FEFCO

GROUPEMENT ONDULÉ

EUROPEAN CONTAINERBOARD ORGANISATION

Agreement On

Moisture content and moisture variations

of containerboard

Index

1 Introduction

2 Moisture requirements

2.1 Measurement and definition of moisture
2.2 Average moisture of a customer reel
2.2 Moisture per paper grade
2.3 Variation in average moisture content between customer reels
2.4 Moisture variation over the reel width
2.4.1 liner
2.4.2 fluting
2.5 not mentioned paper grades

3 Moisture information at the label

3.1 Moisture average
3.2 Moisture variations over the width of a customer reel.

4 To close

5 Summary

1 Introduction

The Corrugator Efficiency Working Group was formed early 2000 as a consequence of the Group discussions at the Technical Seminar in Nice a year before.

The idea was that raw materials, especially paper, have a big impact on our overall corrugator performance. It was agreed to initiate a process of continuous discussions in a small expert group of paper manufacturers and box makers to aim at following objectives:

1. run the project in co-operation with the suppliers
2. improve corrugator efficiency
3. reduce waste at the corrugator
4. Issue guidelines that could be the starting point for a Fefco Boxmaker's standard.

The first guideline is Reel Identification and Finishing. The document includes guidelines for reel labelling to support the easy identification of paper reels and to allow more efficient warehousing of paper stocks. Recommendations on cores are also included.

This second document describes the agreement between FEFCO and the Groupement Ondule and European Containerboard Associaton on the moisture **content and the moisture variations** of containerboard (corrugated base papers)
This document should be seen as a starting document, a base for moisture guidelines of containerboard.

The main issue to improve the corrugator efficiency was defined as the improvement of the specifications for moisture of containerboard. The moisture level and the variations of the moisture over the width of a customer reel seems to be the most important parameter to improve:

- The board quality by producing flat sheets (no Warp) , and better starch bonding
- The runability at the corrugator by preventing creases
- The convertibility at printing and die cutting machines over flat sheets

Shrinkage and shrinkage differences of the paper width at the corrugator, are the reason for problems like warp, and creases to be present at corrugated sheets.
Within the Corrugator Efficiency Working Group, also other variations of paper are defined to have an important influence:

1) grammage
2) temperature
3) winding & web tension
4) fibre orientation
5) moisture

This document content guidelines for moisture.

2 Moisture guidelines

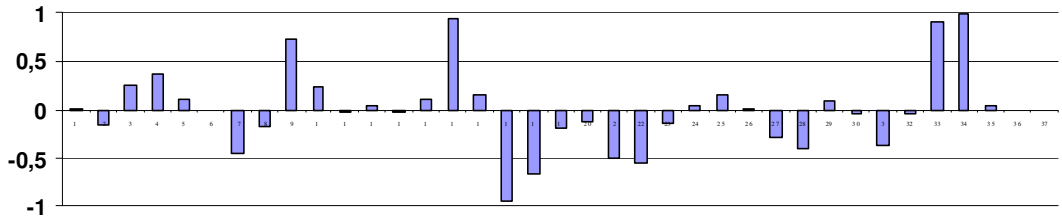
2.1 Measurements and definition of moisture

Introduction

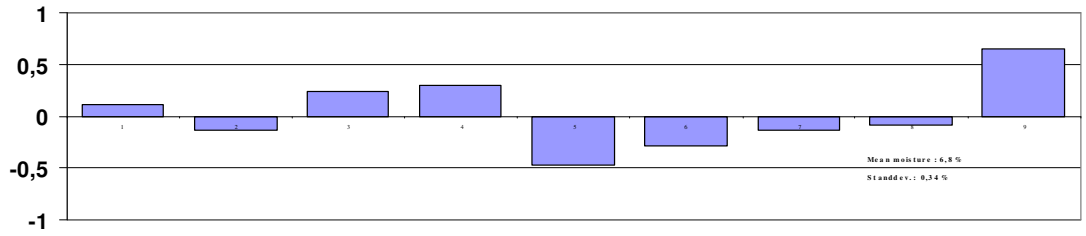
Discussions about moisture are always interfered by the question “how is the moisture content determined.” At the papermachines on- line scanning devices control over Infrared the moisture content in consecutive scans over the width of the Jumbo reel.
This information is collected, and an average of the moisture contents are calculated per defined width. This defined width is called a box. This box width is almost always related with the width of tools within the papermachine to control the variations. For example the width of the slice opening of the headbox, the width of a steambox at the press section or moisturizer in the dry section.

Recent investigations at corrugators and the CID (Corrugated Industry Development Corp.) work in Sweden in the past, showed moisture determined at a papersample of 15 cm width is a good standard for guidelines.

The importance of the box width is to be seen at next 2 moisture profiles.



The profiles are from the same reel, but calculated on a different box width.



Definition of moisture.

In these guidelines moisture of a papersample is defined as the average moisture content, determined over a:
papersample of 15 cm and measured according ISO 287

The starting point of the 15 cm wide paper sample is at random**.**
Problems at the corrugator will be faced at a certain place at the customer reel.
This place could be the middle of the 15 cm paper sample, but the starting point of the 15 cm is not defined, so at random.
The moisture control at the papermachine is on-line measured by a traversing tool, measured at the JUMBO reel. Depending of the width of the jumbo reel, 1 to 4 or more different customer reels could be cut and rewinded out of this jumbo reel. Sophisticated calculation programmes are necessary to calculate the exact moisture content and variations of the customer reel.
The paper industry is at his starting point to introduce these programmes.

2.2 Average moisture content of a customer reel

The average moisture content of a containerboard grade is defined by the origin and the converting of the papers.
Kraftliner, made mainly out of virgin fibres, have a high content of celluloses and hemicelluloses. Kraftliner fibres have never been dried which make them more flexible and no hornification effects have occurred and therefore the moisture content at conditioned circumstances (equilibrium phase) is about 8,0 %. Testliners, with less virgin fibres, contain more ashes coming from fillers and coatings in the recovered fibre, are hornificated during repeated drying during their recyclings and have a lower equilibrium moisture content of 7,5 %.
Wellenstoff, also made of recovered material should be produced with a little more moisture, 8 %, to be more flexible in the single facer. This is also the reason for the higher average moisture content of semichemical of 9 %. Semichemical pulp contain more lignin compounds due to a higher yield and less dissolution of lignin, and is therefore more brittle. To be convertible at the single facer the moisture content should be 9 %.

Since paper is made of a natural product with variations in the fibre quality, and substances out of the raw material could influence the status of the papermachine, and the techniques of the papermachine could be different, variation of the moisture content is a normal phenomenon. For all the grades ± 1,5 % absolute moisture is defined to be the limit. In next table you will find an overview of all containerboard papergrades.

	Kraftliner	Testliner **(Recycled liner)**	Semichemical fluting	Wellenstoff **(Recycled fluting)**
Target average moisture content of a customer reel maximum and minimum average in % absolute	8,0 6,5 - 9,5	7,5 6,0 - 9,0	9 7,5 - 10,5	8 6,5 - 9,5

2.3 Variation in average moisture content between customer reels

For every grade, the mean value of the moisture content of each customer reel may not differ by more than ± 1% absolute of the specified moisture (= maximum of 2 % variation between the reels) of a shipment.

	Kraftliner	Testliner **(Recycled liner)**	Semichemical fluting	Wellenstoff **(Recycled fluting)**
Maximum difference of average moisture content in % absolute between customer reels within a shipment	2	2	2	2

2.4 Moisture variation over the reel width

2.4.1 Liner

The individual moisture content values over the width of the customer reel may not differ by more than 3 % absolute, calculated on a sampling width/measuring box of 15 cm. Between two adjacent measuring boxes of 15 cm the maximum peak to peak difference is 2,8 %

2.4.2 Fluting

The individual moisture content values over the width of the customer reel may not differ by more than ± 4 absolute, calculated on a sampling width/measuring box of 15 cm. Between two adjacent measuring boxes of 15 cm the maximum peak to peak difference is 2,8 %

	Kraftliner	Testliner **(Recycled liner)**	Semichemical fluting	Wellenstoff **(Recycled fluting)**
Maximum CD moisture peak to peak difference over the width of customer reel with a measuring box of 15 cm (6 inches) width in % absolute	3,0	3,0	4,0	4,0
Maximum CD moisture peak to peak difference two adjacent measuring boxed of 15 cm (6 inches) width in a customer reel in % absolute	2.8	2.8	2.8	2.8

2.5 Not mentioned paper grades

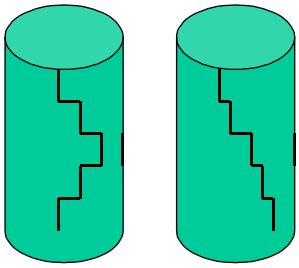
Not mentioned paper grades like Schrenz, Brown Duplex, or Deckenstoff are not defined by moisture requirements. Although the average moisture content may not be defined, the Corrugator Efficiency Working group believes the requirements on moisture variations should be at least as strong as Recycled fluting, with a goal to fulfil the recycled liner requirements.

3 Moisture information at the label

3.1 average moisture

The average moisture of the reel doesn't give information of the moisture variations over the reelwidth as shown below.

The two reels indicated below have both the same moisture average:



Within document no 1: Reel Identification and finishing, the moisture content information at the label is optional.

3.2 moisture variations

The containerboard industry is starting to introduce calculation software to calculate the real moisture per customer reel. The moisture variations information of a Jumbo reel is not that simple translated to information per customer reel. So at the moment no real relevant information is available per customer reel. At the other hand corrugators have no possibilities to control the heating of the paper per section/ box of the width of a customer reel.

4 To close

We want to stress again that this document should be the base, the starting point of future guidelines, because developments at the corrugating industry like higher speed, bigger width, smaller flute types and developments of the corrugator, will ask for more demanding guidelines for moisture of containerboard.

The proceedings in this first document on **requirements on moisture and moisture variations of containerboard** are:

- It's an agreement between the corrugated and containerboard associations at european level
- The moisture is defined over the measured boxwidth

A big step forward in the improvement of the efficiency of the corrugating industry will be gained if these first requirements as described in this document will be fulfilled by the containerboard producing papermills.

5 Summary

FEFCO and GO/ECO agreement on moisture requirements

Containerboard requirements for Moisture Content and Variation:

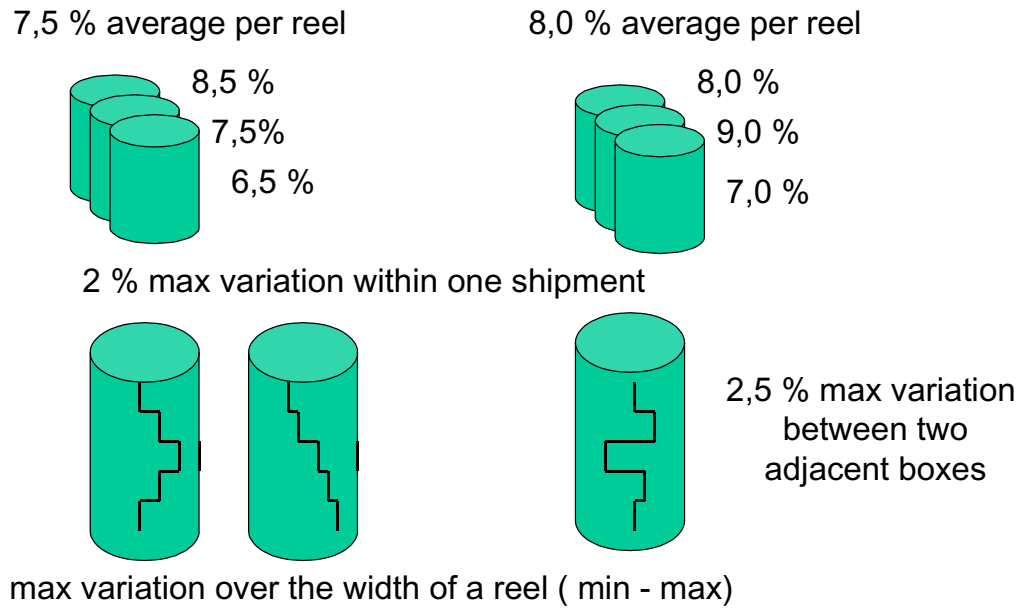
Agreement september 2004	Kraftliner	Testliner (Recycled liner)	Semichemical fluting	Wellenstoff (Recycled fluting)
Target average moisture content of a customer reel maximum and minimum average in % absolute	8,0 6,5 - 9,5	7,5 6,0 - 9,0	9 7,5 - 10,5	8 6,5 - 9,5
Maximum difference of average moisture content in % absolute between customer reels within a shipment	2	2	2	2
Maximum CD moisture peak to peak difference over the width of customer reel with a measuring box of 15 cm (6 inches) width in % absolute	3,0	3,0	4,0	4,0
Maximum CD moisture peak to peak difference two adjacent measuring boxed of 15 cm (6 inches) width in a customer reel in % absolute	2.8	2.8	2.8	2.8

The moisture measurements refers to measurements on- line in the papermachine.
Measurements and on -line equipement calibration should be according the standard ISO 287

The CD moisture information refers to the average CD profile of all scannings during the production of the customer reel.

All the customer reels of delivery should be within these specifications.

CD: Cross Direction



Example Testliner *Average of a reel 6 - 9 %*