

*Knowing paper better!*

**emco**



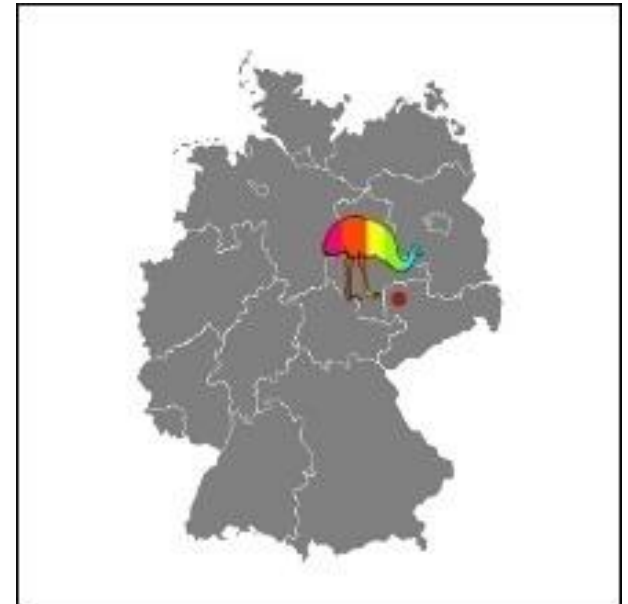
## Moisture Determination in Pulp

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# emco GmbH – Leipzig, Germany



- emco – Elektronische Mess- und Steuerungstechnik GmbH
- since 1992
- in Leipzig – Germany
- partner of the paper industry since 1992
- partner of the printing industry since 1996



# Absolute material moisture

Absolute material moisture indicates the proportion of water contained in the material to the total weight (or else dry weight).

## Example for weight percentage:

weight pulp bales = 1000 kg

moisture pulp = 8.0 %

→ 80 kg of water are bonded in the bale

# Humidity

The humidity indicates to which extent the air is saturated with steam.

$$\text{humidity} = \frac{\text{real water content of air}}{\text{max.}^1 \text{ water content of air}} \times 100$$

<sup>1</sup> dependent from temperature

# Humidity → equilibrium moisture

The equilibrium moisture indicates the humidity of the ambient air with which the material is in balance and therefore – in this state – does not absorb or release any moisture.



# Water in pulp

- 1 m<sup>3</sup> of pulp, which is balanced with 50 % humidity, contains more than 50 kg of water in fiber and less than 7.5 g in the air.
- Therefore, the humidity of air in the pulp bale is determined by the water content in pulp.  
The physical laws of humidity in air do not prevail (Mollier-diagram).
- If the correlation is known (characteristic curve), the humidity of air in the pulp bale can be used to determine the moisture.

# Practice-oriented moisture measurement on paper

In more than 20 years of cooperation with the innovative measuring instrument manufacturer *Schaller Messtechnik* in Sankt Ruprecht (Austria), *emco* GmbH has developed a modular system of measurement-technology solutions to determine the water content in bales, stacks, loose piles and single sheets of hygroscopic materials like paper.

# Practice-oriented moisture measurement on paper (2)

The measuring technologies meet practice-oriented requirements:

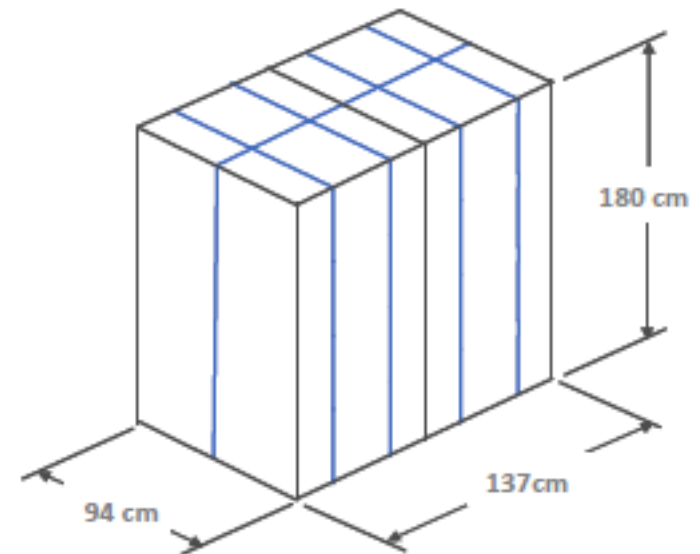
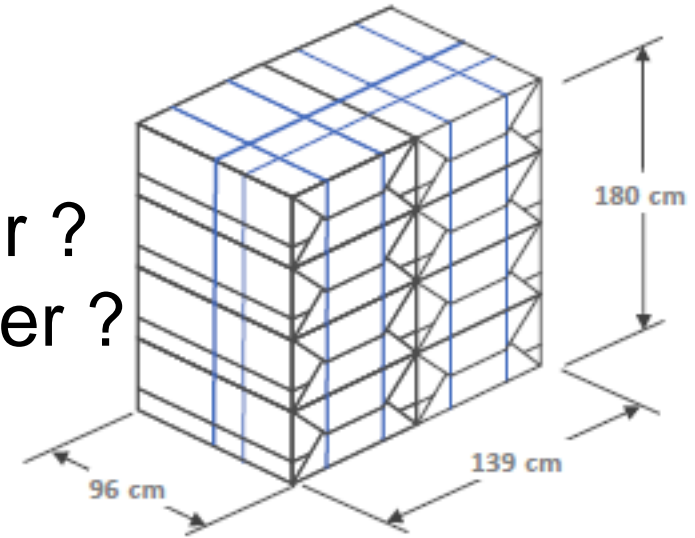
- measurements directly on the material,
- non-destructive,
- through the packaging,
- applicable everywhere,
- high reproducibility (equal to absolute reproducibility),
- accuracy of practical relevance,
- objective, void of subjective influences,
- data safety through automated data transfer and data management
- calibration for moisture is done in correlation to drying oven



# Water content and fiber content of pulp



Content of fiber ?  
Content of water ?



# Devices for stacks and bales in the volume

The mobile measurement at stacks and bales – through paper and plastic packaging – with a defined measuring depth

- **MP5-Z (Moisture Predictor 5-Z)**  
with special characteristic curves for pulp  
→ measuring depth 50 mm



- **AP 500-M5-Z**  
with special characteristic curves for pulp  
→ measuring depth 500 mm



# MP5-Z



- measuring range 1 % – 25 % water content
- measuring depth 50 mm
- also possible to measure directly at the warm running roll
- detection of moisture stripes
- integrated IR temperature measurement for compensating the influence on the measured result
- automated data transfer to data terminal – data base

# AP 500-M5 – Z

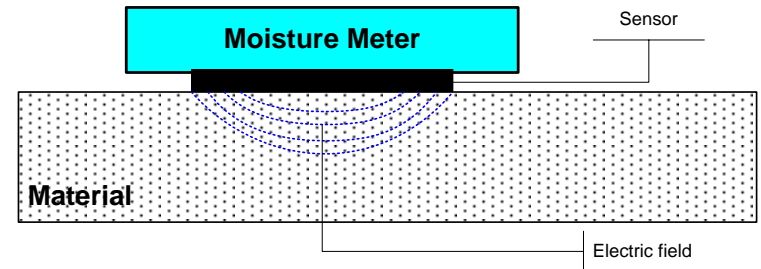
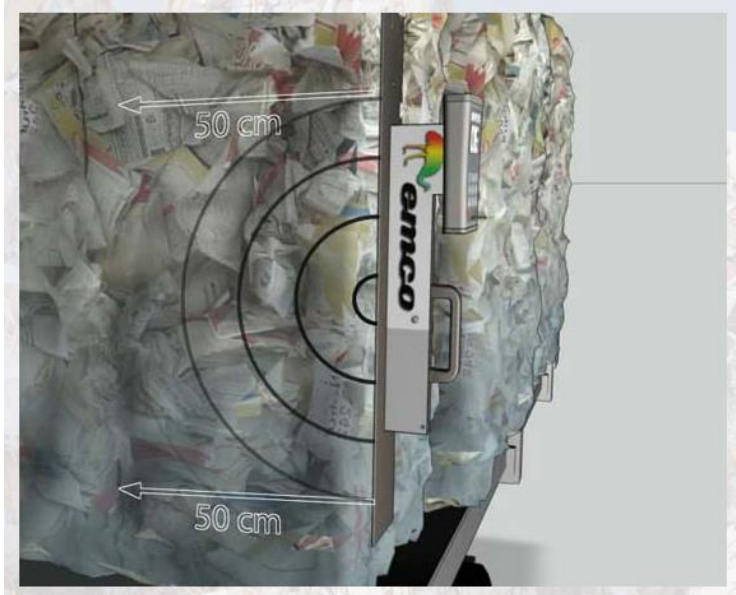
Reliable measuring device for waste paper with characteristic curves (calibration) – for pulp



- measuring range 1 % – 50 % water content
- measurement directly at the bale or stack at flat surfaces
- measuring depth 500 mm through the packaging
- detection of moisture zones of the bale
- integrated temperature measurement
- automated data transfer to data terminal – data base

# emco AP 500 – measuring principle

- By generating an electric field, the measurement of the water content % (weight percentage) in a big volume is possible.
  - to a depth of 500 mm
  - without sampling
  - without destruction of the bale



# Devices for stacks and bales – local / selective

The mobile local measurement at stacks, bales and between sheets

- **SMM**

- for determination of water content in weight percentage
- with special characteristic curves for pulp



- **Sword Sensor Dolphin**

- for humidity and temperature
- for dew point and cockling point temperature
- with special characteristic curves for pulp



# SMM – Z



- measuring range 7 % – 20 % water content
- local, selective measurement
- measurement directly at the stack and bale and between sheets
- integrated temperature measurement
- automated data transfer to data terminal – data base



# Dolphin – equilibrium moisture content %rH



- measuring range 0 % -100 % rH
- measuring range -10°C to + 60°C.
- local, selective measurement
- measurement directly at the stack
- automated data storage for process monitoring (drying, temperature control)
- integrated temperature measurement
- very fast temperature adjustment  
 $t(90\%) < 10 \text{ s.}$



# PMSA – water content in the sheet

Determination on the single sheet on a laboratory scale – non-destructive, within seconds and with an accuracy / reproducibility of 0.1 % water content



**NEW since 2017**

- measuring range 1 % – 20 % water content
- measurement of individual sheets
- integrated IR temperature measurement
- external accessories: weighing scale
- data base with characteristic curves for individual formulations, sorts
- actual water content not influenced by oven drying

# Example of incoming goods control

- Job registration with data terminal via bar code, RFID or manually for one bale or the whole delivery



- automated job entry, user identification
- avoidance of input errors
- quality features such as image, dimensions, bale weight available

# Web data base – importance

- Automated data collection and transfer in web data base for data-safe documentation, management and evaluation
  - secure
  - automated
  - tamper-proof
- Tamper-proof documentation of Who-When-Where-What-Wherewith
- Central management of all moisture measurements, ordered by location, production/order, supplier, sort, operator and measuring device
- Allocation of rights allows individually configured access for management, operators, customers and suppliers




The screenshot shows the 'emco' web interface with a navigation bar and a table of moisture measurements. The table has columns for 'Ansichten', 'Kunde', 'Gerät', 'Messauftrag', 'Laufende Nummer des Messauftrags', 'Laufende Nummer des Messgeräts', 'Bediener', 'Typ', 'Wert', 'Einheit', and 'Kennlinie'. The data rows show various measurements for different customers and devices.

Ansichten	Kunde	Gerät	Messauftrag	Laufende Nummer des Messauftrags	Laufende Nummer des Messgeräts	Bediener	Typ	Wert	Einheit	Kennlinie
Details	emco	EMCO 3007	078366200058	12	12	(007)	Temperatur	25,5	°	S2
Details	emco	EMCO 3007	078366200058	11	11	(007)	Feuchte	17	%	S2
Details	emco	EMCO 3007	078366200058	2	2	(007)	Temperatur	25	°	S2
Details	emco	EMCO 3007	078366200058	1	1	(007)	Feuchte	5,5	%	S2
Details	emco	EMCO 3007	078366200058	4	4	(007)	Temperatur	25	°	S2
Details	emco	EMCO 3007	078366200058	3	3	(007)	Feuchte	7,5	%	S2
Details	emco	EMCO 3007	Code 128	28	2	(007)	Temperatur	25	°	S2
Details	emco	EMCO 3007	Code 128	27	1	(007)	Feuchte	7,5	%	S2
Details	emco	EMCO 3007	Code 128	30	4	(007)	Temperatur	25	°	S2
Details	emco	EMCO 3007	Code 128	29	3	(007)	Feuchte	8	%	S2
Details	emco	EMCO 3007	078366200058	6	6	(007)	Temperatur	25	°	S2
Details	emco	EMCO 3007	078366200058	5	5	(007)	Feuchte	6	%	S2

# Web data base – functions

- Tamper-proof documentation of operator, serial number, date, time and location (GPS) for each measurement
- Additional information such as pictures, weight, dimensions
- Realisation of data base queries and statistics
- Documented data changes due to incorrect assignments and marking of incorrect measurements



 Datenbank - Altpapier

Kunden Handheld-Geräte Messaufträge Messgeräte Bediener **Messwerte**

emco - Messwerte

Messwert zur Änderung auswählen

Ansehen	Kunde	Gerät	Messauftrag	Laufende Nummer im Messauftrag	Laufende Nummer im Messgerät	Bediener	Typ	Wert	Einheit	Kennlinie
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	12	12	(leer)	Temperatur	25.5	°	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	11	11	(leer)	Feuchte	17	%	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	2	2	(leer)	Temperatur	25	°	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	1	1	(leer)	Feuchte	5.5	%	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	4	4	(leer)	Temperatur	25	°	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	3	3	(leer)	Feuchte	7.5	%	S2
<a href="#">Details</a>	emco	EMCO 3007	Code 128	28	2	(leer)	Temperatur	25	°	S2
<a href="#">Details</a>	emco	EMCO 3007	Code 128	27	1	(leer)	Feuchte	7.5	%	S2
<a href="#">Details</a>	emco	EMCO 3007	Code 128	30	4	(leer)	Temperatur	25	°	S2
<a href="#">Details</a>	emco	EMCO 3007	Code 128	29	3	(leer)	Feuchte	8	%	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	6	6	(leer)	Temperatur	25	°	S2
<a href="#">Details</a>	emco	EMCO 3007	9783868200058	5	5	(leer)	Feuchte	8	%	S2

# Web data base – global use

- Defined online access for all, according to authorisation:
  - order accounting
  - management
  - supplier
- Export to local data bases / networks
- Recorded revaluation of moisture for new or incorrect characteristic curves by the data base software
- Automation and transparency allow the establishment of a consistent moisture-evaluation within supply chains



Benutzername:

Passwort:

Anmelden



# ISO-compliant device inspection

- The scope of supply includes a device case with test plate
- Every device will be delivered with a certificate including values for the test plate and a second reference plate
- At all times, inspection of the device is possible on site by comparing the values with those in the certificate



# Forklift scale - determination of the weight

- "Forklift weight determination" automatically documents the weight at a certain point in time.
- Changes in weight are always changes in water content during storage and transport.
- Each pulp bale could be labelled with a "weight on delivery".
- Data transfer to data base AP 500-M5 solution
- Scale for different weight class of forklift
- „hang-on-system“





# Modular system – water content in pulp

1. Certified and standardised measuring devices  
→ ensure maximum reproducibility
2. Uniform system of characteristic curves – coordinated between the different devices  
→ ensure transferability and comparability of measurements with various devices
3. Web data base system and data base software  
→ ensures transparency and establishment of uniform standard
4. Permits various moisture levels (supplier agreement)