVES** (glues)
  - Starch-based adhesives
  - Modified starch-based adhesives
  - Water-resistant adhesive
  - Weather-resistant adhesive
FLUTE TYPES AND STANDARD:

- A-flute corrugated board
- B-flute corrugated board
- C-flute corrugated board
- E-flute corrugated board

A is the largest flute, C is the second largest followed by B and E. A still finer flute called F-flute is made by a few board makers. Flute-selection will be covered later on.
Corrugated Fiberboard - continued
BOARD MANUFACTURE:

- First, at the single-facer station of a corrugating machine, flutes are formed and bonded to the inside liner (Fig.15.2, OH)

- Next, a second linerboard is bonded to the single-faced materials made above. The glue is applied to the flute and the board is pressed against the medium where heat and pressure cause these to stick(Fig.15.3, OH)
Corrugated Fiberboard - continued

Single Wall Corrugated
(also known as Double Faced)
Corrugated Fiberboard - continued

Double Wall Corrugated
Corrugated Fiberboard - continued
CORRUGATED PACKAGING-6

PROPERTIES AND TESTS:
- Mullen Burst Test: Involves applying pressure against face of board till it bursts. It does not relate to stiffness/compression.
- Edgewise Compression Test: Small test specimen is compressed between loads. Gives the stiffness contributed by the facings and medium and directly relates to stacking strength.
- McKee formula is used to relate ECT to above.
Corrugated Boxes

• McKee formula

Box Compression Strength = 5.87 × ECT × SQRT(BP × T)

Note: Estimated RSC top-to-bottom box compression strength = , KN (lbf)

Where

ECT = edge crush test, KN/m (lbf/in);
BP = inside box perimeter, m (in);
T = combined board thickness, m (in)
Corrugated Boxes - continued
Corrugated Boxes - continued
CARRIER RULES AND REGULATIONS:
- There are four basic steps for determining authorized packaging as per Uniform Freight Classification (UFC) and NMFC.
- Specified boards using Mullen burst test or ECT is used for a given product weight. Dimension size limit for box is determined by adding an inside length, width and depth (Table 15.4, Fig. 15.8, OH)
CORRUGATED PACKAGING-8

SELECTING THE CORRECT FLUTE:
- As a starter, use carrier classification and C-flute, best for warehouse load bearing
- E- and F-flutes are not used with shipping containers but as thicker paper boards
- A flute is used as cushion pads and making triple-walled thicker boards
- B-flute is used for canned goods & other products not requiring stacking strength & combined with C-flute to print better
BOX DESIGN VARIATIONS:

- Regular slotted containers (RSC): boxes in which all scores and cuts are in straight lines, in machine and cross-directions (OH)

- Die-cut designs: require using steel-rule cutting and creasing die. Is more expensive but extra features can be added (OH)

- Bliss-style box: these can be made from different cut pieces to give maximum board use and compressive strength. Requires special handling and increases inventory (OH)
SPECIAL BOARD TREATMENTS:
- Board-treatments done to prevent exposure to high humidity/direct water
- Thermoset resins (2%) added at the mill
- Waxing can also increase wet performance
- Waxing can be done in several ways: wax can be added to liner/medium during corrugating, wax can be added after corrugation is finished or the finished box can pass through a number of hot wax curtains (Cascading).