Performance Requirements of Corrugated Fibre Board Boxes (CFB) for Fish and Fish Products

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Processed and semi processed fish and fish products are packed in metal cans, glass bottles, semi rigid and flexible packaging materials. During the last four decades the seafood industry in India has achieved a fascinating growth from Rs. 4 crores in 1961-62 to Rs. 6647 crores in 2004-05 of which 89% is from shrimp,fish, squid and cuttle fish exported mainly in frozen form. The present method of packaging of frozen shrimp in India comprises of LDPE liner (100 gauge) or 60 gauge HM-HDPE or 60 gauge LLDPE, a waxed paper board (usually duplex board) and corrugated fibre board box closed with plastic strapping. Dimensions of the duplex carton vary from packer to packer. There are no ISI specifications for these duplex cartons. Ten numbers of these 2kg blocks are packed in corrugated fibre board box (master cartons). There are ISI specifications for these master cartons (IS: 6715-1972). The fish processing industry is utilizing CFB boxes to the extent of 4395 tonnes. The following points need consideration in designing this transport container.

1.	Protection	- Against transport conditions
2.	Handling	- Rationalization of the package size for easy handling in transit and storage.
3.	Shipping	- Conditions of shipping rules, regulations, freight, tariffs, journey hazards
4.	Manufacturing	- To suit in plant packaging line.
5.	Functional utility	- Convenience for inspection staff, handling labour; carrier space
6.	Identification	- International markings on package
7.	Disposability	- To avoid public hazards and pollution
8.	Economy	- Packaging costs.

The advantages of corrugated fibre board boxes as a transport container for processed food products are as follows:

a) Low cost
b) Smooth and non abrasion resistance
c) Optimum cushioning characteristics
d) Good printability
e) Collapsible for storage and transportation
f) Materials can be reused or recycled

Corrugated fibre boxes offer protection against handling and transit hazards.

There are four types of journey hazards for processed food products packed in different types of packaging materials.

1. Hazards of loading and unloading
2. Hazards of movement in vehicles
3. Hazards of warehousing
4. Climatic hazards

Loading and Unloading Hazards

These occur at the manufacturing centre, consumer shops and at any intermediate

transfer points. Such transfers take place at the railway stations, at goods transfer yard or ship at the ship docks. The main hazards are impacts cause by a container being dropped or thrown while transferring them from one vehicle to another or to the ground or floor. For one man loads, packs of 10-20 kg are preferred.

Movement in Vehicles

a) Rail transport: The shunting operations produce impacts with other goods. Vibration during journey also caused damage to the transport container.

b) Road transport: Main hazards are vibration and bouncing of load due to irregularities in the road surface.

c) Sea and river transport: Main hazards are compression stresses and vibration, climatic hazards arise due to changes of temperature and humidity on the journey causing cargo sweat and moisture migration in the ship's hold. Other hazards are salt spray and high temperature on deck cargo.

Warehousing and storage hazards

These occur between transshipments or after delivery. During storage, there is also possibility of stacking hazards and climatic hazards.

Climatic hazards

Main climatic hazards are due to water, high and low humidity, high or low temperature and temperature changes. Water may be due to rain, sea spray or condensation. Condensation inside the package may occur due to a rapid drop in temperature. Corrosion (particularly from sea spray) and mould growth are accelerated where liquid water is present in the package.

Requirements of specifications for CFB boxes for processed fish products

a) Frozen products

Among several packaging materials used in fishery industry I.S.I. specifications have been formulated only for corrugated fibre board boxes for export of frozen seafoods (IS 6715 : 1972). Many of the corrugated fibre board cartons are made of 5 ply and do not conform I.S.I. specifications. Corrugated fibre board boxes are standard shipping containers and preferred for all frozen foods including fish, precooked and prepared because these are light in weight, expandable and have insulating property.

b) Canned fish products

Tinplate containers are widely used for packing processed meat and fish products. These canned products require a suitable transport packaging material to cause less damage to the cans. CFB boxes are used for this purpose. They should ensure packages with less free space, reduced risk of dents to cans and damage to labels, prevent bulging of outer boxes in warehouses.

Problems

a) Rusting of external surface due to the presence of moisture in CFB

b) Chloride and sulphate ions cause localized rusting

c) Leakage in cans affects the strength of the box due to absorption of moisture.

This also causes mould growth

d) Bulging in cans may affect the size and shape of the CFB box

e) Salt spray with high humidity causes rusting of tinplate cans

f) If the dimension (width and length) of the box is slightly more than the specified limit, cans are likely to tilt and affect the body of neighbouring cans.

Performance evaluation of packages is an important integral part of package design. Its importance is derived from the fact that it throws light on the protective abilities of the package during the course of the distribution cycle. Now a days it is

the practice to subject the package to performance tests before finally accepting it for any distribution tests. The various tests conducted for transport packages are;

a) Drop test
b) Vibration test
c) Impact
d) Compression test
e) Rolling test
f) Environmental or climatic tests

Drop test

The purpose of the drop test is to simulate those hazards, which are encountered during handling of the packages by men and equipment. The test is perhaps the most damaging and most probable hazard for any package during distribution as handling operations and the consequential drops are inevitable. There are two main types of drop tests. One drop tester is for light packages, which can be slung easily. It has release mechanisms from where the package is suspended by means of sling, which allows it to drop in any desired position. The second type of drop tester is meant for heavy packages, consists of table top and trap door. The package is held in the desired position on the table top and a trap door is opened thus allowing the package to fall to the floor. The height and position of fall and the types of floor can again be altered as required.

Inclined Impact test

The purpose of inclined impact test is to determine the ability of a container and inside packing to withstand impact stresses. The inclined plane test consists of a tract inclined to 10^0 to the horizontal on which a dolly can be released so as to impact a buffer placed at right angles across the end. The speed can be varied by adjusting the starting position of the dolly. Maximum speed 8 miles (13 Km) per hour.

Vibration test

Vibration test is conducted to determine the ability of a container, with its internal fitments and means of closure to provide sufficient protection against damage to its contents when subjected to the vibrations of transportations. Vibration table consists of a bed, which is driven by two eccentrics, one at each end connected in phase with each other. To the top of the vibration bed, a platform is attached and the platform describes a circular harmonic type vibration when the equipment is in operation. The amplitude of the vibration is one inch and frequency may be varied from 120 to 360 cycles per minute. This covers the range of vibration frequencies experienced in railway wagons and road vehicles. It has been roughly estimated that one hour ride on the vibration table is approximately equivalent to 1000 miles journey by rail.

Rolling test

The rolling test is performed for testing the strength of the transport package and the protection that it offers to its contents when the package confronts the hazard of rolling.

Compression tests

This test gives the measure in terms of stackability of the box both under dynamic and static conditions. Compression strength is influenced by all the component materials in the box and the complete manufacturing practice. Almost all aspects that make a box directly influence the value of the compression strength. For example, substance and stiffness of the liner and the corrugating medium, formation and type of corrugation, combination of corrugations, quantity and uniformity of bonding medium, combination of plies, bending stiffness of the board, cutting and creasing of the board, moisture content, style of the box as well as the inner fitments all have a tangible influence on the compression strength. The compression strength is measured under standard conditions of temperature and humidity using a Universal Compression Strength

tester with the platten movement fixed at a given speed. The compression strength comes from the load carrying capacity of the vertical panels. The load generally concentrated only at the corners. The box fails when the lateral bulge becomes sufficiently large and failure lines transmit into the center of the panel usually beginning from the corners. When flutes run vertically in the direction of the stacking the box will have better load carrying capacity. For combinations it is better that the heavier liner may be placed inside. For superior compression strength it should be ensured that the flutes are not crushed during conversion or printing and the ventilation holes if any must be punched away from the areas of higher stress.

The compression strength measures the load at which the board collapses under laboratory conditions. Such values are generally higher than the load when the box is stacked under sustained load in a warehouse. Therefore such practical working load in the warehouse have to be related to the lab compression strength by a safety factor. This safety factor would be necessarily influenced by the method pf stacking, storage time, presence and effect of moisture etc. It can be generally vary between 2 and 5.

Climatic testing

The object of climatic testing is to assess the protection offered by the package to its contents from climatic conditions and to assess the overall performance of the package when it is exposed to particular conditions. In general three types of equipments are used.

(1) Cabinets or ovens

(2) Conditioning rooms

(3) Shower booths

Methods of using cabinets and rooms are as follows: -

(1) To assess moisture barriers, the package is stored at set conditions in the cabinet and periodically withdrawn for examination or measurement of criteria appropriate to the content. It may be necessary to give the pack a preliminary handling test before storage.

(2) To assess the climatic performance of a package, the package is stored for a period, usually in a room, as part of a test sequence that includes other hazards. Packages may also be stored for a period and then subjected to specific test.

Specification for master carton for export of frozen sea foods & frog legs

DETAILS	CIFT	IS: 6715-1972 (20 – 30 Kg)	Up to 20Kg
Grammage of papers g.m²	140[5]		
a). Corrugating medium		150	150
b). Combined weight of liners		500	450
Bursting strength (kg/cm²)	12 (min.)	14	12
Puncture resistance (Beach units)	250 (min.)	200 (min)	175
Wax coating (g/m²)	On both sides preferred	20 GSM (Min.) on each side	
Compression strength (kg)	350 (min.)		
Type of Flute	B/B(Narrow / Narrow)	A, B, C or any combination of these	
Cobb's 30'value (Water proof ness)		120 (max.)	120

Specifications of CFB for canned sea foods for export

Sl.No.	Physical characteristics	Up to 20 Kg	20 – 30 Kg
(1)	Bursting strength kg.cm^2	12	15
(2)	Water proofness (Max) Cobb 30'value	120	120
(3)	Substance (g/m^2)		
	(a) For corrugative medium	170 (3 ply)	170 (3 ply)
		150 (5 ply)	150 (5 ply)
	(b) For combined weight of liners	400 (3 ply) 450 (5 ply)	450 (3 ply) 500 (5 ply)
(4)	Type of flute	A, B, C or any combination of these	A, B, C or any combination of these
(5)	Puncture resistance (Beach units) (min.)	175	200

The manufacturers joint shall be stitched, glued or taped.