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SPECIFICATION FOR

CORRUGATED FIBREBOARD BOXES

SRI LANKA STANDARDS INSTITUTION

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SLS 801:1987

Gr. 7

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This standard does not purport to include all the necessary provisions of a contract.

* Served in the Sub-Committee (3) on Paper and Board

SRI LANKA STANDARD

SPECIFICATION FOR CORRUGATED FIBREBOARD BOXES

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1987-11-18, after the draft, finalized by the Drafting Committee on Paper and Board, had been approved by the Chemicals Divisional Committee.

Corrugated fibreboard boxes are utilized as inner and outer containers for packaging of a wide variety of goods for domestic use and for overseas shipment. The choice of a box is dependent to a great extent on contents, their mass, fragility and shape, storage, handling and transport requirements and climatic conditions. Internal fitments and cushioning materials are required in order to restrict internal movement and to provide support to the box when the contents do not conform to the shape and dimensions of the box.

When boxes are manufactured for special purposes or against specific requirements of a purchaser, any additional requirements needed or deviations shall be as agreed to between the purchaser and the supplier. Sub clauses 4.1.1.6, 4.1.2, 4.1.3, 4.2.1, 4.2.3, 4.3.2 and 5.1 in this specification call for agreement between the purchaser and the supplier.

All standard values in this specification are given in SI units.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with CS 102. The number of significant places retained in the rounded off value should be the same as that of the specified value in this specification.

In the preparation of this specification, the assistance obtained from the publications of the British Standards Institution, the Indian Standards Institution and the Standards and Industrial Research Institute of Malaysia is gratefully acknowledged.

1 SCOPE

1.1 This specification prescribes the requirements and methods of sampling and test for corrugated fibreboard boxes for packaging of contents up to 75 kg in mass.

1.2 This specification does not cover the requirements for corrugated fibreboard boxes intended for packaging of dangerous goods and food products which could be contaminated by being directly in contact with the box.

2 REFERENCES

CS 102 Presentation of numerical values

SLS 338 Determination of substances of paper and paper board

SLS 428 Random sampling methods

SLS 473 Testing of paper and board for water absorption - Cobb method

SLS 479 Testing of single-faced and single wall corrugated fibreboard for flat crush resistance

SLS 680 Testing of board for bursting strength

SLS 800 Code for styles of fibreboard boxes.

DEFINITIONS

For the purpose of this specification the following definitions shall apply:

3.1 **corrugated fibreboard** : Board consisting of one or more sheets of fluted paper (fluting) bonded to two or more liners, usually of kraft.

3.2 **single wall corrugated fibreboard** : Board consisting of one sheet of fluted paper with flute designation A, B, C or E (see Table 1), interposed between and bonded to two liners (see Figure 1).

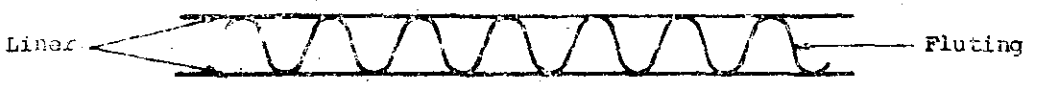

FIGURE 1 - Single wall corrugated fibreboard

3.3 **double wall corrugated fibreboard** : Board consisting of two sheets of fluted paper usually from a combination of A, B and C flute designations (see Table 1), interposed between and bonded to three liners (see Figure 2).

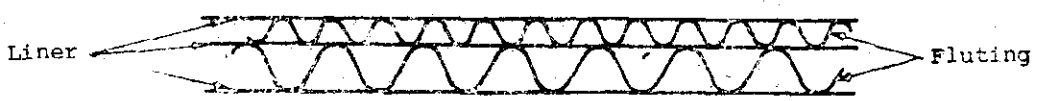

FIGURE 2 - Double wall corrugated fibreboard

3.4 triple wall corrugated fibreboard : Board consisting of three sheets of fluted paper usually from a combination of A, B and C flute designations (see Table 1), interposed between and bonded to four liners (see Figure 3).

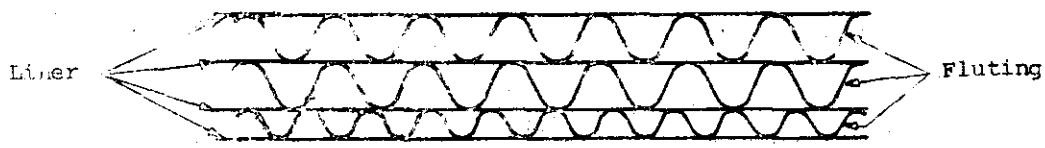

FIGURE 3 - Triple wall corrugated fibreboard

3.5 corrugation (flute) : A single complete wave in corrugated board having designation A, B, C or E (see Table 1).

TABLE 1 - Designation of corrugations (flutes)

Designation (1)	Corrugations per metre (2)	Height of corrugations, mm (3)
A flute	105 to 125	4.5 to 4.7
B flute	150 to 185	2.1 to 2.9
C flute	120 to 145	3.5 to 3.7
E flute	290 to 320	1.1 to 1.5

3.6 crease : An indentation in corrugated fibreboard to give the line of fold (see Note).

Note - Crease at right angles to the flutes is sometimes called a score.

3.7 fluted paper (fluting) : Paper (see Note) after undergoing a process resulting in a pattern of regular and permanent undulations.

Note - The paper used is usually called corrugating medium.

3.8 kraft paper : A strong paper manufactured mainly from bleached or unbleached sulfate pulp.

3.9 liner : Paper or board intended to be bonded to fluted paper.

3.10 manufacturer's joint : Parts of the box which are joined together by the manufacturer.

4 REQUIREMENTS

4.1 Materials

4.1.1 *Corrugated fibreboard*

The corrugated fibreboard shall have non-leaning flutes of correct profile. Height of the flutes shall be uniform. Creasing shall be adequate to bend the corrugated fibreboard at correct positions.

4.1.1.1 Resistance to cracking or delamination

The corrugated fibreboard used shall not crack or delaminate on bending or creasing.

4.1.1.2 Flat crush resistance

Single wall corrugated fibreboard shall have the following minimum flat crush resistance values when determined as given in 7.1.

A flute - 140 kPa

B flute - 180 kPa

C flute - 165 kPa

4.1.1.3 Substance of fluting

Nominal value of the substance of the fluting used shall be not less than 112 g/m^2 (see Note 1). The substance of the fluting shall be determined as given in 7.2 (see Note 2).

Note 1 - A tolerance of ± 5 per cent is permitted on the nominal value of the substance specified.

Note 2 - It is not necessary to carry out this determination as a routine for all the samples. It should be determined in case of dispute and when required by the purchaser or the vendor.

4.1.1.4 Substance of liners

4.1.1.4.a) The combined nominal values of the substance of all liners with respect to maximum mass of contents shall be not less than the values specified in Column 3 of Table 2 (see Note 1 given under 4.1.1.3). The substance of liners shall be determined as given in 7.2 (see Note 2 given under 4.1.1.3).

4.1.1.4.b) For double wall and triple wall corrugated fibreboards nominal value of the substance of inner liner (s) shall be not more than the minimum nominal substance of either of the individual outer liners and also shall be not less than 125 g/m2 (see Note 1 given under 4.1.1.3). The substance of the liners shall be determined as given in 7.2 (see Note 2 given under 4.1.1.3).

4.1.1.5 Printability

The outer surface of corrugated fibreboard shall have good printability.

4.1.1.6 Weatherproofness

When waterproofness or weatherproofness is required, special boards having wet strength characteristics or coated or laminated boards shall be used for the outer liner as agreed to between the purchaser and the supplier.

4.1.2 *Adhesive*

A suitable adhesive capable of firmly adhering the components of the board together shall be used. Highly alkaline adhesives shall not be used for the outer liner. However, sodium silicate grades which are commonly referred to as "neutral silicates" may be used for bonding the outer liner if agreed to between the purchaser and the supplier (see Note). Water resistant adhesives shall be used for bonding the components of corrugated fibreboard intended for use in the manufacture of waterproof or weatherproof boxes.

Note - When "neutral silicates" are used, alkali resistant inks may be required for printing.

4.1.3 *Stiching wire or staples and adhesive tapes*

4.1.3.1 For staples and stitches, flat wire shall be used as agreed to between the purchaser and the supplier.

4.1.3.2 Adhesive tape shall be of suitably prepared woven fabric or of laminated kraft paper with reinforcing strands of cotton, linen, glass fibre, nylon or other suitable material as agreed to between the purchaser and the supplier.

4.2 Construction

4.2.1 The boxes shall be manufactured to the style as agreed to between the purchaser and the supplier. A wide range of styles of fibreboard boxes is given in SLS 800. Corrugated fibreboard used in the manufacture of boxes shall be described as given in Appendix A.

4.2.2 The corrugated fibreboards shall be properly creased and slotted so that when the box is assembled, there shall be no holes at the corners.

4.2.3 *Manufacturer's joint*

Manufacturer's joint shall be made by one of the following methods as agreed to between the manufacturer and the purchaser such that the direction of the flutes are parallel to the manufacturer's joint, unless otherwise specified. For triple wall corrugated boards, manufacturer's joint shall be made in accordance with 4.2.3.1.b).

4.2.3.1 Stitched lap joint

4.2.3.1.a) Manufacturer's joint shall overlap not less than 30 mm and be fastened with metal staples or stitches not more than 60 mm apart. The first and the last staples shall not be further than 25 mm from the beginning

and the end of joint respectively. The staples and stitches shall be centrally located along the overlap and may be straight or at an angle of 45°.

4.2.3.1.b) For triple-wall corrugated board, manufacturer's joint shall overlap not less than 35 mm. The joint shall be fastened with flat metal stitches at an angle of 45° and uniformly spaced not more than 40 mm apart with double stitches at each end of the joint.

4.2.3.2 Glued lap joint

Manufacturer's joint shall overlap not less than 30 mm and be firmly bonded with suitable adhesive throughout the entire area of the joint. There shall not be excess adhesive spread outside the joint. When subjected to very humid conditions, the adhesive shall have a performance better than or equal to that of the adhesive used in the manufacture of corrugated fibreboard.

4.2.3.3 Butt joint

When the manufacturer's joint is made by butting the edges, it shall be secured by adhesive tape along the entire length of the joint. The adhesive tape shall be not less than 50 mm wide.

4.3 Dimensions

4.3.1 The dimensions of the boxes shall be the internal dimensions of the assembled box, measured between the opposing faces of the box in the sequence of:

Length (L) - the longer dimension at the opening

Breadth (b) - the shorter dimension at the opening

Height (H) - the dimensions from the top of the opening to the base, measured, where applicable, from inner flap to inner flap.

4.3.2 The boxes shall conform to the dimensions specified by the purchaser. A tolerance of $\pm$ 3 mm shall be permitted on the specified dimensions. If special tolerances are required, it shall be as agreed to between the purchaser and the supplier. However, the combined internal dimensions of the box with respect to maximum mass of contents shall not be more than the value specified in Column 4 of Table 2.

4.3.3 While the dimensions of many boxes are predetermined by the dimensions of the unit to be packed, when the contents of the box permit a choice, it is desirable that no single dimension should be greater than 50 per cent of the combined dimensions (L + B + H).

4.4 Bursting strength

The bursting strength of the corrugated fibreboard with respect to maximum mass of contents shall not be less than the value specified in Column 5 of Table 2 when determined by the method given in SLS 680.

4.5 Water absorption

The increase in the substance of the outer surface of the corrugated fibreboard shall not be more than 155 g/m^2 when determined as given in 7.3.

TABLE 2 - Requirements for substance of liners, dimensions and bursting strength

Type of board (1)	Maximum mass of contents, kg (2)	Minimum combined nominal substance of all liners, g/m^2 (3)	Maximum combined internal dimensions (L+B+H), mm (4)	Minimum bursting strength of board, kPa (5)
-Single wall	5	250	635	600
	8	300	750	800
	10	400	1 025	1 030
	15	450	1 275	1 180
	20	500	1 525	1 270
	30	600	1 650	1 500
	40	800	1 775	1 850
Double wall	15	375	1 275	850
	20	425	1 525	1 000
	30	575	1 650	1 380
Double wall and Triple wall	40	675	1 775	1 610
	55	900	1 900	2 200
	75	1 200	2 150	2 550
Methods of test (Reference to relevant clause and SLS)	-	7.2	-	SLS 680

5 PACKAGING AND MARKING

5.1 The boxes shall be packed and supplied as agreed to between the purchaser and the supplier.

5.2 Unless otherwise stated by the purchaser, each box shall be legibly and indelibly marked with the following:

a) Name and address of the manufacturer/supplier and country of origin;

b) Batch or code number;

c) Type of board;

d) Gross mass limit, in kilograms;

e) Minimum bursting strength, in kilopascals;

f) Combined maximum internal dimensions, in millimetres;

g) Registered trade mark, if any; and

h) Description of the corrugated fibreboard (see Appendix A).

5.3 The corrugated fibreboard boxes may also be marked with the Certification Mark of the Sri Lanka Standards Institution illustrated below on permission being granted for such marking by the Sri Lanka Standards Institution.

Note - The use of the Sri Lanka Standards Institution Certification Mark (SLS Mark) is governed by the provisions of the Sri Lanka Standards Institution Act and regulations framed thereunder. The SLS Mark on products covered by a Sri Lanka Standard is an assurance that they have been produced to comply with the requirements of the standard under a well defined system of inspection, testing and quality control, which is devised and supervised by the Institution and operated by the producer. SLS marked products are also continuously checked by the Institution for conformity to that standard as a further safeguard. Details of conditions under which a permit for the use of Certification Mark may be granted to manufacturers or processors may be obtained from the Sri Lanka Standards Institution.

6 SAMPLING

6.1 Lot

In any consignment all the boxes of the same style and size and belonging to one batch of manufacture shall constitute a lot.

6.2 Scale of sampling

6.2.1 Samples shall be tested from each lot for ascertaining its conformity to the requirements of this specification.

6.2.2 The number of boxes to be selected from each lot shall be in accordance with Column 1 and Column 2 of Table 3.

TABLE 3 - Scale of sampling

Number of boxes in a lot (1)	Number of boxes to be selected (2)	Acceptance number (3)
Up to 5 000	20	3
5 001 to 10 000	25	3
10 001 and above	30	4

6.2.3 The boxes shall be selected at random. In order to ensure randomness of selection, tables of random numbers are given in SLS 428 shall be used.

6.3 Number of tests

6.3.1 Each box selected as in 6.2.2 shall be inspected for marking requirements.

6.3.2 Fifteen boxes shall be selected from the boxes selected as in 6.2.2 and examined for dimensional requirements given in 4.3 and Column 4 of Table 2.

6.3.3 Each box selected as in 6.2.2 shall be examined for the requirements given in 4.2.2 and 4.2.3.

6.3.4 For single wall corrugated boxes, five boxes shall be selected from the boxes selected as in 6.2.2 and tested for flat crush resistance (see 4.1.1.2) taking two specimens from each box.

6.3.5 Five boxes shall be selected from the remaining boxes and tested for substance (see 4.1.1.3 and 4.1.1.4) taking two specimens from each box.

6.3.6 Two subsample each containing five boxes shall be selected from the boxes selected as in 6.2.2 and one subsample shall be tested for bursting strength (see 4.4 and Note) and the others shall be tested for water absorption of the outer surface (see 4.5).

Note - Take two specimens from each box selected and test half of them for bursting strength, with one face of the specimen uppermost and half with the other face uppermost.

7 METHODS OF TEST

7.1 Flat crush resistance

Determine the flat crush resistance as given in SLS 479.

7.2 Substance of liners and fluting

Separate the liners from the fluting and determine the substance of separated liners and fluting as given in Appendix B.

7.3 Water absorption of the outer surface of corrugated fibreboard (Cobb method)

Determine the water absorption of outer surface as given in SLS 473. The total time of test shall be 30 minutes.

7.4 Bursting strength

Determine the bursting strength as given in SLS 680.

8 CONFORMITY TO STANDARD

A lot shall be declared as conforming to the requirements of this specification, if the following conditions are satisfied.

8.1 Each box inspected as in 6.3.1 satisfies the marking requirements.

8.2 Each box examined as in 6.3.2 satisfies the relevant requirements.

8.3 The number of boxes not satisfying one or more requirements in 4.2.2 and 4.2.3 does not exceed the corresponding acceptance number given in Column 3 of Table 3.

8.4 Each specimen tested as in 6.3.4 satisfies the relevant requirements.

8.5 The values of the expressions $(\bar{x} - 1.1s)$ and $(\bar{x} + 1.1s)$ calculated using the test results on substance when tested as in 6.3.5 lie within $\pm$ 5 per cent tolerance of the nominal value.

NOTES

1. *Mean ($\bar{X}$) = The sum of values of the observations divided by the number of observations.*

2. *Standard deviation(δ) = The positive square root of the quotient obtained by dividing the sum of squares of the deviations of the observations from their mean by one less than the number of observations in the sample.*

8.6 Each specimen tested as in **6.3.6** satisfies the relevant requirements.

APPENDIX A

DESCRIPTION OF CORRUGATED FIBREBOARD USED IN THE MANUFACTURE OF BOXES

A.1 ABBREVIATIONS

A.1.1 Flute designation

Abbreviations, A, B, C and E shall be used to designate flutes (see 3.5).

A.1.2 Type of liner		Abbreviation
a)	Kraft liner	K
b)	Bleached kraft liner	BK
c)	Test liner (see Note)	T
d)	Chip or straw liner	C

NOTE - A liner that complies with the requirements of an agreed test specification.

A.2 DESCRIPTION OF CORRUGATED FIBREBOARD

Describe each liner and flute designation in turn, from the outside to the inside of the box. For single wall corrugated fibreboard, indicate first, the substance and the type of liner facing outside the box. After an oblique sign, indicate the flute designation followed by a hyphen and then the substance of fluting. After another oblique sign indicate the substance and the type of the liner facing inside the box. For double wall and triple wall boards, insert further flute designations and liner description using the same notation, maintaining the order of fluting and liners from outside to inside of the box. (see Examples).

EXAMPLE 1

A flute single wall corrugated fibreboard of 150 g/m^2 kraft liner facing outside the box, 112 g/m^2 fluting and 150 g/m^2 test liner facing inside the box shall be described as 150 K/A-112/150 T.

EXAMPLE 2

B and C flute, double wall corrugated bibreboard of 200 g/m^2 bleached kraft liner facing outside the box, 125 g/m^2 fluting, 125 g/m^2 chip liner in the middle, 125 g/m^2 fluting and 150 g/m^2 kraft liner facing inside the box shall be described as 200 BK/B-125/125 C/C-125/150 K.

APPENDIX B

METHOD OF SEPARATION OF LINERS OF CORRUGATED FIBREBOARD FROM FLUTING AND DETERMINATION OF SUBSTANCE

B.1 METHOD FOR THE SEPARATION OF LINERS FROM FLUTING

B.1.1 Test specimens

Test specimens of area not less than 100 cm^2 shall be used.

B.1.2 Procedure

B.1.2.1 Immerse the test specimens in water for long enough to cause the liners to separate spontaneously, or with an extremely light pull, from the fluting. Care shall be taken in separating the components of the board that no fibres are removed from one surface and adhere to the adjoining one. To accelerate the process and to separate component sheets of paper bonded with more or less water resistant adhesive, hot water may be used.

B.1.2.2 Lightly scrape the surface of the liners and fluting while wet to remove any adhesive which has not been absorbed by them (see Note).

NOTE - Complete removal of the absorbed adhesive cannot be expected, but removal of paper fibre is to be avoided.

B.1.2.3 Dry the separated liners and fluting medium at a temperature less than 105 °C.

B.2 DETERMINATION OF SUBSTANCE OF LINERS AND FLUTING

B.2.1 Condition the separated liners and fluting (see A.1.2.3) as given in 2 of SLS 338 : 1975. Flatten the fluting and recut an area of 100 cm^2.

B.2.2 Determine the substance of fluting and liners as given in SLS 338.

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