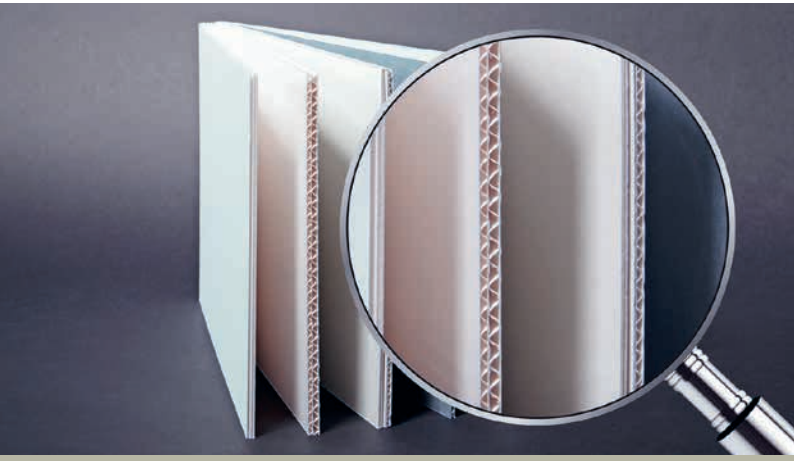
KLUG CONSERVATION

Technical Knowledge
Folder No. 9

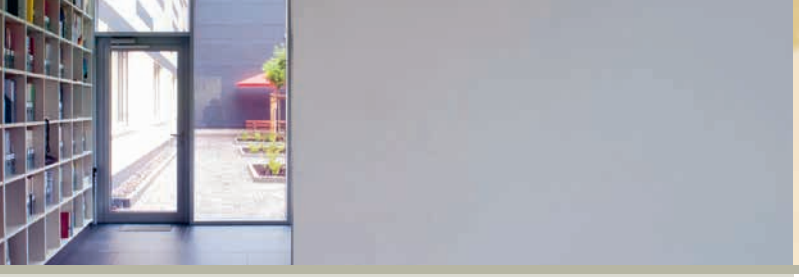


Comparing corrugated boards

Relevant quality factors for proper evaluation of offers

QUALITY FOR THE FUTURE

YOUR PARTNER
FOR PRESERVATION
MATERIALS



KLUG's expertise. Preserving VALUES. Securing the FUTURE.

For more than 150 years, KLUG-CONSERVATION has been a trusted partner in the preservation of movable cultural assets. Preserving values means more than protection: it safeguards identity, history and cultural legacy.

Our guiding principle, "Preserving values," is both a promise and a source of motivation. By ensuring product authenticity and providing guaranteed quality, we build trust, credibility and long-term reliability. Honesty, a spirit of partnership and respectful dialogue form the foundation for long-lasting collaboration.

Working closely with clients, industry partners, academies and universities, we develop innovative, solution oriented concepts. This collaborative approach ensures the highest standards of quality and creates a lasting advantage in knowledge – insights we are pleased to share through our „Technical Knowledge Folders".

KLUG-CONSERVATION combines traditional paper expertise with state-of-the-art innovation. This unique combination enables us to ensure sustainable preservation of cultural assets at the highest professional level.

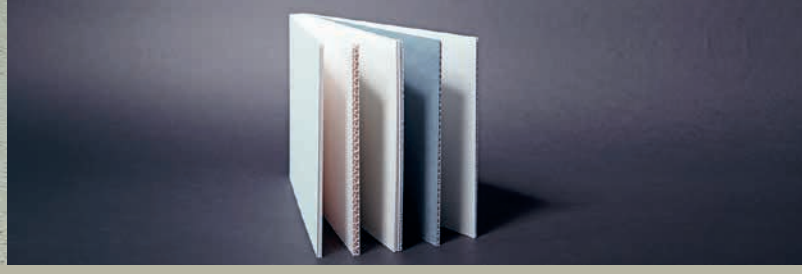
Quality and »full disclosure of materials«

KLUG-CONSERVATION started to produce corrugated board made from ageing-resistant paper in 1994 and has become the market leader for corrugated corrugated board manufactured on the basis of the technological requirements of the EN ISO 9706 and the DIN ISO 16245 – Type A. Since 2003 – and not least in response to the Elbe river flooding in Saxony – all corrugated boards used to make boxes and folders are laminated with wet-strength adhesive.

The term »Sortenwahrheit« – approximating to »full disclosure of materials« in this context – was coined by Prof Dr Guido Dessauer in a number of important talks and articles in specialist magazines in 1996. The term refers to a transparent and exact disclosure of all materials contained in a particular paper or board. This information is absolutely essential for a meaningful assessment of the quality of paper or board.

Other companies have started to produce and offer ageing-resistant corrugated boards for some years now. Unfortunately, not all competitors state or disclose the parameters required for assessment of quality and price.

DIN EN ISO 9706
DIN ISO 16245



Quality criteria for proper evaluation of offers

The following questions arise in an effort to compare the offers of various manufacturers: what makes up the price of a corrugated board and which criteria determine the quality of a corrugated board?

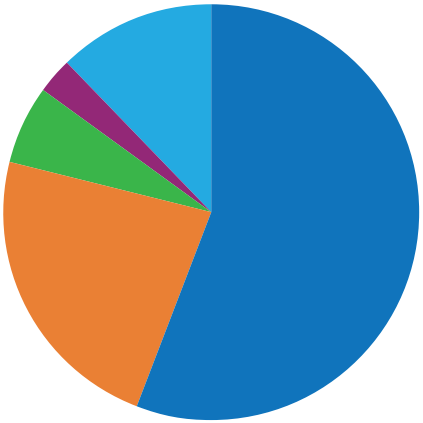
In order to meet the quality characteristics in accordance with EN ISO 9706 and DIN ISO 16245 – Type A, all products for long-term storage must be fabricated from 100% primary fibre – no recycled fibre may be used. Fresh cellulose fibre is traded on the world market just like crude oil. We are all familiar with the price fluctuations reflected at our local petrol filling stations. It's a similar scenario for the price of fresh pulp fibre.

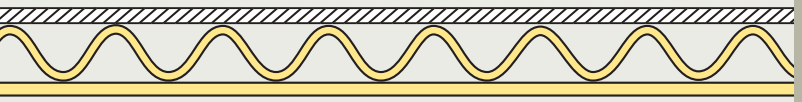
The price of paper products can be determined quickly by looking at the pulp price index. The three main resources for the production of paper are fibre, water and energy. Production costs (paper machine, staff, transport etc.) barely fluctuate. At approximately 56%, the fibre constitutes the biggest component of the costs. A price comparison of different offers should therefore always include grammage as a significant parameter.

Production cost components for single-ply corrugated board

On a percentage basis, the price of a single-layer corrugated board is made up as follows:

- 56% material = fibre = cellulose
- 23% manufacture of corrugated board
- 6% adhesive
- 3% wet-strength finish
- 12% pallet, packaging, transport





QUALITY FOR THE FUTURE

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Beware of quality losses due to savings in manufacturing

Manufacturers of ageing-resistant corrugated board aim to achieve a competitive advantage through savings in the manufacturing process. These savings usually involve a decrease in quality. Examples of this include:

- The biggest economic advantage can be gained by reducing the grammage of corrugated board or its individual layers, yet this also has a major impact on the strength of the corrugated board and the boxes, folders and other items produced from it.
- Omission of wet-strength finish of corrugated boards also leads to a significant price advantage, but corrugated board without wet-strength finish should under no circumstances be used for the storage of cultural artefacts.
- The use of short-fibred papers, possibly also secondary fibres, also leads to a price advantage, while at the same time decreasing stability.

Comparison of offers based on price and quality

Comparability of different products or manufacturers is sometimes also hindered by non-disclosure of technical parameters. For example: a supplier may only specify the thickness of a corrugated board, while withholding information about the grammage of the individual layers or the entire laminate.

In line with the concept of »full disclosure of materials« (Sortenwahrheit), suppliers should atleast specify the mentioned technical parameters and provide confirmation by means of a legally binding quality guarantee. This would allow proper assessment of the quality of an ageing-resistant corrugated board and facilitate fair competition. A comparison of different offers can only be meaningful if all of the named parameters are provided. A merely price-based assessment will ultimately lead to a decrease in the quality of ageing-resistant corrugated board and the protective packaging made from it.

Important criteria for assessment

Materials for long-term conservation must meet the technological requirements of the standrads EN ISO 9706 and DIN ISO 16245 – Type A. To make sure that the material you are buying complies with these standards, you should always request for a legally binding, signed quality guarantee, irrespective of tests carried out in the past. Products for archiving photographs are additionally required to have passed the Photographic Activity Test (PAT) in accordance with ISO 18916:2007. For more information please visit our website: klug-conservation.com > Quality.

The following aspects should be considered for assessing the quality of an ageing-resistant corrugated board:

- Fibre quality
  - Papers with a higher content of long fibres result in corrugated boards with higher strength
  - Papers made from primary fibres produce corrugated boards with higher strength
- Grammages of individual layers
  - Higher grammages (in accordance with DIN ISO 3039) of the component layers result in corrugated boards with higher strengths
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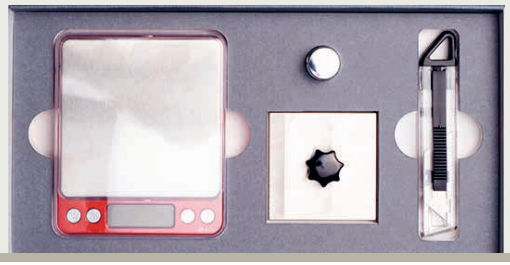
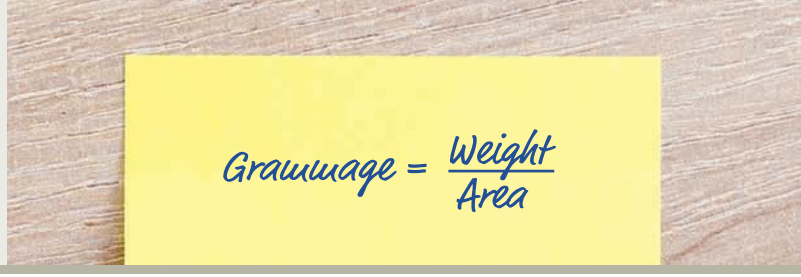
  - Higher grammages (in accordance with DIN ISO 3039) of the component layers result in corrugated boards with higher strengths
  - Outer layers with higher grammages lead to higher puncturing resistances (puncture resistance in accordance with DIN 53142)
- Total grammage of finished corrugated board
  - The total grammage (in accordance with EN ISO 536) is the sum of the grammages of all layers including the weight of the introduced adhesive
  - Higher total grammages of the corrugated board result in higher strengths..
- Thickness of individual layers of corrugated board
  - Thicker paper layers produce corrugated boards with higher strengths
- Water absorptiveness of corrugated board layers
  - The layers should have a water absorptiveness (Cobb 60) <= 25
  - Test in accordance with EN 20535
  - The denser the layers (low absorptiveness), the longer the resistance to humidity or water in the event of damage
- Top layer finishing
  - Is the top layer dyed throughout or printed?
  - Top layers that are dyed throughout are smoother and more erasable





- **Flute height of corrugated board**

– Bigger flute height leads to higher compressive strength (flat crush resistance in accordance with EN ISO 3035), however to lower edgewise crush resistance (edgewise crush resistance in accordance with EN ISO 3037) and lower puncture resistance (puncture resistance in accordance with DIN 53142)

- **Wet strength**

– Wet-strength glued layers of corrugated board in accordance with DIN 53133 guarantee at least 24 hours of water resistance of the adhesive bond.

– Wet-strength glued layers of corrugated board prevent the layers of a corrugated board from falling apart and hence the loss of »units« in case of water damage; boxes made of corrugated board without wet-strength glued layers disintegrated in a shorter period of time and lose their entire stability.

- **Bleeding resistance and optical brighteners**

– The layers of corrugated board must not bleed colour in the event of water damage, they are required to have passed the bleed resistance test in accordance with DIN ISO 6245 point 5.8.

– The layers of corrugated board should not contain any optical brighteners and there must be no evidence of typical fluorescence under UVA light (DIN ISO 16245 point 5.8).

P.S. Calculation of grammage

The grammage of a paper, board or corrugated board can be calculated easily. A rectangular sample piece is cut and then weighed on a paper scale. For a more accurate determination of the weight of thin papers, a number of papers in the same format or a folded, large sheet can be used. Grammage is the quotient of weight and unit area and is stated in gsm (or g/m²). This should not be confused with the term »basis weight«, which is more widely used in the US and describes the weight per number of sheets of a specific size, or ream.

Example:
One piece of board of size 10 x 10 cm weighs 3 g.
The grammage of the board is therefore:
3 g / 0.1 x 0.1 m² = 300 gsm.

You may find it even easier to determine grammages with our specifically designed measuring set.

References

G. Dessauer: Zur Sortenwahrheit von Papieren und Kartons. Bindereport No. 5/1996, p. 271

DIN ISO standards can be found in T. Allscher and A. Haberditzl: Bestandserhaltung in Bibliotheken und Archiven (6th edition). Berlin: Beuth, 2019; all other standards are available from DIN (https://www.din.de/en/about-standards/buy-standards)

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KLUG-CONSERVATION
Zollstrasse 2
87509 Immenstadt/Germany
Telephone +49 (0)8323 9653 30
info@klug-conservation.com
www.klug-conservation.com

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