UNILIN

14ème Edition Rencontres Filière Bois – Workshop Trituration du 9/05/2019

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Le bois d'industrie

- Pas de définition officiel dans de nombreuses régions
- Un cahier de charges souvent spécifique à chaque usine
- Un classement spécifique en Allemagne

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Industrieholz

Als **Industrieholz** wird Rohholz bezeichnet, das nicht als Vollholz oder Schnittholz weiterverarbeitet, sondern in weiterer Verarbeitung mechanisch zerkleinert oder chemisch aufgeschlossen wird. Es ist damit vom Industrierestholz, der Restholzfraktion der holzverarbeitenden Industrie, zu unterscheiden. Das Industrieholz setzt sich vor allem aus dünneren oder minderwertigen Rohholzbestandteilen verschiedener Holzarten zusammen.
Industrieholz findet wie Industrierestholz vor allem Verwendung für die Herstellung von Holzschliff und Zellstoff als Grundstoffe der Papierherstellung, Holzwolle sowie für die Produktion von Holzwerkstoffen wie Span- und Faserplatten. Je nach Verwendungsart unterscheidet man Industrieholz in *Schleifholz* bzw. *Papierholz* (S), *Zelluloseholz* (Z), *Plattenholz* (P) und *Holzwolleholz* (H), eine weitere Unterteilung erfolgt in Laub- und Nadelholz (L und N) sowie in Holz 1. und 2. Klasse (1 und 2). Entsprechend kann das gewünschte Holz genau bezeichnet werden, ZN2 bedeutet zum Beispiel Zelluloseholz/Nadelholz 2. Klasse.

Industrieholz

Im Industrieholzbereich wird zwischen zwei Güten unterschieden:

- IS N (gesund - frisch)
  Als Papierholz eignet sich Frischholz von Fichte und Tanne. Der Mindestzopf liegt bei 8 cm und der maximale Stockdurchmesser bei 30 cm. Fäule ist nicht zulässig.
  Die Nennlänge ist 2m.
- IS F/K (fehlerhaft - krank)

In diesem Sortiment können die extrem starkastigen, faulen, trockenen, teilweise anbrüchigen Stammstücke vermarktet werden. Der Mindestzopf liegt bei 8 cm und der maximale Stockdurchmesser bei 80 cm.
Die Nennlänge ist 2 m.
Fichte, Kiefer, Tanne und Douglasie sind als Zellstoffholz bzw. Spanplattenholz zulässig. Bei einigen Abnehmern ist keine Lärche erlaubt.

Le bois d'industrie fait référence au bois brut, qui n'est pas transformé en bois massif ou en bois scié, mais fragmenté mécaniquement lors d'une transformation ultérieure ou chimiquement perturbé. Il doit donc être distingué des déchets industriels du bois, la fraction de bois résiduel de l'industrie de transformation du bois. Le bois d'industrie est principalement composé de bois brut de dimensions variables et d'essences différentes.
Le bois d'industrie est principalement utilisé pour la production de pâte de bois, de pâte à papier en tant que matière première pour la fabrication du papier et de la laine de bois, ainsi que pour la production de matériaux à base de bois tels que les panneaux de particules et de fibres. Selon le type d'utilisation, une distinction est faite dans la qualité des bois d'industrie : le bois à pâte (S), le bois cellulosique (Z), le bois à panneaux (P) et le bois de fibres (H), subdivisés en bois feuillus et résineux (L et N) et bois 1. et 2e classe (1 et 2). En conséquence, le bois souhaité peut être désigné avec précision, ZN2 signifie, par exemple, Zellholzholz / Softwood 2nd Class.

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1. MDF & HDF

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1. MDF & HDF
1.1 Scope

- The Unilin Group holds 3 divisions:
  - Flooring
    - Laminate
    - Wood
    - LVT
  - Insulation
    - Structural & insulated roof elements
    - Insulation panels for walls, floors and roofs
  - **Panels**
    - Boards (e.g. chipboard, **MDF & HDF**)
    - Decorative panels
    - Finished products

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1. MDF & HDF
1.2 What ?

- MDF & HDF are **engineered wood based products made** from
  - wood fibers
  - glue
  - Additives
- The panels are divided in 2 density categories:
  - **MDF** = **M**edium **D**ensity **F**ibreboard
  - **HDF** = **H**igh **D**ensity **F**ibreboard (density ≥ 800kg/m³)

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1. MDF & HDF
1.3 Advantages

- MDF/HDF panels shape well (i.e. sawing, drilling, milling, 3D-shaping,...)
- MDF/HDF panels are easy to finish (i.e. paint, lacquer,...)
- MDF/HDF is an excellent substrate for wood veneer, melamine, laminate, etc ...
- MDF/HDF is a homogenous material
- MDF/HDF panels are consistent in strength and size

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1. MDF & HDF
1.4 Processing

Sawing

Drilling

Milling (edge moulding / surface profiling)

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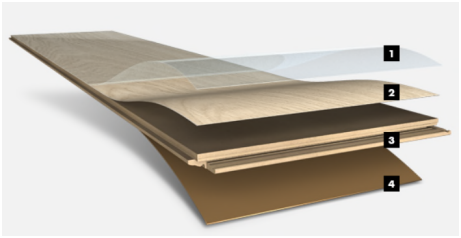
1. MDF & HDF

1.5 Finishing of MDF/HDF panels



Paint / Laquer / Powdercoat / Print / ...

Melamine / HPL / Veneer / Foil / ...

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1. MDF & HDF

1.6 Applications

- **MDF**
  - Furniture & cabinetry
  - Kitchens, bath rooms, ...
  - Upholstery
  - Interior design (wall paneling, decorative profiles, plinths,...)
  - Fair booths
  - Shop fitting, exhibition displays, ...
- **HDF**
  - Substrate for flooring:
    - Laminate
    - Engineered wood (wood veneer)

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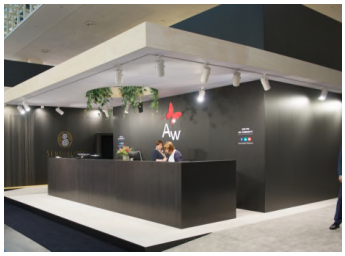
1. MDF & HDF
1.6 Applications

MDF:

Decorative panels & walls (e.g. ClicWall®)

Plinths, decorative profiles,...

Cabinetry, kitchens, bath rooms,...



Decoration, shop fitting, fair booths ,....

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1. MDF & HDF
1.6 Applications

MDF:

Automotive (interiors)

Displays, shelves, ...

Furniture

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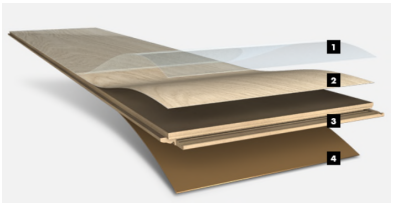
1. MDF & HDF

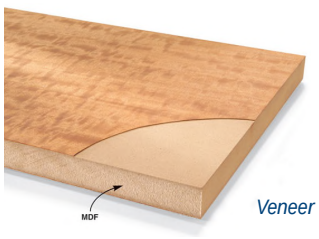
1.6 Applications

HDF:

Flooring



Laminate
(e.g. Quick·Step®)



Veneer

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2. Raw materials

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2. Raw materials

- MDF/HDF panels are made from different materials:
  - Wood
  - Glue
  - Additives
  - Colorants (optional)

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2. Raw materials

2.1 Wood

- MDF/HDF panels are only made from **virgin wood** (no reclycled wood).
- 4 kinds of wood are used:
  - **1) Round wood** (‘*rondins*’) in different qualities:
    - Soft wood: black pine, epicea, larch (= coniferous wood)
    - Hard wood: beech, ash, birch, …
    - Oak & poplar
  - **2) Tree waste** (‘*chutes*’)
    - Branches, …
    - Cut in smaller pieces
    - Mainly soft wood

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2. Raw materials

2.1 Wood

- 4 kinds of wood are used:
  - **3) Slab wood** (‘*dosses*’):
    - Surplus after sawing tree trunks (sawmill waste)
    - Both softwood & hard wood
  - **4) Wood chips** (‘*plaquettes extérieures*’)
    - Timber residues (sawmill waste)
    - Chopped in chips (by supplier)

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2. Raw materials

2.1 Wood

- How wood is measured
  - Stère
  - Dry Ton
  - Ton

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2. Raw materials

2.3 Additives

- Hardener
  - Helps the crosslinking of the glue
- Wax
  - Parafine: makes the wood fibres water repellent (to limit swelling)
- Colorants
  - For identification:
  - For aesthetics:

Moisture resistant (MR)

Fire Retardant (FR)

Noir

Rhino

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3. PRODUCTION PROCESS

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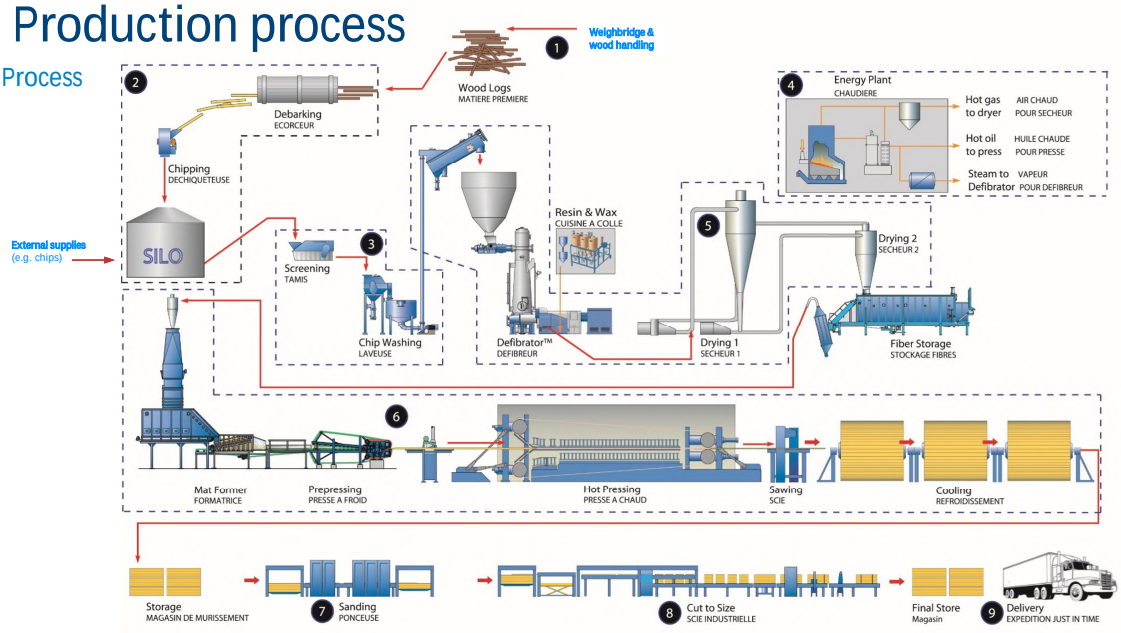
3. Production process

3.1 Process



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3. Production process

Weighbridge & wood handling

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- Incoming trucks are weighed and inspected
  - Weighing of the wood load
  - Inspection of the wood quality
- The incoming wood & external chips are stored in the wood parc

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3. Production process

Debarking & chipping

2

- The **bark** of the wood logs is **removed mechanically**:
  - Bark is not allowed for quality / aesthetical reasons
  - The bark is burned on site to generate energy for the production
- Afterwards, the wood logs are **chopped** into +/- 25mm chip
- Also externally purchased chips are used (from sawing mills or chipped by subcontractors)

3 Calibrating & washing

- The chips are **calibrated** and **washed** to remove impurities, such as
  - Sand
  - Soil
  - Stones, boulders, ...

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3. Production process

Energy plant

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- The **energy plant** ('chaufferie') is **fully integrated** in the production process of MDF/HDF panels @ Unilin
- The plant **recuperates** and **burns**
  - raw material impurities (bark, wood dust, ...)
  - waste of the production process (sanding dust, sawing loss,...)
  - scrap and rejected panels
- ... and **generates energy** for the **production** of the panels:
  - steam (defribrator, steam injection, glueing)
  - hot air (dryer)
  - thermal oil (press)

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3. Production process

Defibrating, blending & drying

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- The washed chips are subsequently
  - **steamed** (under pressure)
  - **defibrated** (= squeezed into fibers in a refiner)
  - mixed with **glue** and **additives** (wax, hardener, colorant, ...)
- The **blend** of fibers, glue and additives is then **dried**.

defibrating:

drying:

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3. Production process

Panel pressing, sawing & cooling

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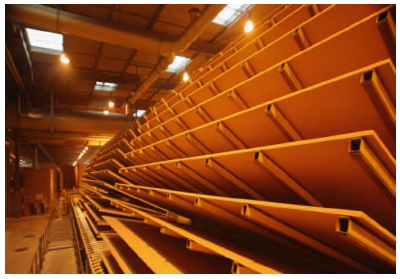
- The **dry blend** is formed into a '**matrass**' on a conveyer belt.
- The mattress is **pressed** in a **continues process** into a dense MDF or HDF panel:
  - 1. Cold pre-press (to remove air)
  - 2. Warm press (at high temperature and pressure)
- After pressing, the panels are **cut** into **big panels** (e.g. 6550 x 2250 mm) with a diagonal saw
- The big panels are **cooled down.** This allows the chemical reaction to stabilize and offers the panel its correct properties before further processing.



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3. Production process

Sanding

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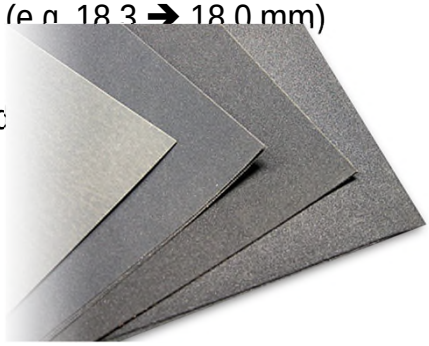
- After cooling, the big panels are **sanded** at **both sides**.
- The sanding process is key to:
  - give the panel its **exact required thickness** (e.g. 18.3 ➔ 18.0 mm)
  - guarantee a stable **surface quality**
  - allow **good finishing** of the panel afterward
    - painting or lacquering
    - veneering, laminating, …



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3. Production process

Cutting (sawing)

https://www.youtube.com/watch?v=qitenYvpSx

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- After sanding, the big panel is **cut** in the **final required panel size**
- The cut panels are **packed** according to the (customers) specification

3 Warehousing & delivering

- The panels are stored
- And delivered to the customers.

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3. Production process
3.2 MDF/HDF production @ Unilin

Vielsalm

SPANOLUX

Bazeilles

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3. Production process
3.2 MDF/HDF production @ Unilin

2 plants, 3 lines	VIELSALM	BAZEILLES
Location	Belgium	France
Construction	1997	1999 (line 1) 2002 (line 2)
Production lines	1	2
Avg. Capacity	320.000 m³/y	720.000 m³/y
Raw material	100% soft wood	Mix of soft & hard wood

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3. Production process

3.3 Differences with chip (particle) board

	MDF BOARD	CHIP BOARD
Raw materials	Fresh wood	Recycled wood (85%)
Production process	Glue before drying	Glue after drying
Panel composition	1 homogenous layer 	3 layers: *2 outer layers of fine particles,* *1 middle layer of larger particles* 

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4. QUALITY

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4. Quality
4.1 Different quality criteria

Physical *('behavior')*
- Density
- Swelling
- Absorption
- Humidity
- Fire resistance
- Color
- Surface quality
- Panel dimensions

MDF/HDF

Mechanical *('rigidity')*
- Internal bond
- Surface strength
- Bending strength
- Elasticity

Chemical *('composition')*
- Formaldehyde

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4. Quality
4.2 **Physical** criteria

DENSITY *(densité)*	
What ?	**Average weight** of the panel
Measurement	kg/m³
How measured ?	Scale
Impact	2 product categories: MDF (< 800 kg/m³) HDF (≥ 800 kg/m³)

Densité du bois/fibres

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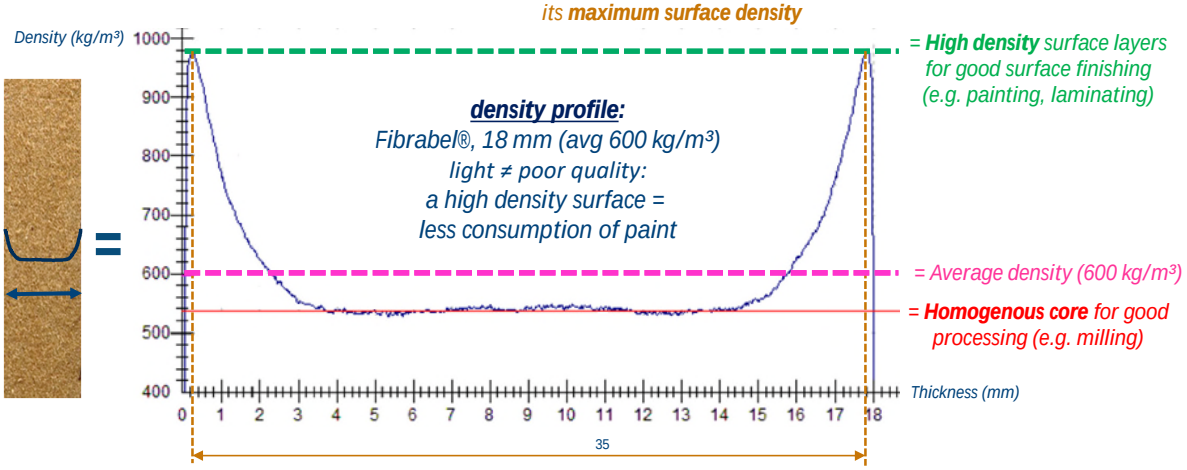
4. Quality
4.2 **Physical** criteria

*= The panel is sanded to 18 mm thickness, giving the panel its **maximum surface density***



Caractéristiques du bois intervient

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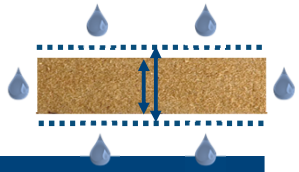
4. Quality
4.2 **Physical** criteria



SWELLING *(gonflement)*	
What ?	**Thickness swelling** of the panel after: - being **submerged in water** for 24h (general purpose grade) - **cyclic testing** or **boiling test** (moisture resistant grade)
Measurement	(new - original) / original thickness x 100% = x %
How measured ?	Digital micrometer
Impact	The more a panel swells in humid conditions, the less stable it will behave.

Essences de bois réagissent différemment

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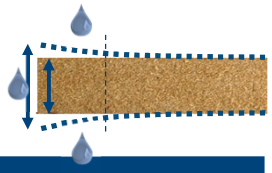
4. Quality
4.2 Physical criteria



EDGE SWELLING *(gonflement de champ)*	
What ?	**Edge swelling** of the panel after being **submerged partly (5 cm) in water** for 24h
Measurement	(new - original) / original thickness x 100% = x %
How measured ?	Digital micrometer
Impact	Edge swelling is particularly important for flooring: the floor panel is covered with melamine at the top, so the edges are vulnarable

Essences de bois réagissent différemment

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4. Quality
4.2 Physical criteria

ABSORPTION	
What ?	**Absorption** of the panel after being **submerged** in water for 24h
Measurement	(new - original)/original weight x 100% = x %
How measured ?	Scale
Impact	The less a panel absorbs, the less paint will be consumed during painting / laquering.

Essences de bois réagissent différemment

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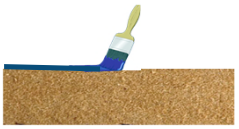
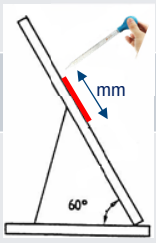
4. Quality
4.2 **Physical** criteria



ABSORPTION (toluene test)	
What ?	**Length** of the **toluene trace** on a slanted panel
Measurement	Toluene test (EN 382-1)
How measured ?	Meter
Impact	The longer the tolueen trace, the less the panel surface absorbs paint, the less paint is consumed



Essences de bois réagissent différemment

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4. Quality
4.2 **Physical** criteria

HUMIDITY *(humidité)*	
What ?	**Water content** of the panel is measured by its **weight loss** after being heated in an oven for 24h @ 103°C.
Measurement	(new - original)/original weight x 100% = x %
How measured ?	Scale
Impact	Humidity of MDF panels should be between 4 and 11% for good dimensional stability.

Essences de bois réagissent différemment

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4. Quality
4.2 **Physical** criteria

REACTION TO FIRE *(réaction au feu)*	
What ?	The **reaction** of the material to **fire**.
Measurement	Heat release / spread of flame / smoke production / droplets / impingement
How measured ?	Physical test
Impact	The more the panel resists to fire, the more time people have to escape ('live saving')

Attention: reaction to fire ≠ fire resistance
Fire resistance refers to the capacity of a construction element (wall, floor, ceiling, door, ...) to retain its function, integrity and/or thermal insulation over certain period of time.

Essences de bois réagissent différemment

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4. Quality
4.2 **Physical** criteria

COLOR		
What ?	**Mass coloring** of the panel by adding color pigment	
Measurement	n/a	
How measured ?	n/a	
Impact	**Identification**: Moisture resistant (MR); Fire Retardant (FR)	**Decoration**: Noir; Rhino

Essences de bois réagissent différemment

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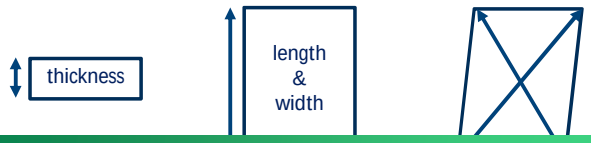
4. Quality
4.2 **Physical** criteria

DIMENSIONS	
What ?	The **dimensions** of the finished panel
Measurement	mm (EN 324-1 & 324-2)
How measured ?	meter
Impact	Correct dimensions are crucial for good processing



Essences de bois réagissent différemment

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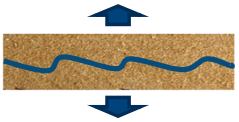
4. Quality
4.3 **Mechanical** criteria



INTERNAL BOND *(résistance à la traction)*	
What ?	**Force** required to **pull** the panel **apart** in the thickness direction.
Measurement	N/mm²
How measured ?	Tensile testing machine
Impact	The higher the internal bond, the higher the panels resistance against splitting & the better the panel can be milled.

Essences de bois réagissent différemment

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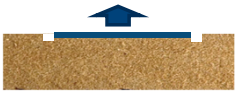
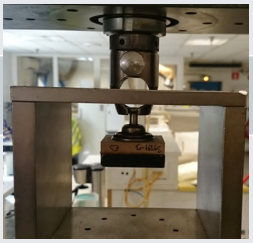
4. Quality
4.3 **Mechanical** criteria



SURFACE STRENGTH *(arrachement)*	
What ?	The **force** required to **remove** the **surface layer** of a panel in a perpendicular direction
Measurement	N/mm²
How measured ?	Tensile testing machine
Impact	This surface strength is particularly important for surface finishes such as melamine, laminate, etc.



Essences de bois réagissent différemment

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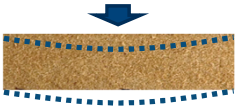
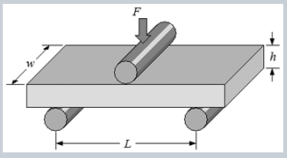
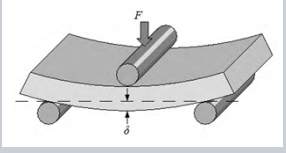
4. Quality
4.3 **Mechanical** criteria



MODULUS OF ELASTICITY IN BENDING *(module d'élasticité)*	
What ?	Measures the panel's **resistance** to being **deformed elastically** when stress is applied.
Measurement	N/mm²
How measured ?	 
Impact	The higher the modulus of elasticity, the less a panel will bend.

Essences de bois réagissent différemment

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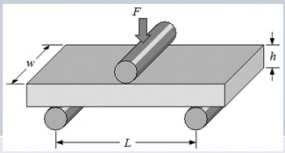
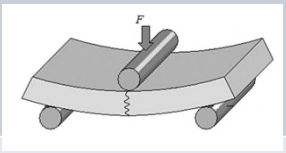
Diapositive 46

BC2 Bart CATTEEUW; 19-04-18

4. Quality
4.3 **Mechanical** criteria

BENDING STRENGTH (MODULUS OF RUPTURE) *(résistance à la flexion)*	
What ?	Measures the **load limit** value of an MDF/HDF board (breaking)
Measurement	N/mm²
How measured ?	 
Impact	The higher the bending strength, the stronger the panel.

Essences de bois réagissent différemment

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4. Quality
4.4 **Chemical** criteria

CH_2O

FORMALDEHYDE	
What ?	The panels **content & emission** of **formaldehyde**
Measurement	mg / 100 gr • mg/m³ air • mg/l water • ppm
How measured ?	• Chamber method (emission/release in air) • Perforator method (content) • Desiccator method (emission/release in air)
Impact	Formaldehyde level should be in line with legal requirements.

Composition chimique du bois intervient (ex. tanin)

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En conclusion

- Les caractéristiques du bois déterminent les caractéristiques du panneau MDF
  - On ne fait pas n'importe quel panneau avec n'importe quel bois
- Les variations de qualité de bois impactent la qualité du panneau
  - Il faut des volumes suffisamment importants par essence de bois
- La forme du bois n'est pas un facteur essentiel de qualité
  - Le bois sera transformé en plaquettes de petites dimensions
- L'essence du bois est un critère déterminant
  - La composition chimique de certaines essences n'est pas toujours compatible avec les colles
- Les fibres de bois ne doivent pas être dégradées
  - La dégradation de la lignine, la cellulose, l'hémicellulose change les caractéristiques de la fibre
- Les applications du panneau MDF requièrent certaines caractéristiques de fibres (résineuses ou feuillues)
  - Certaines applications exigent certaines essences de bois

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Merci pour votre attention

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