

Inspection checklist



Test criteria and defect assessment for corrugated cardboard packaging

INSPECTION CHECKLIST FOR CORRUGATED CARDBOARD PACKAGING

INSPECTION CRITERIA AND DEFECT CLASSIFICATION FOR CORRUGATED CARDBOARD PACKAGING

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January 2021

Version 5.0

TEST CATALOGUE FOR CORRUGATED CARDBOARD PACKAGING

1. Introduction

This test catalogue is intended for the inspection of corrugated cardboard packaging supplies (e.g. folding boxes, die-cut blanks) by the customer. It reflects the current state of the art. The test catalogue constitutes a recommendation.

Characteristics and requirements that do not comply with this test catalogue may be agreed separately. Requirements for the transport of packaging materials, e.g. regarding bundling, palletising and strapping, must also be agreed separately. Hygiene aspects also require additional agreements.

The catalogue covers the processing characteristics of corrugated board as a packaging material and of packaging materials made from corrugated board. It may be supplemented by DIN 55468-1.

2. Explanatory notes

The test catalogue distinguishes between the following types of errors:

Critical faults (KF):

Faults whose presence or occurrence can lead to critical consequences, e.g. they

- endanger human life or health,
- or violate legal provisions,
- or lead to the destruction or unauthorised alteration of the contents,
- or significantly impair the reliability of storage and transport, or significantly impair the efficiency of production tools, filling and packaging equipment.

Major fault (MF):

Defects which, if present or occurring, may cause adverse effects, e.g. they

- lead to malfunction and thus to the failure of the packaging material/package,
- or result in complaints from the customer,
- or cause a reduction in production output or impair the efficiency of production tools, filling and packaging equipment.

Minor defect (NF):

Defects whose presence or occurrence has no significant consequences; for example, they

- represent a general reduction in quality.

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Defect types are assigned to defect classes, which are defined as follows:

Defect class 1: Packaging unusable
Defect class 2A: Usability of the packaging severely impaired
Defect class 2B: Usability of packaging material conditionally impaired
Error class 3: Usability of packaging material slightly impaired

Sampling procedures based on ISO 2859, Part 1¹, are assigned to the defect classes. A statistically valid inspection using samples requires that the test items are selected individually using a random procedure. Folding crates that have become unusable due to transport or other external influences must be excluded from the assessment. The specified acceptance quality limit (AQL) corresponds to an acceptance probability of 95%.

A delivery is accepted with this high probability provided that the following defect rates for the delivery item (batch) are not exceeded:

Table 1: Determination of AQL values

Defect type	Defect class	Defect rate (AQL)
Critical defects (KF)	1	—
Major defects (MF)	2A	0.65
		1.0
	2B	1.5
		4.0
Secondary defects (NF)	3	6.5

Defect class 1 contains no defects, as such defects would lead to the rejection of the delivery.

¹⁾ DIN ISO 2859, August 2014: Acceptance sampling based on the number of defective units or defects (attribute inspection) – Part 1: Sampling plans based on the Acceptable Quality Limit (AQL) for the inspection of a series of lots.

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The batch size N (delivery quantity) is the number of packages presented for testing at the same time.

The sample size n (sample size) is the number of packages taken from the batch for inspection.

The acceptance number c is the maximum permissible number of defective packages within the sample.

In the case of a single defective package (folding box, blank) with multiple defects, only the most serious one is counted. Defects on multiple packages from different characteristic areas are added together within their defect class.

Table 2: Basic sampling table

Lot size N (units)	Sample size n	AQL					
		0.65	1.0	1.5	2.5	4.0	6.5
		Acceptance number c Number of acceptable defective items in samples					
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

For very large orders, it is recommended that the total delivery be divided into smaller batches to achieve acceptable batch sizes, e.g. a loading unit.

For arbitration tests, the applicable standard climate is used as a basis. At the time of completion of the test catalogue, this is the standard climate of 23 °C and 50% relative humidity in accordance with DIN EN 20187.

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Example of sampling

A delivery consignment of $N = 20,000$ folding crates is to be inspected. According to Table 2, $n = 80$ folding crates are to be selected at random, i.e. individually.

The samples are to be distributed across the entire delivery (beginning, middle and end).

Depending on the defect class, the following number of defects may be present in the sample:



Defect class 1:	no defects
Defect class 2A:	one defect for AQL 0.65 or two defects for AQL 1.0
Defect class 2B:	three defects for AQL 1.5 or six defects for AQL 4.0
Defect class 3:	Eight defects

In this case, only the most serious defect is assessed for each folding crate.

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3. Test checklist

3.1 Characteristics of the packaging material

No.	Characteristic	Drawing	Test method	Assessment	Evaluation	
					Defect class	AQL value
1	Type of ceiling paper		Visual inspection to check whether the cover papers used comply with the order in terms of colour and type (see also next page).	Correct Incorrect	- 2 A	- 0.65
2	Condition of the covers		Visual inspection for creases, blisters and other damage.	not present present	- 2 B	- 4.0
3	Shaft type and shaft direction in the packaging		Visual inspection to check whether the wave type and wave direction correspond to the order (see DIN 55468-1 or the following page).	correct incorrect	- 1	- -
4	Formation of the corrugations		Check by cutting into the web, preferably in the lid-flap area. Exception: influence of the ejector rubbers in the area of the crease and cut lines.	correct incorrect	- 2 B	- 1.5
5	Bonding of corrugated cardboard		Check by tearing to see if there is sufficient adhesion is present (visible fibre tear).	fibre tear No fibre tear present	- 1	- -
6	Alignment of roof and ceiling membranes		Visual inspection Corrugated and ceiling sheets are flush	correct incorrect	- 3	- 6.5
7	Plan		The plan is in accordance with the agreement	correct incorrect	- 2 B	- 1.5

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Notes on the table

No. 1 – Type of liner paper

The choice of face and fluting papers is left to the manufacturer, unless specific arrangements have been agreed. Face papers refer to the papers used for the smooth sheets. Fluting papers refer to the papers used for the fluting(s). Face and fluting papers are characterised by their basis weight and technical specifications, and are further classified as follows:

- Top sheets:**
- Kraft liner (brown, white)
 - Kraft Top Liner (brown, white)
 - Testliner (brown, white)
 - Schrenz
 - others

- Corrugated papers:**
- Corrugated medium
 - High-performance fluting
 - Semi-chemical pulp
 - Other

With regard to the colour of the face papers used, it should be checked whether, for example, a specified white or coloured paper has been used.

Standard colour variations in paper are manufacturer-dependent and should therefore not be taken into account during the visual inspection.

The surface of the ceiling papers used is usually machine-smoothed (see DIN 6730). If the paper has a smoothed side, this is normally placed facing outwards.

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Item No. 3 – Flute type and flute direction in the packaging

This check is to verify whether the corrugation has been supplied in accordance with the order. The check is carried out by making a cut away from the edge, across the direction of the corrugation, at an unprinted point.

A distinction is made between single-flute and multi-flute grades. Multi-flute grades are combinations of different flute types. Due to processing factors, the thickness of the finished corrugated board is not a distinguishing feature of the flute type; instead, it is the flute pitch t (see DIN 55468, Part 1).

With regard to the corrugation direction in the finished folding box, it should be checked whether the running direction of the corrugated sheet corresponds to the order. Unless otherwise agreed, the corrugation runs parallel to the slits of the folding box.

Item No. 5 – Gluing of the corrugated board

Good to satisfactory is acceptable as long as the functionality of the packaging is guaranteed. Item No. 7 – Flatness

Flatness is expressed as deflection in %.

The corrugated board sheet is placed flat on a surface with the corrugations facing upwards. The maximum rise divided by the distance between the two supporting edges, expressed as a percentage, indicates the degree of deflection.

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3.2 Processing characteristics



Notes: All specifications refer to the standard climate of 23 °C and 50% relative humidity.

Dimensional checks are carried out on the flat blank.

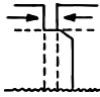
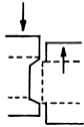
A Grade 2 tape measure with millimetre graduations is used as an aid.

No.	Characteristic	Drawing	Test method	Assessment	Evaluation	
					Defect class	AQL value
1	Design review		Complies with the specification / drawing	correct incorrect	- 1	- -
2	Dimensions (L x W x H)		<p>Determining the distance between two crease line centres or between a crease line centre and the corresponding outer edge</p> <p>Die-cut per dimension:</p> <p>up to 200 mm: +/- 1 mm</p> <p>over 200 mm up to 700 mm: ± 2 mm</p> <p>over 700 mm: ± 3 mm</p> <p>other manufacturing methods:</p> <p>up to 300 mm: ± 3 mm</p> <p>over 300 mm to 700 mm: ± 4 mm</p> <p>over 700 mm to 1200 mm: ± 0.6%</p> <p>Over 1200 mm by agreement</p> <p>Special tolerances may be required for machining.</p>	correct incorrect	- 2 A	- 0.65

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No.	Feature	Drawing	Test method and requirements	Assessment	Evaluation	
					Defect class	AQL value
3	Dimensional tolerances of the punched-in, punched-out and embossed features		Inspection for deviations from dimensional specifications. up to 600 mm: +/- 3 mm Over 600 mm: +/- 0.5%	correct	-	-
3.1	Manufacturing process: rotary			incorrect	2 B	4.0
3.2	Manufacturing process: flatbed die-cut			incorrect	2 B	1.5
4	Function of the crease		The crease bends at the intended point.	correct incorrect	- 2 A	- 0.65
5	Formation of the groove		Visual inspection to check for external cracking. Visual inspection to check for internal bursting. (Cracking of the inner ceiling is not a manufacturing defect that would lead to the batch being rejected.)	Correct incorrect correct incorrect	- 2 B - 3	- 1.5 - 6.5
6	Positioning of the slots, location and size of the cut-outs (if any)		Check for lateral offset relative to the centre of the longitudinal groove Tolerance ± 2 mm.	correct incorrect	- 2 A	- 1.0
7	Slot depth		Check whether the tolerance of ± 5 mm from the centre of the height groove is maintained.	correct incorrect	- 2 A	- 1.0

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Serial No.	Feature	Drawing	Test method	Assessment	Evaluation	
					Defect class	AQL value
8	Formation of cut edges and slits		Visual inspection for uneven cuts, waste, etc.	OK Not OK	- 2 B	- 4.0
9	Gap width		Standard width = 6 mm and 8 mm (slot width) Tolerance range 1- corrugated – 4 mm to + 4 mm 2- wavy – 4 mm to + 6 mm measured at the top edge of the gap in each case <u>Note:</u> Tolerances apply to machine-glued blanks; for manually glued blanks, separate agreements may need to be made	Correct	-	-
9.1	Manufacturing process: rotary			incorrect	2 B	4.0
9.2	Manufacturing process: flatbed die-cut			incorrect	2 B	1.5
10	Strength of the manufacturer's seal		Testing of strength by manual inspection. <u>Note:</u> It is considered sufficient if 80% of the adhesive surface is covered with fibres after tearing.	sufficient insufficient	- 2 A	- 0.65
11	Alignment at the cut edge		Checking whether the tolerance for the offset of the flap edges at the factory edge is maintained. up to 600 mm cutting height: +/- 3 mm Over 600 mm cutting height: +/- 0.5%	correct incorrect	- 2 B	- 1.5

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Serial No.	Feature	Drawing	Test method	Assessment	Evaluation	
					Defect class	AQL value
12	Tab bonding		Check for adhesive leakage (Boxes are glued together inside and out).	Correct incorrect	- 2 A	- 1.0
13	Strip bonding		Check that the correct type of tape is being used and whether the strip is positioned correctly.	correctly incorrect	- 2 A	- 1.0
14	Stitching		Check whether the formation of the brackets and The staple spacing is correct.	correct incorrect	- 2 A	- 1.0
15	Type of print		Checking whether the print matches the print template (i.e. whether the content of the print as a whole matches the template).	correct incorrect	- 1	- -
16	Pressure test		Testing against limit samples (crush edges, smudged, blurred, incomplete).	sufficient insufficient	- 2 B	- 1.5
17	Colour		Check whether any obvious deviations within the reference samples	correct incorrect	- 2 B	- 1.5
18	Fitting accuracy during Multi-colour printing		Checking whether the tolerance of ± 2 mm is maintained.	Correct incorrect	- 2 B	- 1.5
19	Print status		Check whether the print layout matches the template matches	correct incorrect	- 2 B	- 1.5

