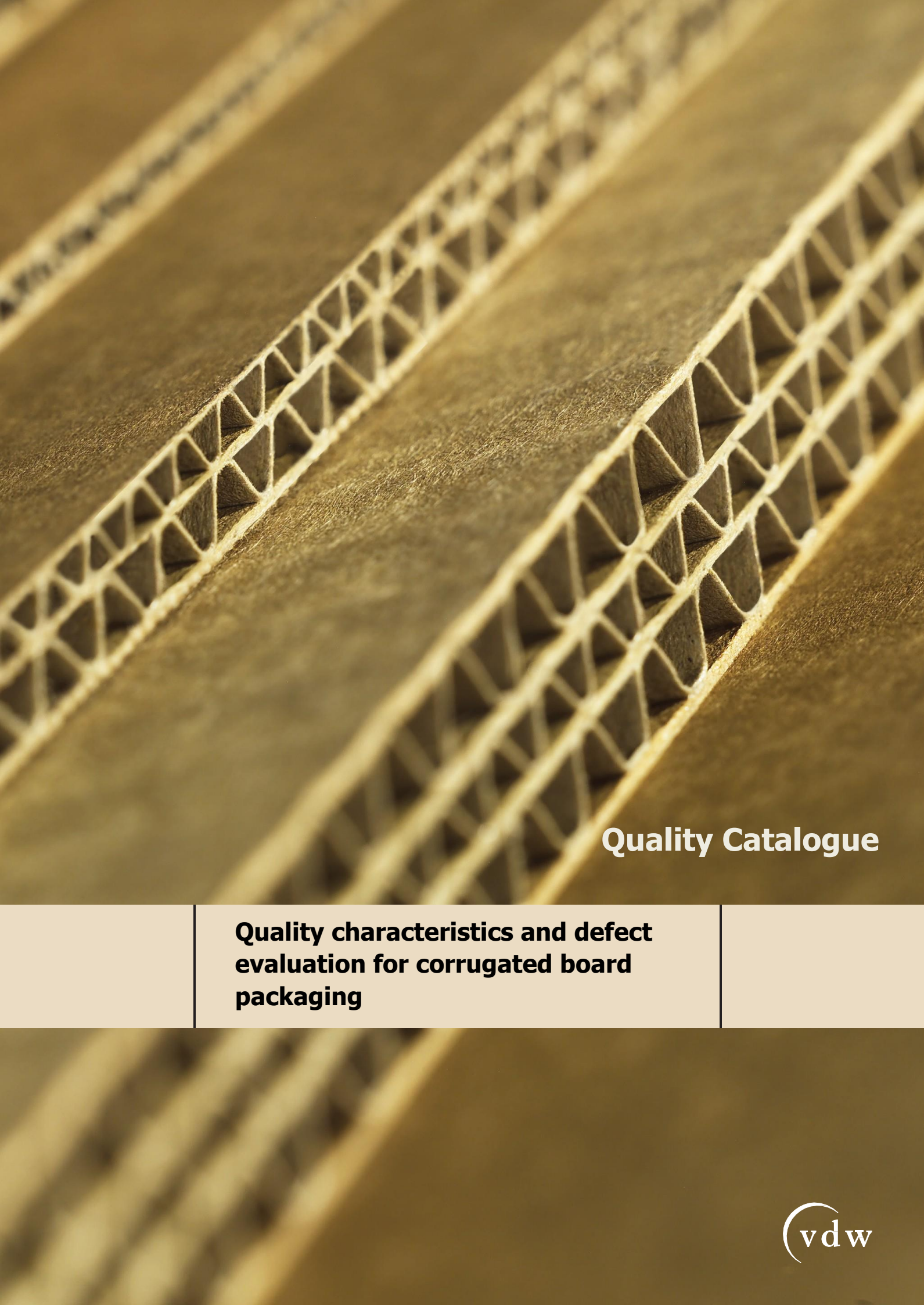

Quality Catalogue

Quality characteristics and defect evaluation for corrugated board packaging

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QUALITY CATALOGUE FOR CORRUGATED BOARD PACKAGING

QUALITY CHARACTERISTICS AND DEFECT EVALUATION FOR CORRUGATED BOARD PACKAGING

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1. Introduction

This catalogue is intended to be used for customer´s quality assurance of the packaging deliveries (e.g. folding boxes, blanks) made from corrugated board. This catalogue helps to define best practice and can be considered as 'state of the art'.

Special conditions apply for all other types of packaging, these conditions are to be agreed separately. The requirements for the transportation of the packaging in respect of bundling, palletisation and strapping are also outside of the scope of this document and to be agreed separately as hygiene-related matters.

This scope of this catalogue covers converting quality issues of both corrugated board and the subsequent packaging made from corrugated board. The catalogue could be used as a supplement to the German standards DIN 55468-1 and RAL-GZ 492.

2. Explanatory notes

This catalogue distinguishes between the following types of defects:

Critical defects (CD)

Defects whose existence/occurrence can bring about critical consequences e.g. here they may:

- endanger human life or health,
- violate statutory provisions,
- lead to the destruction or transformation of the packed goods,
- significantly impair either the reliability of the storage or the efficiency of the production tools and/or the filling equipment and/or the packing equipment.

Major defects (MJD)

Defects whose existence/occurrence can bring about impairments, e.g. they may:

- lead to performance inefficiencies and thus to the failure of the packaging/package,
- lead to complaints by the customer,
- cause loss of efficiency in the production, impair the efficiency of production tools and/or of the filling and packing equipment.

Minor defects (MND)

Defects whose existence/occurrence do not have any significant consequences, e.g. they may represent / lead to a general reduction in quality.

The different types of defect are assigned to defect classes that are defined as follows:

Defect class 1: Packaging unusable

Defect class 2A: Usability of the packaging seriously impaired

Defect class 2B: Usability of the packaging impaired to a lesser extent

Defect class 3: Usability of the packaging impaired but does not significantly affect the properties of the packaging

Sample specifications based on ISO 2859, Part 1[1] have been laid down for the respective defect classes. A statistically secured test procedure requires that the test pieces are drawn randomly from the production run. Folding boxes that have become unusable due to their transportation and other external influences have to be excluded from the evaluation. The envisaged goods defect limit (AQL) corresponds to a significance probability level of 95%.

A delivery with this high probability level will be anticipated as long as the following defect limits in the shipment (batch) are not exceeded:

Table 1: Setting the AQL values

Type of defect	Defect class	AQL value
Critical defect (CD):	1	–
Major defect (MJD):	2A	0.65 1.0
	2B	1.5 4.0
Minor defect (MND):	3	6.5

Defect class 1 does not contain any defect level, as such defects may well lead to a delivery rejection.

The batch size “N”
The batch size (delivery quantity) is the quantity of packaging run that is presented for testing at one time as defined in the following guidelines.

The sample size “n” is the quantity of the packaging that is taken from the batch for the evaluation.

The acceptance number “c” is the highest permitted number of defective items of packaging found in the sample.

[1)] DIN ISO 2859, August 2014: Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

In the case of a single defective item of packaging (folding box, blank) with multiple defects, only the most serious defect is evaluated. Defects to multiple items of packaging from different ranges of key characteristics will be added up within their defect class.

Table 2: Samples - basic table

Batch size N (no. of items)	**Sample size** n	**AQL**					
		0.65	1.0	1.5	2.5	4.0	6.5
		Number of defective items permissible in the sample (acceptance number "c")					
up to - 500	N or 10	0	0	0	1	1	2
501 - 1,200	20	0	1	1	1	2	3
1,201 - 3,200	32	1	1	1	2	3	4
3,201 - 10,000	50	1	1	2	3	4	6
10,001 - 35,000	80	1	2	3	4	6	8
35,001 - 150,000	125	2	3	4	6	8	12

In the case of very large orders, it is recommended that the total delivery will be subdivided to acceptable batch sizes, e.g. one loading unit.

Arbitration tests should be based on the valid standard climate. As this quality catalogue was being completed, the standard climate is 23 °C and 50 % relative humidity according to DIN EN 20187.

Note the following when using this quality catalogue:

The thickness (height) of the corrugated board is an approximate value in millimetres. The heights of the various flutes are shown in Table 3. The thickness of multiwall corrugated board is to be calculated by addition.

Table 3: Flute types

Flute	Flute height h	Flute pitch t
	mm	mm
G	< 0,6	≤1.8
F	≥ 0.6 to < 1.0	1.8 to < 2.6
E	≥ 1.0 to < 1.9	> 2.6 to ≤ 3.5
D	≥ 1.9 to < 2.2	> 3.5 to ≤ 4.8
B	≥ 2.2 to < 3.1	> 4.8 to ≤ 6.5
C	≥ 3.1 to < 4.0	> 6.5 to ≤ 7.9
A	≥ 4.0 to < 5.0	> 7.9 to ≤ 10.0
K	≥ 5.0	>10.0

In addition, different papers for corrugated are in use. Depending on the corrugated board layer, linerboard or papers for medium will be used.

Linerboard are papers used for flat facing. Papers for medium are papers used for flute(s).

Linerboards and medium papers are characterised by different basis weight and technical values and are subdivided as follows:

Linerboards:
- kraftliner (e.g. brown, white)
- testliner (e.g. brown, white)
- schrenz
- other

Medium:
- wellenstoff
- semichemical pulp
- other

An example of sampling

A shipment of N = 20,000 folding boxes is to be evaluated. According to Table 2, n = 80 folding boxes which should be taken completely randomly.

The sample should be distributed over the entire shipment (beginning, middle and end).

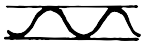
In the sample, the following numbers of defects may be present for each defect class:

Defect class 1:	no defects
Defect class 2A:	one defect at AQL 0.65 or two defects at AQL 1.0
Defect class 2B:	three defects
Defect class 3:	eight defects

Only the most serious defect in each of the folding boxes sampled is evaluated.

3. Quality catalogue

3.1 Characteristics of the packaging material

No.	Property	Drawing	Test method	Evaluation	Score	
					Defect class	AQL value
1	Linerboard grade		Visual inspection to see whether the linerboards used match the order by colour and grade (see also following page)	correct/wrong	2 A	0.65
2	Condition of the facings		Visual inspection for creases, blisters and other damage.	good to acceptable / unacceptable	2 B	4.0
3	Flute type and flute direction in the packaging		Visual inspection to see whether the flute type and flute direction correspond to the customer's order (see DIN 55468-1 and following page).	correct/wrong	1	-
4	Flute structure		Test by cutting the flute, preferably in the cover/flaps area.Exception: Effect of the ejection rubber in the area of the creases and cutting lines.	correct/wrong	2 B	1.5
5	Bonding of the corrugated board		Test by tearing to see whether the adhesion is adequate (visible tear).	good to acceptable unacceptable	2B 1	-
6	Alignment of flute and liner		Visual inspection	yes/no	3	6.5
7	Flatness of the board		Flatness according to specification	yes/no	2 B	1.5

Explanatory notes on the table

No. 1
The choice of linerboards and papers for medium is left to the manufacturer, provided that no special arrangements have been made. With regard to the colour of the linerboards used, these should be checked whether for example a required white or coloured paper has been used.

Typical variations in paper colour are caused by the manufacturing process and accordingly should not be taken into account in the visual inspection.

The surface of the linerboards used are usually machine finished (see DIN 6730). If the paper has a finished side then this will normally be placed on the outside.

No. 3
It should be tested whether the flute was delivered according to the order. For test purposes, a cut will be made on an unprinted surface cross to the flute direction, away from the edge.

There is a difference between single-wall and multiwall grades. Multi-wall grades are combinations of various flute types. Due to various processing factors, thickness of the finished board is not an indicator for the flute type, this can be referred to the flute pitch (see Table 3 and DIN 55468, part 1).

With regard to the fluting direction in the finished folding box, it should be tested to determine if the flutes direction is in line with the order. Unless agreed otherwise, flutes direction runs parallel to the slots of the box.

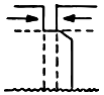
No. 5
Good to acceptable applies as long as the packaging's functionality is ensured.

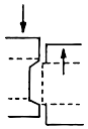
No. 7
Warp is measured as a warp in percentage.
The corrugated board sheet is laid on a flat surface with the bend facing upwards. The maximum elevation divided by the distance between the two supporting edges expressed as a percentage gives you the degree of warp.

3.2 Converting issues

Note: All data relates to the standard climate of 23 °C and 50% relative humidity.

No.	Property	Drawing	Test method	Evaluation	Score	
					Defect	AQL value
1	Structural design of the box		In line with the specification/drawing	yes/no	1	–
2	Dimensions		Determination of the distance between two creasing centrelines or between a creasing centerline and the associated outer edge. Tolerances up to 300 mm: ± 3 mm over 300 mm to 700 mm: ±4 mm over 700 mm to 1,200 mm: ± 0.6 % over 1,200 mm: as agreed Special tolerances may be required for machine converting.	OK/not OK	2 A	0.65
3	Dimensional tolerances for die-cuts and embossments		Test for deviations from specified dimensions. Tolerance ± 0.5 %, min. of ± 1 mm. The measurements are either made from creasing centerline to centreline or to the outer edge of the flat die-cut.	yes/no		
3.1	Manufacturer's process: rotational				2 B	4.0
3.2	Manufacturer's process: flatbed die-cutting				2 B	1.5

No.	Property	Drawing	Test method	Evaluation	Score	
					Defect class	AQL value
4	Positioning of the creasing		Creasing does not fold at the scheduled position.	yes/no	2 A	0.65
5	Crease structure		Visual inspection for outer layer bursts. Visual inspection for inner layer bursts. If the inner layer is bursted, this is not a converting error that can cause the batch rejection.	yes/no	2 B 3	1.5 6.5
6	Positioning of the slots; position and size of the blanks (if present)		Test for lateral displacement compared to centerline of longitudinal crease. Tolerance ± 2 mm.	yes/no	2 A	1.0
7	Slot depth		Evaluation of tolerance of ± 5 mm from the centreline of the elevated crease.	yes/no	2 A	1.0
8	Structure of the cutting edges and slots		Visual inspection for an unclean cut or scrap etc.	good to acceptable / unacceptable	2 B	4.0
9	Gap width		Normal width = 6mm and 8 mm (gap width) Tolerance range single wall: – 4 mm to + 4 mm double wall: – 4 mm to + 6 mm Measured in each case at the gap edge on the top Note: Tolerances apply for machine glued die-cuts; special agreements may be needed for manually glued die-cuts.	yes/no		
9.1	Manufacturer's process: rotational				2 B	4.0
9.2	Manufacturer's process: flatbed die-cutting				2 B	1.5

No.	Property	Drawing	Test method	Evaluation	Score	
					Defect class	AQL value
10	Strength of the manufacturer's joint		Testing the strength by manual testing. Note: Sufficient if 80% of the glue surface is covered with fibres after being torn.	acceptable / unacceptable	2 A	0.65
11	Alignments on the cutting edge		Test for the displacement of the flap edges of the manufacturer´s joint (0.5% of the die-cut's height, min. of 3 mm)	yes/no	2 B	1.5
12	Flap bonding		Test whether boxes are glued inside/outside externally.	yes/no	2 A	1.0
13	Strip bonding		Test whether the right type of strip has been used and whether the strips have been applied correctly.	yes/no	2 A	1.0
14	Stitching		Testing whether stitches are set properly and the distance between the stitches is correct	yes/no	2 A	1.0
15	Printing method		Visual inspection if the print is in line with the print template (it means the whole print inclusive content)	correct/wrong	1	-
16	Print completion		Visual inspection of reference samples (squeezed edges, smudged, fuzzy, incomplete).	Good to acceptable / unacceptable	2 B	1.5
17	Colour shade		Visual inspection for deviations by comparison with reference samples.	no/yes	2 B	1.5

No.	Property	Drawing	Test method	Evaluation	Score	
					Defect class	AQL value
18	The register accuracy for multicolour printing		Test if the tolerance is within ± 2 mm.	yes/no		
18.1	Flexo directprint				2 B	1.5
18.2	Flexo preprint				2 A	1.0
19	Print position		Comparison of the print position with the print template.	correct/wrong	2 B	1.5

Examples

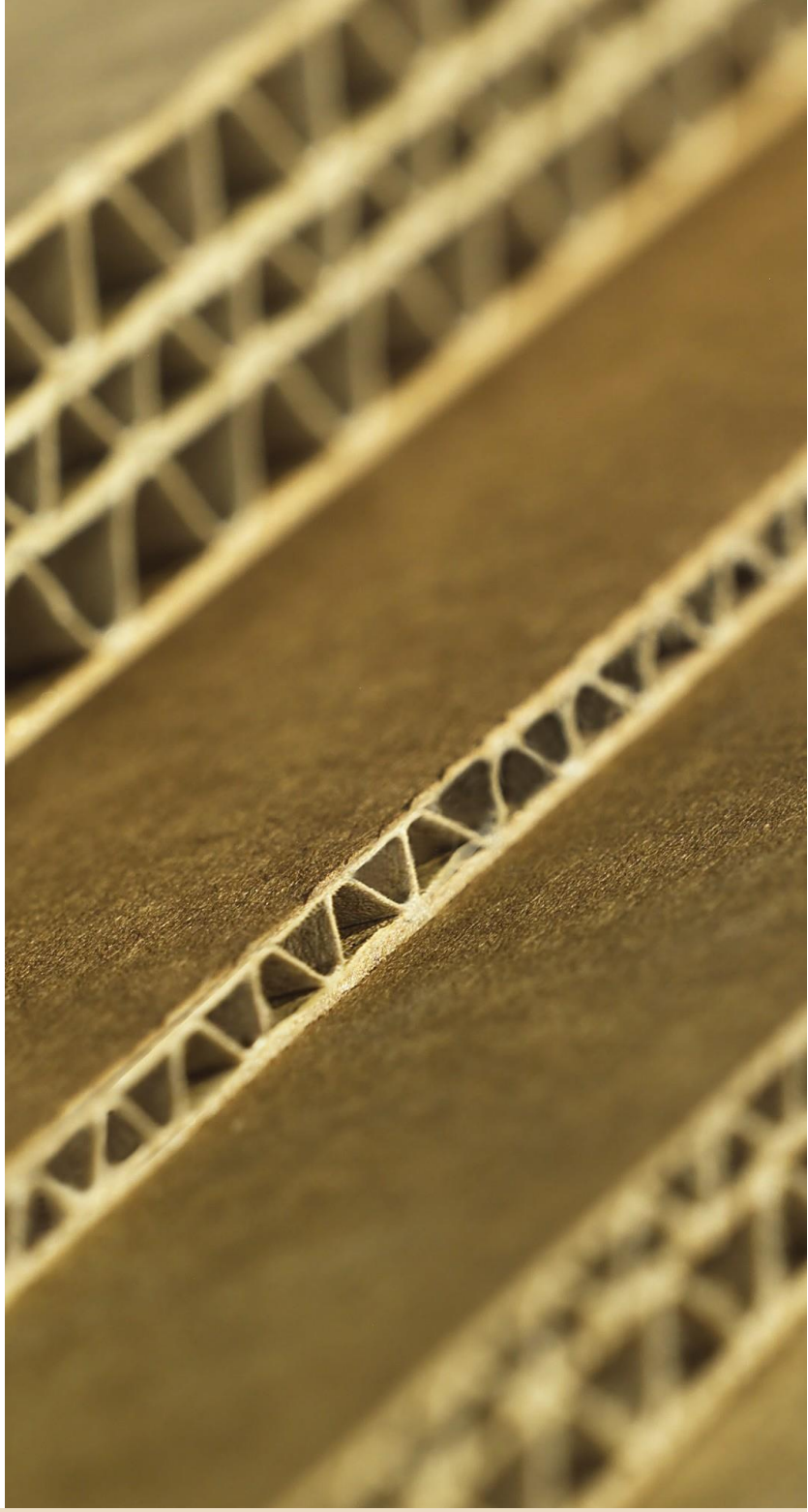
1. Corrugated board box with a B flute and with the following inner dimensions is required: 650 x 400 x 250 mm.

   The crease dimensions are calculated by using the following formula: (L + t) x (B + t) x (H + 2t), where (t) is the packing material's thickness in mm.

   According to Table 3, the dimensions for the distances between the creasing lines (for a B flute) are: 653 + 403 + 256 mm.

   Taking the maximum permissible tolerances into account, the measured values may accordingly be: 653 ± 4 x 403 ± 4 x 256 ± 3 mm.

2. Based on the creasing lines for a die-cut, the packing material's thicknesses are to be subtracted in line with the above formula. The value obtained is the inner dimension of the packet. The tolerances laid down in 3.2 - No. 2 apply to this packet.



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