1. Introduction

1.1. MDF with all its possibilities

MDF (Medium Density Fibreboard) is the preferred wood panel material of wood processors. Spanolux produces a variety of MDF types, each of which provides an ideal solution for a wide range of possible applications. The processor of MDF board material may be an industrial furniture maker, an interior builder, a carpenter... or a private DIY'er. The numerous application, processing and finishing possibilities (brought about by constant innovation and technological progress) have given rise to many questions regarding MDF and its proper use: the different properties of the different MDF types, special lacquer finishes, processing of lightweight MDF, etc.

The purpose of this Spanolux MDF Manual is to provide the customer with a reference guide on the use and processing of Spanolux MDF. Taking into account the specific properties of MDF board material, this manual develops user guidelines to deal with some of the frequently encountered problems.

“All information contained in this MDF manual is not to be used for legal proceedings.”

1.2. Spanolux

Spanogroup

Spanogroup consists of four companies: Spanolux, Spano, Dekaply, and Balterio. Spanolux, located in Vielsalm, produces basic MDF. Balterio, located on the same site, produces HDF-based laminate flooring. Spano, located in Oostrozebeke, is active in the production of particleboard and MDF, and in the manufacture of furniture components.

Spanolux

Spanolux, possibly the best MDF producer in the world, has developed a market-driven, customer-oriented strategy. Its corporate philosophy is to offer customers the products they want, in all qualities and quantities. All of Spanolux products can, upon request, be delivered with the FSC and PEFC certificates.

1.3. Wood Based Solutions

Spanogroup’s core competence is woodworking and wood transformation, using wood in all its forms for the production of board material, energy or composites.

Spanogroup continuously builds on its know-how of transforming wood to develop new innovative products in order to diversify its product portfolio and optimise the use of wood resources.

With its MDF boards, Spanolux provides a solution for every use or application via its ‘Wood Based Solutions’ such as: Water Resistant, Fire Retardant, Construction/Flooring, Health & Environment, Light Products and Interior Design.

1.3.1. Moisture Resistant: Unafraid of high humidity

Problem description

Wood does not like moisture. Not only direct contact with water but also high humidity is dangerous for wood and for MDF boards in particular. A damp environment, with a relative humidity exceeding 70%, may be present in any house, e.g. in the bathroom, the kitchen or under the roof.

Wood may also be exposed to high humidity during the construction phase. This may be due to adverse weather conditions, but also after plastering the walls or pouring the floors the relative humidity inside a building can reach 90% or higher.

Moisture causes wood to change (linear expansion, swelling) and in the case of MDF board material it may have a highly adverse impact on its technical characteristics (such as rigidity, bending strength...). In the most critical of environments, even surface fungus may occur.

Solution

Spanogroup, and Spanolux in particular, offers solutions that allow MDF boards to be used in a damp environment. The board materials are in fact produced using a moisture resistant glue that is based on non-hydrolisable and also moisture repellent glue bonds. The glues used are so-called MUF (Melamine Ureum Formaldehyde) glues and feature an efficient curing system. This special Spanolux production process positions the finished product far above the common standard values. These boards can be applied in service class 2 environments (not in outdoor applications) and are capable of withstanding accidental contact with water. The products are characterised by low swelling and limited linear expansion when exposed to an increased humidity level. Brief exposure to water (e.g., rain shower at a site) will not substantially alter the mechanical characteristics. Spanolux moisture-resistant MDF boards (Umidax®, Umidax® Noir and Umidax® Light) can be melaminated, laminated or coated with another surface finish without any problem. Sawing and milling is possible using standard tools.
1.3.2. Fire Retardant: Fire - every second counts!

Problem description

Sadly, not a day goes by without a fire breaking out somewhere. Nobody can predict the danger, a fire is usually caused by accident or negligence. However, we can and must try to keep the fire from spreading. In a fire, every second counts for the slower the fire spreads, the more time the emergency services have to limit personal injury and property damage.

Breakout of fire

A fire breaks out if the following elements are present to a sufficient degree:

- Heat source: a spark caused by a short-circuit, an overheated machine, a smouldering cigarette, etc.
- Oxygen
- Combustible material such as furniture, clothes, books, etc.

If one of these elements is missing, there is no risk of fire. Of these three elements, however, there are two that cannot be kept under control: the heat source (which is usually created by accident) and oxygen (which is always present to a sufficient extent in air), so that all attention should be directed towards the last element: the combustible material. Fire safety can be considerably increased through the use of non-combustible or fire retardant material.

Spread of fire

Once a fire has broken out, it can spread in different ways:

- By convection: The heat is transferred from one material to the next. The heat conduction of the material plays an important role in this process. Thus, a metal, while non-combustible, will transfer heat faster than wood.
- By radiation: Hot air and combustion gases rise up and heat other material that will in turn catch fire.

Fire behaviour of materials

It is important to know how construction materials will behave in the event of a fire. Do they easily catch fire? Do they spread the fire? Do they cause high amounts of smoke or gas? But there are also other questions to be answered. How, for instance, will the material itself react to high temperatures? Will it deform, bend (e.g. steel, crack (e.g. plaster) or melt (e.g. plastic)? Wood products are known to react favourably to fire and therefore score well on the above-mentioned criteria.

Flame spread

Flame spread is the rate at which flames travel along the surface of a given material. This rate varies from one material to another. The degree of flame spread can be subdivided into four classes:

- Class 1 (M1) - No flame spread
- Class 2 (M2) - Slight flame spread
- Class 3 (M3) - Average flame spread
- Class 4 (M4) - High flame spread

Flashover and combustibility

The spread of fire is determined not only by the flame spread but also by the heating of non-combustible materials. This may result in the generation of ignitable gases, which will in tum cause other materials to catch fire (flashover).

Depending on their contribution to flashover, these materials are subdivided into four classes:

- Class 1 - No contribution to flashover
- Class 2 - Limited contribution to flashover
- Class 3 - Average contribution to flashover
- Class 4 - Large contribution to flashover

Solution

The development of fire retarding products has been a priority within Spanogroup for more than 30 years, which has resulted in an extensive know-how in the field of fire behaviour of wooden board material. Spanogroup, and Spanolux in particular, offers solutions for flame spread, flashover, smoke development and burnthrough time. Spanolux fire retardant MDF boards are CE marked and regularly tested and inspected by national and international agencies. Certificates and test reports are available upon request. Sister company Dekaply specialises in the melamine facing of fire retardant MDF boards: Firax, Firax Class 0 and Firax Light.

1.3.3. Interior Decoration: From panel to beauty

Problem description

Domestic interiors change and homes are increasingly designed to meet the needs and requirements of modern man. Children each have their own room and the kitchen emerges as the central living space in many homes.

In today’s society, the home is becoming not only a place for relaxing but also a showcase for modern technology. Domotics or home automation pervades all parts of the home, from the bedroom through the living room to the kitchen.

Design, too, is increasingly gaining acceptance and recognition. Beauty is added to functionality. New residential concepts are emerging in the form of lofts, apartments or modern, open-plan villas. Just like fashion and culture, the appearance of homes is becoming more sensitive to changes and trends.

Solution

Everyone has their own preferences when it comes to shapes, colours and finishes. Dekaply specialises in melamine coating of all types of MDF with a wide range of uni-colours and trendy wood decors. This also enables it to respond swiftly and efficiently to new market trends:

- Accessory products such as matching laminates, edge band melamine and ABS are kept in stock.
- Flexible dimensions and choice of carrier board.
- Specialised in melaminated fire retardant boards, including Firax, Firax Class 0 and Firax Light.

Also MDF Prime®, covered with a white primer is ready to paint and ideal for interior applications. Umidx® Noir, colored black in the mass, gives the possibility for creative applications in modern interior decoration.

1.3.4. Construction / Flooring: Natural construction materials

Problem description

The construction of houses, apartments, lofts, office and public buildings is undergoing a tremendous change as increasingly innovative products are being developed for use as building materials. Also the use of wood and wood board material continues to evolve within the construction sector, both in load bearing and non-load bearing applications.

Solution

Spanogroup produces CE marked products for the building sector, e.g. the MDF Standard. Moisture resistant boards are used for applications in high humidity environments. They guarantee limited swelling and minimise linear expansion due to humidity variations. The Umidx® type can be used for this purpose.

For applications where specific fire safety requirements apply, the Spanolux MDF boards can be used. These MDF boards comply with rigorous fire standards and carry various international certificates. The Firax and Firax Class 0 MDF types can be used for this purpose.

For applications where air quality is critical, Spanolux has developed MDF boards with a formaldehyde emission that is equal to or less than that of natural wood. The MDF type to be used for this purpose is Pure.
1.3.5. Health & Environment: For a clean world

**Problem description**

The Kyoto protocol has placed the CO2 issue high on the agenda. In the combustion process, hydrocarbons are converted into CO2, which as greenhouse gas is responsible for global heating. Switching from fossil fuels to biofuels does not reduce but can compensate for the amount of greenhouse gases through the cultivation of crops. Wood and forests are strong CO2 sinks. If wood is not burned and thus given a long life cycle, the greenhouse gas is fixed over this long period. Wood and wood products therefore constitute an important step in the control of greenhouse gases.

Public awareness of nature, environment and energy is a trend in society that can no longer be denied and one that will continue to command a great deal of attention in the future. In housing construction, too, there is a growing trend towards the use of ecologically sound techniques. The choice for environmentally friendly products and products that are not harmful to human health results in properly insulated and ventilated houses with good air quality.

**Solution**

Spanolux offers MDF boards with low formaldehyde content. Our standard products invariably meet the rigid E1 standard for formaldehyde emission, but our low-formaldehyde MDF boards contain an amount of formaldehyde that is equal to or less than that of natural wood. The Spanolux MDF types to be used for this purpose are Pure and Pure Light.

Also in terms of production technology, the Spanolux production departments are equipped with environmental-technical facilities to ensure compliance with European environmental standards.

1.3.6. Light Products: Innovative by weight

**Problem description**

Product development is growing exponentially: electronics, domotics, new materials, etc. This also applies to board material. A major impulse for change is the demand for lighter material. Light material offers a number of significant advantages:

- The lighter materials are made, the fewer raw materials are required. The future of the world depends to a significant degree upon the judicious use of the available raw materials.
- Furthermore, light board material offers distinct ergonomic benefits. The handling and processing of heavy material calls for appropriate tools and imposes a heavy physical load on the user. Transportation costs, too, are to a great extent determined by the weight of the product.
- Finally, there is the constant search for innovative products, products with new characteristics that open up new fields of application.

**Solution**

The creation of light board materials is one the top priorities of Spanolux’s development programme, the aim being to provide light MDF boards that can be perfectly processed for their respective applications.

Thanks to its sustained research and development efforts, Spanolux can already today propose a light product for most MDF board materials, notably Fibrabel® (600 kg/m³), MDF Ultra Light (500 kg/m³), MXL (400 kg/m³) in the standard product range, and Umidastr® Light, Firax Light and Pure Light in the moisture-resistant, fire-retardant and low-formaldehyde lines respectively.
2. What is MDF?

2.1. General: what is MDF?
MDF (Medium Density Fibreboard) was developed in the United States and has since 1973 been produced in Europe, where it achieved an effective breakthrough only in the 1990s. MDF is manufactured using the so-called dry process in which the wood fibres are mixed with glue and pressed in dry condition.

Initially, the furniture industry processed MDF as an alternative to solid wood panels. Subsequently, MDF was also used for other furniture parts. Finally, applications in interior design and construction were identified. By the end of 2004, Europe’s total production capacity was approximately 11.9 million m³ per year.

2.2. Spanolux production process

The Spanolux MDF production process is illustrated step by step from raw material to finished product, in Figure 3.

Raw materials:
For its MDF production, Spanolux uses spruce (Picea Abies) as base raw material (1), in the form of round or sawn timber, originating from nearby saw mills.

Manufacture of chips:
After debarking, the round timber is reduced to small chips (2) approx. 20 mm in length. Both in-house produced and external chips are stored in silos, after which they are screened and washed. Chips larger than 40 mm or smaller than 5 mm are removed from the process flow. The other chips are washed (3) in order to eliminate possible contaminants such as minerals or metals.

Manufacture of fibres:
The rinsed chips are steamed under pressure for a few minutes at a temperature of approx. 160°C. After softening, the chips are fiberised in a defibrator using two structured grinding discs: one stationary and one rapidly rotating disc. A wood-fired energy plant (4) provides steam together with hot air and thermal oil for downstream processes.

Addition of resin mixture and drying:
The loose fibres and/or wood bundles are glued in a so-called blowline, i.e. a pipe through which the fibres are blown at high speed. The glue resin used is urea-formaldehyde (UF) resin, or melamine-urea-formaldehyde (MUF) resin for boards with increased moisture resistance. In addition, other additives can be added together with the resin, e.g. to improve the fire retardant properties of the board. Next, the fibres are dried (5) and stored in a small buffer silo for the Pendistor or spreading machine. The wet, resinated fibres are dried in two steps, resulting in virtually dry fibres being spread and pressed.

Formation of the mat:
In the forming station, the dried fibres are spread onto a belt, with the air at the bottom being sucked off, thereby causing the fibres to form a so-called pulp or mat. (6). The mat of spread fibres is almost 30 times as thick as the board at the end of the production line.

Pressing of the board:
Pressing of the MDF boards is accomplished in two steps. First the pulp is passed through a belt press, which reduces the thickness and imparts a certain stability to the mat. Then the edges are trimmed and the mat is fed into the continuous main press. The continuous press consists of two steel belts that move on a chain system through the press. In this step, the boards are pressed at high temperature and pressure. At the end of the press the boards are sawn to length. In principle, it is possible to produce an infinitely long board, but in practice the length of the MDF board is limited by the stacking capabilities and the subsequent process steps (sanding and sawing). Capabilities of the Spanolux continuous press:
- widths from 2450 to 2550 mm
- lengths from 3660 to 6310 mm
- thicknesses from 6 to 38 mm

Final operations:
When the boards exit from the press and have initially been sawn to length, they are cooled with ambient air in a star dryer or cooling carousel. Next, the boards are temporarily stored in a conditioned room to ensure complete stabilisation of the board. After conditioning, the boards are sanded (7) on a 4-head sander. In this process, the board is calibrated and sanded with e.g. 60, 80, 100 and 150 grit. Before the boards are stored (9) for subsequent shipment, they are trimmed to size (8) and carefully packed.

Figure 3: Spanolux production process

Figure 4: Spanolux dryer
2.3. MDF product classes

MDF is produced in various types and qualities. In terms of weight by volume, MDF can be classified as follows:

- HDF: ≥ 800 kg/m³
- MDF: ≥ 650-800 kg/m³
- Light MDF: ≥ 550-650 kg/m³
- Ultralight MDF ≥ 450-550 kg/m³

European standard NEN-EN 622-5 further subdivides MDF into various application classes by the addition of one or more letters:

- H: increased moisture resistance
- E: outdoor applications
- L: structural applications
- A: permanent loads
- S: momentary (short-term) loads
- FR: fire retardant applications (not included in the standard)

Based on this classification, the following specific MDF types can be defined:

- **MDF-LA:** Structural applications in dry environments (all load classes cf. EN 1995-1-1)
  - Membrane
  - Pure
  - MDF Standard
- **FR-MDF-LA:** Structural applications in dry conditions, with fire retardant properties
  - Firax Class 0
  - Firax
- **MDF-HLS:** Structural applications in humid conditions (momentary or short-term loads cf. EN 1995-1-1)
  - Umidax®
  - Umidax® Noir
- **L-MDF:** Light MDF, for general applications in dry conditions
  - Firax Light
  - Pure Light
  - MXL
- **L-MDF-FR:** Light MDF, for general applications in dry conditions, with fire retardant properties
  - Firax Light
  - Pure Light
- **L-MDF-H:** Light MDF, for general applications in humid conditions
  - Umidax® Light
- **UL2-MDF:** Ultralight MDF, for general applications in dry conditions
  - MDF Ultra Light
  - MXL

3. Technical characteristics

The specific properties of MDF are determined by the production method, the quality of the raw materials, and the resin recipe. Spanolux achieves a constant quality of the various product types through advanced process and product control. The quality lab uses an extensive test protocol under which each production batch is tested for a number of major quality parameters.

3.1. Weight by volume and density profile

The weight by volume represents the mass per unit of volume. For MDF boards, the weight by volume varies from 450 to 800 kg/m³. Spanolux even produces MXL with a weight by volume of approx. 400 kg/m³. The Spanolux MDF with the highest density is MDF Membrane, which has a weight by volume of over 800 kg/m³.

In the case of MDF boards, the weight by volume is not constant across the thickness and across the width (and to a lesser extent across the length) of the board. The press can be set for the production of MDF with high or low densified cover layers. Light MDF is produced with high densified cover layers. MDF for laminate flooring is pressed as homogeneously as possible. Upon delivery, the tolerance on the average weight by volume within a single board must be less than ±7% (EN 323).

The volume of the board is not always an indication for the properties and performance of the board. Parameters that are equally important include the variation of the weight by volume, the weight by volume of the cover layers, etc. It is important to use the appropriate MDF board with the correct weight by volume if the specified processing and application requirements are to be met.

Figure 5 shows the density profile of a Firax MDF with a weight by volume of 600 kg/m³. The profile shows that the surface layers, over a limited thickness with respect to the total board thickness, exhibit a density of 950 to 1000 kg/m³, i.e. significantly higher than the average board density (600 kg/m³). The high densified surfaces of the MDF board allow, e.g. a wet paint surface finish.

By contrast, the almost horizontal line, between the peaks on the left and right, represents a virtually constant density of 500 kg/m³. This homogeneous core has a slightly lower density than the average board density (600 kg/m³). The homogeneous core of the MDF board allows for simple processing of the board, e.g. profile milling.

The lighter the MDF board, i.e. the lower the average density, the greater the difference between the constant lowest density in the core of the board and the highest density at the surfaces of the MDF board will be. For an MDF board with a lower average density, the difference resides mainly in a lower constant density in the core of the board.

3.2. Surface degree of finish

3.2.1. Sanding quality

As a rule, MDF boards are sanded in production with 100 grit and then with 150 grit. This surface degree of finish is suitable for further processing of the board. Finish options such as painting, veneering, melamine facing, etc. will be discussed in detail further in this MDF manual.

Sanding with a specific or finer grit, already in the production stage, is possible upon request.

3.2.2. Surface absorption

An important parameter for obtaining a uniform finish is the surface absorption of MDF, notably the extent and rate of penetration of liquids. If the surface absorption is too high or non-uniform, stans may appear on the surface during the finishing process. In addition, differences may occur in the curing of paints, resulting in insufficient adhesion or too rapid penetration, so that the desired result will not be achieved.

The surface absorption cannot be determined visually and must be carried out using the method specified in EN 382-1. For surface absorption, the following general conclusions can be drawn:
• The type Membrane has a slightly lower surface absorption than the Pure and MDF Standard types.

• The lighter Fibrabel®, MDF Ultra Light and MDF Light types have a slightly higher surface absorption than the above-mentioned types.

• Because of their moisture resistant properties, the Umidax®, Umidax® Noir and Umidax® Light types have a lower surface absorption than all of the above-mentioned MDF types.

• Because of the added fire retardants, the Firax, Firax Class 0 and Firax Light types exhibit a higher surface absorption than the light MDF types.

### 3.3. Sand content

Contaminants (in particular sand) in wood board material adversely affect the quality and lifetime of the cutting tools. The abrasive action causes saw blades, cutter heads and other cutting tools to become dull more rapidly, resulting in a poorer finish quality of the end product. Since MDF requires a high degree of processing, it is important to ensure that the board contains as few contaminants as possible. The standard prescribes a sand content < 0.05 %. Spanolux processes only debarked and washed chips, allowing it to achieve an exceptionally low sand content in the order of ± 0.00x %.

### 3.4. Dimensions

#### 3.4.1. Length / width / thickness

Spanolux produces boards in the following standard thicknesses and dimensions:

- Thicknesses (mm): 6, 8, 9, 10, 12, 15, 16, 18, 19, 22, 25, 28, 30, 38
- Standard board dimensions (mm): 1220 x 3050, 1220 x 3050, 1830 x 2440

The high capacity saw supports all sawing dimensions. In principle, all thicknesses and lengths/widths are available within the press capabilities and can be produced upon request. The Spanolux press capabilities for MDF are as follows:

- Widths from 2450 to 2550 mm
- Lengths from 3660 to 4310 mm
- Thicknesses from 6 to 38 mm

For the current stock programme, please refer to Chapter 10, which contains the Spanolux product and stock range.

Table 2 below contains the general specifications for tolerances on nominal dimensions in accordance with standards EN 324-1 and 324-2.

#### 3.4.2. Dimensional stability

Wood and wood based board materials shrink and swell according to variations in the moisture content in the material. Compared with solid wood, MDF is a relatively stable material. The “action”, expressed as a % / % change in moisture content within the board, amounts to 0.05 % in the surface of the board and ± 0.35 % in the thickness of the board. By comparison, the “action” of solid wood amounts to 0.5 % in tangential direction and 0.2 % in radial direction. The moisture content in a wood panel mainly depends on the ambient humidity and temperature; prior to testing, test specimens are conditioned at a temperature of 20 ± 2°C and a relative humidity of 65 ±5 %.

The dimensional stability is specified in standard EN 318.

The example here is a Fibrabel® MDF door panel, 600 mm wide, 15 mm thick. With an increase in relative humidity from 35% to 85%, the moisture content in the panel can increase by approx. 5%. This causes a dimensional change of approx. 1.5 mm in the width and 0.25 mm in the thickness of the panel. The application of finish coats will slow down the effect of variations in relative humidity on the wood moisture content of the panel, and all the more so if the finish coats are more vapour tight.

After production, Spanolux MDF has a moisture content of 8 ± 3%, in compliance with the EN standard. At the time of delivery to the end-user, however, the moisture content may have altered due to ambient factors during transport and storage. Storing the panels in a humid environment on the construction site inevitably leads to water absorption (albeit to a limited degree); conversely, the moisture content decreases in a very dry environment. Such moisture content variations initially occur at the edges of the panels and in the outer panels of a stack, but can subsequently spread to all panels of the stack.

Individual MDF panels that are exposed to free ambient air will reach an equilibrium moisture content within a couple of days. MDF panels located in the middle of a stack, by contrast, will take several weeks before they reach the equilibrium moisture content.

### 3.5. Bending Strength & Modulus of Elasticity

The bending strength determines the load limit value of an MDF board, and the modulus of elasticity the stiffness and therefore the degree of deformation at load.

Table 3 shows the average bending strength and modulus of elasticity for the various MDF types, measured in accordance with EN 310.

EN 310 is used to classify MDF, not to generate calculated values.

#### 3.5.1. Bending strength

The ratio between the equilibrium moisture content of Standard MDF and Umidax® (expressed in mass percentage) and relative humidity is shown in Figure 6.

The moisture content of MDF is determined by measuring the loss of mass between the condition at the time of sampling and the condition after drying to constant mass at 103°C (EN 322).

An alternative, but less accurate, measuring method is the use of electric hygrometers designed for solid wood. The measuring accuracy of these instruments can be improved by using a specific calibration scale for MDF, if such a scale is provided by the supplier of the instrument.

Dimensional variations can to some extent be limited by treating and processing MDF at a moisture content that approximates, as closely as possible, the expected final equilibrium moisture content. In Northern European countries, a moisture content of 8 ± 2 % is to be expected for MDF in a normal indoor climate. In Southern Europe, a lower moisture content is to be expected.

### Table 2: Tolerances on nominal dimensions MDF

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard</th>
<th>Unit</th>
<th>Fibreboards - Specific Part 1: General Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>EN 324-2</td>
<td>mm</td>
<td>± 0.2</td>
</tr>
<tr>
<td>Length x width</td>
<td>EN 324-2</td>
<td>mm/m</td>
<td>± 2.0 mm/m</td>
</tr>
<tr>
<td>Squareness</td>
<td>EN 324-2</td>
<td>mm/m</td>
<td>± 2.0 mm/m</td>
</tr>
<tr>
<td>Straightness</td>
<td>EN 324-2</td>
<td>mm/m</td>
<td>± 1.5 mm/m</td>
</tr>
</tbody>
</table>

#### Table 3: Tolerances on nominal dimensions MDF

### Table 4: Load on floors and roofs

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of surface</th>
<th>qk (kN/m²)</th>
<th>Qk (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>General</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>General</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>General</td>
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<tr>
<td>D</td>
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<td>General</td>
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<td>G</td>
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<td>H</td>
<td>General</td>
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</tr>
<tr>
<td>I</td>
<td>General</td>
<td>35</td>
<td>33</td>
</tr>
<tr>
<td>J</td>
<td>General</td>
<td>40</td>
<td>38</td>
</tr>
</tbody>
</table>

#### Table 5: Load duration classes

<table>
<thead>
<tr>
<th>Load duration class</th>
<th>Accumulated duration</th>
<th>Example of loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>Final load</td>
<td>Dwell/office</td>
</tr>
<tr>
<td>Long-term</td>
<td>6 months – 10 years</td>
<td>Storage</td>
</tr>
<tr>
<td>Medium-term</td>
<td>1 week – 6 months</td>
<td>Imposed load</td>
</tr>
<tr>
<td>Short-term</td>
<td>≤ 1 week</td>
<td>Snow and wind</td>
</tr>
<tr>
<td>Instantaneous</td>
<td>≤ 1 week</td>
<td>Occasional load</td>
</tr>
</tbody>
</table>

#### Table 6: Load on floors and roofs

For area types A to D, a ‘medium term’ load duration is assumed, whereas for types E and H, ‘long term’ and ‘short term’, respectively, are used (see Table 4). ‘Short term’ load duration is also applied for concentrated load Qc.
For MDF, the following correction factors apply (see Table 6).

The characteristic values for these MDF types are given in EN 12369-1. An overview of these values is shown in Tables 7 and 8. The 5% characteristic values for stiffness are calculated by taking 85% of the average value of the tables. If immediate deflection has to be limited, the condition must be satisfied: \( u < l/200 \).

### 3.6. Tensile strength perpendicular to surface

The tensile strength perpendicular to surface is defined in accordance with EN 319 and determines the normal force required to pull a panel apart in the thickness direction. The tensile strength thus provides important information about the panel’s resistance to delamination or splitting on the face. As a rule, the thicker the panel, the lower the normal tensile strength. Table 9 shows the normal tensile strength values for the different MDF types, for a panel of 18mm thickness.

### 3.7. Screw withdrawal resistance

MDF has a significantly higher resistance to screw withdrawal as compared to other board materials. Table 10 indicates the screw withdrawal resistance for a steel screw with 4.2mm diameter and 38mm length with 15mm screwing depth, determined in accordance with EN 320, for different Spanolux MDF types of 18mm thickness.

### 3.8. Formaldehyde emission

In the production of Spanolux MDF boards, resin types (UF and UMF) are used that may release formaldehyde. Since high concentrations of formaldehyde in buildings may cause irritation of eyes and upper respiratory tract, requirements are imposed on the emission values of MDF. The emission of formaldehyde decreases in time (after manufacture) but increases at high humidity and temperature. It can be greatly inhibited by finishing the board with a film-forming product (paint, varnish) or by coating the board with e.g. a synthetic finish or melamine.

For the emission of formaldehyde of uncoated or unfinished MDF, the formaldehyde content is determined in accordance with:

- The perforator method as per standard EN 120
- The chamber method as per standard EN 717-1
- The bottle method as per EN 717-3

For MDF, standard EN 622-1 defines the following two classes for the content of free formaldehyde and formaldehyde emission:

- Class 1
- Class 2

### 3.9. Thickness swelling 24 hours

Depending on the use and the resin used, two types of MDF boards can be distinguished:

- Membrane
- Lightweight

A dry environment is defined as a normal indoor climate (as e.g. in living rooms and bedrooms) for a few weeks per year only, and with corresponding to use class 1, as specified in ENV 1995-1-1 (temperature 20 + 2°C; relative humidity > 65% for a few weeks per year only), and with biological risk class 1 as per standard EN 335-3.

- Humid environment: Moisture resistant MDF: Umidax®, Umidax® Noir or Umidax® Light

A humid environment is defined as a temporarily humid indoor climate (as e.g. in kitchens, bathrooms, unheated garages and unheated washrooms) corresponding to use class 2, as specified in ENV 1995-1-1 (temperature 20 + 2°C; relative humidity max. 85% for a few weeks per year only), and with biological risk class 1 as per standard EN 335-3. Test method EN 317 determines the percentage of thickness swelling of the central point on test specimens of 50 x 50 mm after immersion in cold water (20°C) for 24 hours. These values classify the different MDF types in terms of behaviour upon wetting. Values for swelling of the edge areas and long term swelling are not determined on the basis of EN 317.

Table 12 indicates the thickness swelling, determined as per EN 317, of the different types of Spanolux MDF boards for three board thicknesses: 12mm, 18mm and 25mm.
3.10. Durability

3.10.1. Cyclic test

The durability or the behaviour of MDF under extremely humid conditions can be assessed by two test methods.

The durability of MDF for applications under humid conditions can be determined by determining the tensile strength perpendicular to surface and the thickness swelling after a cyclic test in accordance with EN 321. In this cyclic test or “Option 1”, the MDF test specimen is subjected to 3 successive cycles with EN 321. The name is derived from the cycle of the following exposure treatments: immersion in water, frost and heat. Upon completion of the three cycles, the tensile strength perpendicular to surface (N/mm³) is determined. This cyclic test is also known as the “V313” test. The name is derived from the cycle consisting of:

- 3 days: drying at a temperature of 70°C (see figures 7 through 9)
- 1 day: freezing at a temperature of -20°C
- 3 days: immersion in water at 20°C (with subsequent reconditioning of the MDF test specimens), each which is repeated three times (with 4-hour intervals), and the tensile strength perpendicular to surface and the thickness swelling after a cyclic test in accordance with EN 321. In this cyclic test or “Option 1”, the MDF test specimen is subjected to 3 successive cycles of the following exposure treatments: immersion in water, frost and heat. Upon completion of the three cycles, the tensile strength perpendicular to surface and the thickness swelling of the MDF test specimen are determined. This cyclic test is also known as the “V313” test. The name is derived from the cycle of the following exposure treatments: immersion in water, frost and heat. Upon completion of the three cycles, the tensile strength perpendicular to surface and the thickness swelling of the MDF test specimen are determined. This cyclic test is also known as the “V313” test. The name is derived from the cycle of the following exposure treatments: immersion in water, frost and heat. Upon completion of the three cycles, the tensile strength perpendicular to surface and the thickness swelling of the MDF test specimen are determined. This cyclic test is also known as the “V313” test. The name is derived from the cycle of the following exposure treatments: immersion in water, frost and heat. Upon completion of the three cycles, the tensile strength perpendicular to surface and the thickness swelling after a cyclic test (Option 1).

- 3 days: immersion in water at 20°C (see Figure 7; V313/Option 1: 3 days immersion in water at 20°C).
- 1 day: freezing at a temperature of -20°C (see Figure 8; V313/Option 1: 1 day freezing at a temperature of -20°C).
- 3 days: immersion in water at 20°C (see Figure 9; V313/Option 1: 3 days freezing at a temperature of 70°C).

3.10.2. Boiling test

An alternative method for testing the durability of MDF is to determine the tensile strength perpendicular to surface after the so-called “boiling test” in accordance with EN 1087-1. In this boiling test or “Option 2”, the MDF test specimens are immersed in boiling water for two hours. The MDF test specimens are subsequently cooled and then the normal tensile strength is determined. (see Figure 10)

MDF class | Spanolux MDF | Option 1
--- | --- | ---
MDF-LA | Membrane | -
| Pure | -
| MDF Standard | 10,2 | 8,5 | 6,7
FRM-MDF-LA | Pure Class 5 | 8,9 | 7,3
| Pure | -
| MDF-HLS | Umidax® | 5,6 | 3,7 | 2,0
| Umidax® Noir | 5,6 | 3,7 | 2,0
| Pure Light | -
| Pure | -
| L-MDF | Fibrafix® | 11,3 | 15,1 | 7,1
| Pure Light | -
| L-MDF-FR | Firax Light | 9,6 | 7,1 | 7,2
| Pure Light | -
| L-MDF-H | Umidax® Light | 7,6 | 4,7 | -
| Pure Light | -
| L2-MDF | MDF Ultra Light | 10,4 | 11,2 | 8,6
| Pure Light | -

Table 12: Thickness swelling as per EN 317

MDF class | Spanolux MDF | Option 1
--- | --- | ---
| Tensile strength perpendicular to surface (N/mm³) | Average sample
| Thickness swelling perpendicular to surface (mm) | Average sample
| MDF-HLS | Umidax® | 0,25 - 0,30 | 8
| Umidax® Noir | 0,25 | 6
| Pure Light | -
| L-MDF-H | Umidax® Light | 0,25 - 0,30 | 8

Table 13: durability of moisture resistant Spanolux MDF (Umidax®, Umidax® Noir and Umidax® Light) of 18mm thickness after the cyclic test (Option 1).


dimensional: 1190.5x841.9

3.11. Surface strength

The surface strength is determined in accordance with standard EN 311. The purpose here is to determine the force that is required to remove the surface layer of a wood board material in a perpendicular direction. This property is particularly important for surface finishes such as melamine, HPL, laminate, etc.

3.12. Fire behaviour

Specifications for structural applications often include requirements for limiting flame spread along the surface of a board material, burnthrough time or flashover. In this respect, Standard MDF has properties that are similar to those of solid spruce, with special coatings that act as flame-spread retardants.

For more rigorous fire requirements, a fire retardant MDF panel to which fire retardants are added during the production process, can be used. Fire retardant MDF, with the fire retardant homogeneously distributed in the mass, is to be preferred to MDF that is impregnated afterwards. Spanolux has many years experience in the production of fire retardant MDF.

MDF with weight by volume ≥ 600 kg/m³ and thickness ≥ 9 mm has fire class D-s2,d0 or DFL-s1 (for flooring). These fire classes do not apply to UL2-Engeland BS476-6 Engeland BS476-7 Lux.<br>FR-MDF-LA Firax Class 0 8,9 6,3 -<br>FR-MDF-FR Firax LIght 9,6 7,1 7,2 -<br>FR-MDF-H Umidax® 5,6 3,7 3,0 -<br>R-MDF-U Membrane - - -<br>L-MDF-FR Firax LIght 9,6 7,1 7,2 -<br>L-MDF-H Umidax® Light 0,25 - 0,30 8 -<br>L2-MDF MDF Ultra Light 10,4 11,2 8,6 -<br>Umidax® Noir 0,35 5 -<br>Umidax® Noir 5,6 3,7 3,0 -<br>Pure Light - - -<br>Pure - - -<br>MXL - - -

Table 14: Overview of national and international test reports for Spanolux fire retardant products

3.13. Building physical properties

The building physical properties of MDF are determined mainly by the weight by volume.

| Density (kg/m³) | Thermal conduction coefficient (W/mK) | Air permeability (m²/s) | Sound absorption coefficient (cm²)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Λ</td>
<td>μ (wet)</td>
<td>μ (dry)</td>
</tr>
<tr>
<td>400</td>
<td>0,07</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>600</td>
<td>0,13</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 15: Building physical properties of MDF, determined by the weight by volume.

Different values may be obtained according to the type of MDF, e.g. the vapour diffusion resistance number μ (wet) for Umidax® Light (~ 600 kg/m³) is 17.
4. General guidelines for the use of MDF

4.1. Transport and storage

The MDF production method used, in which the fibres are distributed uniformly over the total board thickness, ensures a balanced build-up and permanent flatness of the boards. To preserve this flatness, correct transport and storage is required during the various processing phases.

MDF panels can become permanently deformed in case of improper handling or stacking, e.g. when not supported by flat pallets or a sufficient number of supporting blocks.

The following method is recommended:

- MDF panels are best stacked horizontally in packs, preferably on pallets or on dry stacked beams (70 x 70 mm or 90 x 90 mm). On potentially damp substrates, a waterproof foil, e.g. polyethylene foil, is installed before the panels are stacked on it.

- When using stacked beams, they must be of equal thickness and spaced no more than 800mm apart. For MDF less than 15mm thick, it is recommended to use stacked beams, e.g. spaced at intervals of 50 times the board thickness (see Table 16). The sides of the panels shall project no more than 200mm from the outer stacked beams.

- Vertical stacking of a small number of panels is acceptable, provided the panels are properly supported and stacked vertically (or almost vertically).

Table 16: Minimum number of stacked beams in relation to panel thickness

<table>
<thead>
<tr>
<th>Panel thickness (mm)</th>
<th>Spacing between beams (m)</th>
<th>Panel length (mm)</th>
<th>Min. number of beams per pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.3</td>
<td>2500</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>0.4</td>
<td>2500</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>0.5</td>
<td>2500</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>0.6</td>
<td>2500</td>
<td>4</td>
</tr>
</tbody>
</table>

- The stacked beams are placed on top of each other, in order to prevent deflection of the MDF.

4.2. Moisture content in MDF

After production, MDF has a moisture content of 8 ± 3%. At the time of delivery to the end-user, however, the moisture content may have altered due to ambient factors during transport and storage. In particular, storing the panels in a humid environment on the construction site will inevitably lead to water absorption (albeit to a limited degree); conversely, the moisture content will decrease in a very dry environment. Such moisture content variations initially occur at the edges of the panels and in the outer panels of a stack, but can subsequently spread to all panels of the stack.

Dimensional variations can to some extent be limited by treating and processing MDF at a moisture content that approximates, as closely as possible, the expected equilibrium moisture content. This equilibrium moisture content is dependent on the climate (and the season) and on the conditions in which the material is processed.

- The stacked beams are placed on top of the stacks during processing or for prolonged storage periods.

- Vertical stacking of a small number of panels is acceptable, provided the panels are properly supported and stacked vertically (or almost vertically).

- The storage area must be dry and well ventilated. An average relative humidity of 50% ensures a moisture content of 7 to 9% in the panels.

- Where extremely damp or extremely dry conditions may occur during transport, temporary storage or on site, the panels are wrapped in plastic foil.

- To limit the adverse effects of varying ambient conditions, one or two scrap panels are placed on top of the stacks during processing or for prolonged storage periods.
5. Processing

For the processing of MDF, it is recommended to take into account possible dimensional variations that may be caused by alteration of the equilibrium moisture content in the MDF. Dimensional stability of MDF can be obtained by treating and processing MDF at a moisture content that approximates, as closely as possible, the expected equilibrium moisture content. This equilibrium moisture content is mainly dependent upon the relative humidity and temperature of the environment in which the material is processed.

5.1. Sawing

MDF can be sawn both manually and by machine, without causing the material to splinter or fibres to be torn out of the panel. For manual sawing of MDF, a fine-toothed saw is recommended, whereas for mechanical sawing, the saw blades normally used for particleboard can be used.

On the other hand, the high density of certain MDF panels, in combination with the use of resin as binder, means that MDF will cause the tools to wear slightly more rapidly as compared to the sawing of solid wood. Whereas HSS (High Speed Steel) cutting tools are used for conventional mechanical woodworking, the use of hard metal (HM) or Widel® tools is recommended for the processing of MDF.

For the processing of large MDF quantities, the use of polycrystalline diamond (PCD) saw teeth may, in spite of the higher cost, be economically justified because of their longer working time (i.e. the time between regrinding of the tool).

For intricate shapes and patterns, high-energy laser beams can be used, provided that charred fragments (fire stains) are admissible or can be removed by sanding.

Based on research and experience, a number of general recommendations can be made both to obtain smooth surfaces and sawn edges, and to lengthen the lifetime of the tools.

### 5.1.1. Rotation Speed

A correctly set speed ensures optimal operation and working time of the tool. The maximum speed indicated on each saw blade should in no case be exceeded.

$$V_c = \frac{(d \times 3,14 \times n)}{(1000 \times 60)}$$

Where $V_c$ is the cutting speed (m/s), $d$ is the diameter of the saw (mm), $n$ is the speed (number of revolutions per min.), and (r.p.m.)

For MDF, a circumferential speed of 60 to 70 m/s is recommended.

Table 17 below gives an overview of the sawing speeds for a number of saw blade diameters and a number of speeds.

<table>
<thead>
<tr>
<th>Tooth diameter (mm)</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10</td>
<td>16</td>
<td>24</td>
<td>31</td>
<td>39</td>
<td>47</td>
<td>63</td>
<td>79</td>
<td>94</td>
</tr>
<tr>
<td>150</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>24</td>
<td>31</td>
<td>39</td>
<td>47</td>
<td>63</td>
<td>79</td>
</tr>
<tr>
<td>200</td>
<td>5</td>
<td>10</td>
<td>16</td>
<td>24</td>
<td>31</td>
<td>39</td>
<td>47</td>
<td>63</td>
<td>79</td>
</tr>
<tr>
<td>250</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>21</td>
<td>26</td>
<td>31</td>
<td>39</td>
<td>47</td>
</tr>
<tr>
<td>300</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>21</td>
<td>26</td>
<td>31</td>
<td>39</td>
</tr>
<tr>
<td>350</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>16</td>
<td>21</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>400</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>16</td>
<td>21</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>450</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>13</td>
<td>17</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>500</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>13</td>
<td>17</td>
<td>21</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 17: Cutting speed (m/s) versus speed (r.p.m.)

5.1.2. Cutting speed

The cutting speed ($V_c$) is the distance travelled by the point of a cutting edge with the greatest cutting circle diameter, expressed in m/s. The cutting speed can be calculated with the following formula:

$$V_c = f_v \times n$$

Where $V_c$ is the cutting speed (m/min.), $f_v$ is feed per tooth, and $n$ is speed (r.p.m.)

Example: When using a 40-tooth saw blade and a speed of 3000 r.p.m., the plate feed rate must be comprised between 18 m/min. (chip thickness, or feed per tooth, 0.15mm) and 30 m/min. (chip thickness, or feed per tooth, 0.25 mm).

5.1.4. Geometry of the saw teeth

The shape, position and dimensions of the saw teeth are essential technical characteristics to obtain a good end result.

It is recommended to slightly increase the normally used clearance angle, to allow efficient removal of the fine dust generated during the processing of MDF. In addition, a larger clearance angle will prevent the deposition of resins on the tooth points.

Experiments have shown that the following shape, position and dimensions of saw teeth produce good results:

- **Top angle**: 15° (alternating per tooth in both directions)
- **Lateral clearance angle**: 2° – 4°
- **Clearance angle**: 20° – 22°
- **Rake angle**: 15°
- **Clearance between tip and tooth**: 0.25 – 0.45 mm

The height setting of the saw blade (or saw blade overhang) is in principle sufficient when the saw teeth project just above the panel. In this way, a maximum length for the saw cut is achieved. A higher setting will produce a poorer cut at the bottom of the panel.

During sawing, the MDF panel should be kept perfectly level and the saw blade must be free of vibrations.

5.1.5. Tool maintenance

Proper maintenance of the sawing tools used is also of great importance in ensuring constant and good sawing quality.

During grinding, all original angles of the saw teeth must be maintained. Smaller angles will give rise to resin deposits on the saw teeth, whereas larger angles will reduce the working time. The tooth base must be cleaned at regular intervals to ensure efficient dust collection. Resin deposits can be reduced by polishing the teeth after grinding.

Figure 14: Saw-tooth shape and dimensions

Figure 15: Mitre sawing of MDF

At too high a feed rate, the sawn edges will be of poorer quality, as evidenced by a frayng saw cut.

It is recommended that the chip thickness, or the amount of material that is removed by each saw blade tooth, vary between 0.15 and 0.25mm. (For HDF, this value varies between 0.05 and 0.12 mm). To achieve this feed per tooth, the feed rate can be calculated as follows:

$$f_v = \frac{V_c \times n}{1000}$$

where $V_c$ is the cutting speed (m/min.), $f_v$ is feed per tooth, $n$ is speed (r.p.m.)
5.2. Drilling

For drilling MDF panels, standard drills and speeds of approx. 3500 r.p.m. are recommended, which allows high quality drilled holes with limited material accumulation on the rear side to be obtained.

To prevent material tearing on the rear side in case of drilled through holes, it is recommended to drill half of the hole depth on either side of the panel. Special care should be taken to drill both hole halves in a perfectly straight line.

Figure 16: Drilling in MDF

5.3. Profiling (Milling)

Almost any MDF profile can be profiled or milled. In addition, a highly polished edge finish can be obtained, allowing grinding and application of a pore filler to be reduced to a minimum.

For rigid and sharp profiles, it is advised to use hard metal (HM) tools. For large series, the use of polycrystalline diamond (PCD) cutting tools is recommended, as it allows a working time to be achieved that is 30 to 50 times that of conventional hard metal tools.

Simple profiles with curved edges are to be preferred to sharp edges. Simple profiles have the advantage of being easy to grind and require less preparation for the final finish. The slightly rounded edges are better coated with paint or varnish and will therefore offer greater resistance to hard impacts.

Where there is a risk of damage by impacts (e.g., kitchen doors), a minimum radius of 3mm is recommended. Where no such risk exists, the edges can simply be broken in order to obtain a good paint or varnish covering.

Figure 17: Minimum curvature radius of the edges

5.3.1. Cutting speed

The cutting speed ($V_c$), expressed in m/s, is determined by the diameter and speed of the cutting tool. The cutting speed is calculated according to the following formula:

$$V_c = \frac{(d \times 3.14 \times n)}{(1000 \times 60)}$$

where:
- $d$ = diameter (mm)
- $n$ = speed (r.p.m.)

For profiling or milling of MDF, a cutting speed of 60 to 80 m/s is recommended.

5.3.2. Feed rate

The feed rate for milling or profiling operations initially depends on a number of parameters:

- Desired finish, which in turn depends on the desired result in the end application.
- Strength of the cutter: The rule of thumb here is that the maximum feed rate is limited by the value:
  $$v_f < \frac{d}{2}$$
- Stability of the set-up and the machine.
- Capacity of the milling machine motor.
- Desired finish, which in turn depends on the desired result in the end application.
- Strength of the cutter: The rule of thumb here is that the maximum feed rate is limited by the value:
  $$v_f < \frac{d}{2}$$
- Stability of the set-up and the machine.

Example: for a cutter with 4mm diameter, a maximum feed rate of 2 m/min can be used without any risk of the cutter being broken.

Profiles for which a large amount of material has to be removed or that have deep cuts, may require pretreatment such as rough milling. After rough milling, the final shape is milled and a smooth surface is obtained (e.g. with fine machining).

When working with an already-coated MDF (e.g. with melamine), different reference values apply. As a rule, coated MDF panels require a lower feed rate than uncoated MDF panels, depending on the type of material with which the MDF is coated.

5.3.3. Geometry of the cutters

To find the correct balance between the working time of the tools and the quality of the profiles, the tool must be set at the correct angle to the MDF.

The choice of angle for the cutters used to profile or mill MDF is determined by balancing the working time of the tool and the quality of the cut edge. A large rake angle is necessary to obtain a smooth cut edge with minimum wear of the tip. A wide clearance angle prevents the back of the cutter from rubbing against the already-processed material. However, these two angles cannot be increased indefinitely because a sufficient metal thickness must remain present at the tips.

Table 18 contains a number of feed rate reference values for fixed parameters of feed per cutting tooth. ‘Fine machining’ denotes reference values for a 0.3 mm feed per cutting tooth, and ‘average machining’ those for a 0.8 mm feed per cutting tooth.

In all cases, reference values are used, the aim being, where possible, to achieve the highest possible feed rate (limited as a function of the above-mentioned parameters).

At a lower speed, the cutting edges will compress and grind down the edges of the MDF, and the resultant friction heat will reduce the working time of the cutting edges.
Cutters for the processing of MDF are normally provided with angles in the order of:

- rake angle (a) 10–20°
- clearance angle (b) 20–22°

To reduce the impact of the cutters on the edges of the MDF panel, the rake angle can be set to approx. 10°, so as to obtain a progressive cutting of the panel.

The time for regrinding can be determined by regularly checking the profiled edges or by measuring the current consumption of the milling machine (regrinding can be envisaged when the initial current consumption has increased by e.g. 10%).

5.3.5. Clamping the workpiece

For profiling or milling it is important that the workpiece is properly clamped, so that the vibrations caused during milling are not transmitted to the workpiece. When clamping the workpiece, it is also important to correctly position the workpiece and to make sure that this position is maintained throughout the milling.

On a CNC milling machine, vacuum suction cups are generally used to clamp the workpiece. For lighter MDF types such as MDF Ultra Light and MXL, special attention must be paid to the clamping of the workpiece to ensure that the vacuum suction cups will not partially suck air through the panel.

Surface milling cutters are employed for use on CNC-controlled machines. These tools and machines are ideally suited for manufacturing the most intricate, both two- and three-dimensional, shapes in MDF.

Surface milling cutters are generally characterised by:

- Rake angle 15–25°
- Clearance angle 15–18°

5.3.4. Tools

The use of hard metal cutters is recommended because they produce a better surface finish and have a longer working time.

Disposable cutters have better technical performance but the material is more brittle. The use of disposable cutters is cost-effective because of the limited downtime of the machines, the correct profiling, and the constant diameter of the cutter (no adjustment necessary). The cutter can either be turned around or replaced, whilst the tool itself remains on the machine.

For series production, increasing use is being made of polycrystalline diamond milling tools. The high purchase price is offset by the on average longer working time. Automatic feed is recommended for economic reasons.

To obtain a true cut edge, without any fibres being burnt or torn loose, and to lengthen the lifetime of the tools, the milling tools is regrind at regular intervals. During regrinding, the rake angles and clearance angles must be maintained.

5.4. Laser cutting

MDF laser cutting is a new, effective technique, which, unlike conventional techniques, enables small thicknesses to be cut with high precision and quality.

In addition, in contrast to the customary mechanical tools, the laser works contact-free, making it virtually wear-proof. The benefits of laser cutting are:

- High cutting speed
- High efficiency – minimum loss of material
- Ideal for production prototypes
- Allows cutting in small, medium sized and large quantities

Due to the thermal laser process, the laser cut edges of the MDF will carbonise or blacken. The thicker the MDF panel, the more pronounced this phenomenon becomes.

5.5. Sanding

The quality of the finish greatly depends on the preparation of the surface, mainly at the level of the edges.

At the end of the production process, the top and bottom side of the MDF panels is first calibrated with grit 60 or 80, followed by fine sanding over the sanding base with grit 100 and 150. The surface that is thus obtained is suitable for most finishes such as veneer gluing or pressing with plastic film. To obtain a high quality lacquer finish, it is advisable to re-sand the MDF with grit 180 (or higher). For very high quality requirements (e.g. high gloss lacquer), it is recommended to re-sand the surface using an even finer grit (> 200).

For fine sanding, silicon carbide sanding belts are advised. Aluminium oxide sanding belts tend to become dull more rapidly, reducing their effectiveness.

Profiled edges or milled recesses can also be fine sanded. The higher the quality of the operation - sawing or milling - the less re-sanding will be required (depending on the desired end result). Sanding of profiled edges is important to obtain a smooth and perfect final finish. When sanding with grit between 150 and 240, the upright fibres and irregularities created during milling, are removed to prevent pilling and marking of the fibres when e.g. a first lacquer coat is applied.

5.5.1. Sanding methods

Obviously, less sanding will be required after mechanical processing than after manual processing.

The choice of sanding method for subsequent finishing depends upon the complexity of the profiles, the number of different shapes, and financial considerations.

Manual sanding:

In manual sanding, a flexible sanding block with the form of the profile as support for the sandpaper, can be used to prevent excessive radiusing of sharp edges and the flattening of bent sections in the profile. For sanding edges, grit 150 to 240 is recommended.

Sanding discs:

Sanding discs are used for sanding edges with more complex profiles and for sanding internal profiles. These discs are adapted to suit the form of the profile. Here, the optimal grit size varies from 60 to 100.

Sanding discs can be used both on manual machines and on machines with automatic feed.
Sanding belts:
Sanding belts can be used for simple profile shapes. A fine finish is obtained by sanding in two steps: first with grit 80 against the feed direction and then with grit 120 in the feed direction.

The panel surface can also be fine sanded using sanding belts with grit size less than 150, e.g. for lacquering MDF surfaces.

Sanding belts have the advantage that they last longer because a lower temperature is generated by the associated friction. Sanding belts are less suited for intricate profiles.

Sanding brushes:
Sanding brushes can be mounted both on manual machines and on a sanding facility of a production line. They are efficient for deep and narrow profiles or for very wide milled recesses (several layers of brushes on top of each other). The recommended speed can amount up to 3000 r.p.m., depending on the brush diameter.

Profiled sanding heads:
For sanding intricate profiles, profiled sanding heads are advised. Here, the head is first formed (mirror image of the profile to be sanded) and then enveloped with “elastic sandpaper”. For more complex profiles, a series of wheels can be mounted behind or above each other.

Systems are also being developed in which 6, 8 or 10 rubber blocks are attached to the circumference of a sanding head. The profile shape is sanded in the rubber blocks, and then the sandpaper is attached to the created profile.

5.5.2. Sanding dust
The sanding dust generated during the processing and machining of MDF is finer than that of solid wood or particleboard. The dust collector on a woodworking machine must have sufficiently high air velocities, notably at least 20 to 30 m/s at the exhaust hood and 15 to 20 m/s in the main pipe. The velocity in the main pipe is relevant to avoid dust accumulation. Moreover, the exhaust hood must be located as close as possible to the workpiece. If a central exhaust system is used, it is recommended not to shut off unused openings.

Because of the risk of explosion and ignition, it is recommended to install spark detectors and an automatic fire extinguishing system in the exhaust installation. This recommendation does not apply to exhaust installations that process less than 20 percent by volume of MDF dust.
6. Fasteners and joints

Fasteners that can be used in or with MDF include screws, nails, rivets and glues. Various joints such as end, butt, angle, dowel and removable joints or the use of fittings can be applied.

6.1. Screws

MDF offers excellent resistance to screw pull-out (screw-holding capacity), both in the face and on the edges. Most types of screws can be used. Cylindrical, straight shaft screws with the greatest possible ratio of total screw thickness to shaft thickness, are recommended.

A small chamfer at the end is desirable to prevent lift-up around the screw head. In some cases, the use of screws having a part with no screw thread is recommended.

Predrilling is always required for inserting screws into MDF, and into the edges in particular. The hole diameter recommended for screwing into the edges in particular. The hole to be predrilled must be larger than that used for solid wood or particleboard. As a general rule, it is recommended to drill a hole with a diameter that is slightly smaller than the shaft diameter (see table 19) and at least 1mm deeper than the total screw length. This is especially important when screwing into the edges of thin panels.

Table 19 below shows the drilled hole diameter (rounded to 0.5 mm) relative to the screw diameter.

<table>
<thead>
<tr>
<th>Ø (mm) Screw</th>
<th>Ø (mm) Shaft</th>
<th>Ø (mm) Drilled hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>2.2</td>
<td>2.0</td>
</tr>
<tr>
<td>3.2</td>
<td>2.4</td>
<td>2.2</td>
</tr>
<tr>
<td>4.0</td>
<td>3.1</td>
<td>3.0</td>
</tr>
<tr>
<td>4.5</td>
<td>3.6</td>
<td>3.5</td>
</tr>
<tr>
<td>5.0</td>
<td>4.2</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Figure 25: Minimum distance to workpiece edge when screwing

For screwing large size panels (e.g. walls), a minimum distance of 12mm to the panel edges and 25mm to the corners should be preferably be observed (see also Figure 26). Resistance to screw pull-out is great compared with other types of wood-based panels.

Table 19: Drilled hole diameter (rounded to 0.5 mm) in MDF relative to the screw diameter.

Figure 26: Minimum distances to the edges when screwing large MDF panels.

Table 20 below shows the values for screw pull-out resistance as per EN 320 in the face and in the edge for different types of Spanolux MDF, for a panel thickness of 18 mm.

A higher screw pull-out resistance in the edge of the panel can be obtained by gluing together two panels of the same MDF type and then driving screws into the glued joint. Processing of light MDF panels where screwing into the edges is required can be done in this way, which at the same time allows higher thicknesses to be achieved.

Table 21 below shows that glued panels can achieve screw pull-out resistance values that are twice to three times as high.

Table 21: Screw pull-out resistance on the glued joint of composite panels.

Table 21: Screw pull-out resistance as per EN 320 in the face and in the edge for different types of Spanolux MDF, for a panel thickness of 18 mm.

It should be noted that predrilling is not required when using certain special MDF screws, enabling a significant saving in processing time. These screws drill themselves into the MDF panel without causing the MDF to split or deform. These special screws could also be used closer to the edge and should also be more easy to use in the end edges, making them suitable for MDF angle joints (e.g. Spax-M from ABC Verbindungstechnik, and the pfs-screw: type M from PGB-Fasteners. (see Figures 27 and 28)

Screws can be neatly concealed using putty (white colour) or MDF filler (brown paste). After the putty has cured, the surface must be fine sanded. (see Figure 29).

Table 20: Screw pull-out resistance as per EN 320.
6.2. Nails

With the exception of small diameter nails (needle diameter: small shaft of e.g. 1.2 mm Ø and 40 to 60 mm length), the use of nails is to be avoided. Thin nails in the edges are driven in at 150 mm intervals, preferably with a pneumatic nail gun under a small angle with respect to the panel surface. To prevent splitting, the nails are mounted at least 70 mm away from the corner.

6.3. Rivets

Rivets are mounted with a pneumatic riveting gun, e.g. as a temporary fastener for glue joints in MDF. Rivets can also be used to fasten MDF to a frame or decorative frames to the edges of MDF.

Riveting produces a tight fastening in the face of MDF, provided they are placed at least 12 mm away from the edge and 25 mm from the corner. Rivets should not be placed any closer to the edge, except in the case of small loads. A better fastening is obtained in combination with glue. When riveting in the side of MDF, the distance to the corner should be at least 70mm, with the rivets being driven in under an angle of 15 to 30° with respect to the face in order to obtain splitting. A better fastening and to prevent splitting.

6.4. Gluing

Gluing MDF normally does not present any particular problems. The choice of glue depends on the properties of the materials to be glued.

Temperature and ambient humidity during application and curing of the glue are essential to obtain good results. A minimum temperature of 15°C is recommended for the processing of most glues. Also the moisture content and the temperature of the panels and the planned surface finishes (e.g. veneering) must comply with the instructions of the glue manufacturer and approximate as closely as possible the eventual equilibrium moisture content of the woodwork after installation. Furthermore, the absorption power of the panel and the differences in absorption between the various parts of a single panel (face / edges) must be taken into consideration.

Other factors influencing the choice of glue include the glue application method (by hand, roller or spray gun), flammability, press parameters, etc.

The surfaces to be glued should be as large as possible for maximum load transmission capability. Any forces acting on the joint should be distributed as much as possible across the entire glued joint.

There are a number of suitable glue joints, which are represented in Figure 30.

Most wood glues are also suitable for gluing MDF. When gluing non-MDF to MDF, the choice of glue is usually determined by the surface of those materials.

### Table 22: Cross reference table for glue choice for gluing different types of Spanolux MDF together

<table>
<thead>
<tr>
<th>MDF</th>
<th>Membrane</th>
<th>Pure</th>
<th>Pure Glue</th>
<th>Pure Primer</th>
<th>Membrane</th>
<th>Pure</th>
<th>Pure Glue</th>
<th>Pure Primer</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-MDF</td>
<td>Firax Class 0</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Firax</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>MDF-HLS</td>
<td>Umidax® Noir</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Umidax®</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>L-MDF</td>
<td>Pure Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Pure Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>L-MDF-FR</td>
<td>Firax Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Firax Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>L-MDF-H</td>
<td>Umidax® Ultra Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Umidax® Ultra Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>UL2-MDF</td>
<td>MDF Ultra Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>MDF Ultra Light</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

- = Watery dispersion glue, but no PVAc glue:
  - e.g. ALFO CT31 (Bostik) OR Modified Urea Formaldehyde resin (=UF resin glue):
    - e.g. Tempolite RL150 (Bostik)
- = PVAc (= polyvinyl acetate glue), white dispersion glue:
  - D2 not water resistant: e.g. ALFO DK40, ALFO DG45 (Bostik)
  - D3 water resistant: e.g. ALFO DN41, ALFO DN45 or ALFO DN46 (Bostik)
  - D4 water resistant: e.g. ALFO DN200 (Bostik)

Gluing of different types of MDF together

Gluing different types of MDF together is applied e.g. to obtain a composite thickness, which is not possible with a single panel thickness. Thus, for example, 2 x 20 mm thick door panels in fire retardant MDF material (Firax, Firax Class 0 or Firax Light) are glued together to form a 40 mm composite panel.

In addition, the central zone of glued MDF panels has a higher screw pull-out resistance. The reason for this is that the highly densified MDF surfaces are located on the glued joint, so that light panels such as MDF Ultra Light or MXL will be used.

Table 22 below recommends the glue types to be used for gluing different types of MDF together.

Figure 31: Umidax® panels glued into a strong office furniture item: legs + work surface.

Figure 32: Glued MDF panels: 2 x 38 mm MXL.
6.4.2. Gluing different types of MDF to other materials

Table 23 below contains a detailed overview of glues to be used for gluing different types of MDF Spanolux to other materials.

Table 23 indicates the recommended type of glue for the corresponding glue joint.

When using PVAc glue for Umidax®, Umidax®Noir and Umidax®Light MDF, at least type D3 is recommended because of its moisture resistance properties.

Light MDF has a highly compacted surface with high density, so that in principle no more glue has to be used when gluing.

For gluing edgeband to the MDF panels edges reference will be made to Chapter 7 “Edge finishing”.

MDF sandwich panels are commonly used in e.g. door or wall applications. MDF panels are, for example, glued to a fixed insulation filling (e.g. PUR, PIR or XPS insulation). For this purpose, one-component polyurethane (e.g. Hotmelt Supergrip 9850 or Recticol PU1/D124 from Bostik) can be used.

6.5. Joints

For joining MDF panels, polyvinyl acetate adhesives (PVAc glue or white glue) can be used for both end butt joints, as well as angle joints and dowel joints.

MDF has true surfaces, so that optimal joints can be obtained.

6.5.1. End joints

MDF is available in large format (Spanolux MDF can be up to 2.55 mm wide and 6.31 mm long), so that gluing panels together to obtain larger dimensions can be virtually dispensed with. Where for some reason an end joint should still be necessary, the parts are glued together cold, and reinforced with a loose spring or dowels, if necessary. An overlap joint can also be provided. For a proper joint, the following instructions should be followed:

1. The edges must be level and square.
2. The width of the grooves is maximum one-third of the panel thickness and the depth is at most equal to half the panel thickness.
3. Dowels and springs must be easy to insert. Too tight a fit will cause the panel to split.
4. Use of a filling adhesive.
5. The parts to be bonded must be securely held in place during pressing.

Prior to sanding, glued joints must be conditioned for a few days in order to prevent ‘deepened’ joints. This is especially important for smooth and glossy finishes.

Butt joints are used for bonding two MDF panels in the face. A number of butt joints that can be used for MDF are shown in Figure 33.

6.5.2. Angle joints

In MDF angle joints, which are generally glued, a distinction made is between joints in frames and those in panel connections.

Joints in frames (e.g. panel or glass doors) are usually executed as square or mitre joints, in many cases using MDF finished with veneer or foil. If unfinished MDF is used, a final finish is applied in most cases (e.g. lacquering).

For square joints of panels (e.g. cabinet bodies), conventional cabinetwork techniques such as mitre, dovetails and dowels, can be applied. For these joints the following instructions apply:

• The joints, notably the mitred ends, must fit properly.
• Sharp cutting tools prevent charred glue faces.
• Gap-filling adhesives are recommended.
• Two pieces to be glued together must be properly positioned with respect to each other and must not be allowed to move during curing of the adhesive.
• Grooves for a spring in the joint must not be wider than one-third of the panel thickness and not deeper than half the panel thickness.
• The fit of dowels and springs must not be too tight. Too tight a fit might cause the panel to split.

For gluing fire retardant MDF panels, care should be taken to prevent the glue from coagulating. The
6.5.3. Dowel joints

The dowel joint is simple, produces a strong joint and does not require complex machinery.

For drilling dowel holes, a sharp drill is used, so that no loose fibres will remain in the drilled holes. The use of a hard metal drill bit is recommended because of the longer shelf life. The dowel holes are best drilled rapidly (= high feed rate) at low speed (= low rotating speed). Slow drilling at high speed results in a burnt or ‘polished’ drilled hole, thereby preventing proper adhesion of the glue.

It is best to use profiled (corrugated or grooved) beech or birch dowels with a wood moisture content of 10 ± 2%. Dowels of other wood types can be used, provided they have a straight thread and sufficient strength. The dowel diameter must be adjusted to the thickness of the MDF board (see Table 24).

6.5.4. Detachable joints / Fittings

A large number of mechanical fasteners are available for making detachable joints in MDF. Some examples:

**Cylinder-shaped fasteners:**

With cylinder-shaped or eccentric fasteners, consisting of a metal cylinder and a metal pin, the pin is inserted into the cylinder. The cylinder is then rotated to tighten the pin so as to accomplish the joint. Various alternative versions of this type of joint are available.

**Block-shaped fasteners:**

These are screwed to the panel and then screw connected to each other.

**Fittings:**

In addition to the above techniques, several other fittings are possible. For these, the following recommendations apply:

- Choose fittings that are mounted on the panel surface.
- Avoid fasteners that grip in the sides of the panel. Such fasteners could cause the panel to split.
- Provide sufficient clearance for fasteners such as screws and dowels that are driven into the edges of the panel.

Also in the lighter density MDF types, such as Fibrabel®, Umida® Light, Pure Light and Firax Light, fittings can be applied using standard screws.

For MXL, the use of standard screws in combination with furniture fittings is not recommended.

<table>
<thead>
<tr>
<th>Thickness of MDF panel (mm)</th>
<th>Dowel diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - 18</td>
<td>6</td>
</tr>
<tr>
<td>18 - 25</td>
<td>8</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 24: Dimensions of dowel, in function of thickness of the MDF panel
7. Surface finishing

MDF board material provides an ideal substrate for a wide variety of final finishes.

### 7.1. Painting

With its smooth and stable surface and easily finishable edges, MDF has the ideal substrate for paint finishing. The choice of paint system depends on the available painting installation, the possible drying techniques and the associated paint requirements in the end application. A private DIY'er, for instance, does not have access to an industrial painting line, an MDF panel with paint film can be used, etc.

In general, the panel is best painted all-round so that it becomes stabler and less sensitive to temperature or moisture variations. It is important that the paint system used meets the following requirements:

- **Elasticity:** the paint must have a certain degree of elasticity so that it can absorb dimensional changes of MDF caused by moisture intake and release, without cracking.
- **Low dissolving power for paraffin (present in MDF)** so as not to adversely affect curing
- **Relatively high solids content which allows an extremely smooth surface to be obtained in a limited number of layers.**

There exists a wide variety of paint types:

- **Nitrocellulose** are easy to apply through various methods and produce good results, but are less environment friendly because of their high solvent content.
- **Acrylic** or water-borne paints are also easily processable on MDF. The faster the water content can be dried out of the paint, the less the fibres will swell.
- **Acid-curing** paints produce a strong and stable surface, but may still emit formaldehyde after curing.
- **Polyester** paints enable a perfectly glossy finish, but may also cause environmental problems.
- **Of the two-component paint systems, polyurethane are the most important because of their excellent quality.**
- **UV curing** paints are used on industrial painting lines, usually to paint flat panels in large numbers. UV paints have a very high solids content, so that their environmental impact is minimal.

Under the EU Directive on the limitation of emissions of volatile organic compounds, solvent-borne products will be banned in 2010 and shall be replaced with water-borne paints. A first phase of this law entered into force in January 2007, and has led to increased activity in the development of water-borne paints.

#### 7.1.1. Non-industrial paint finish

By non-industrial paint finish is meant the painting carried out by e.g. an interior painter or DIY painter. This painter can finish paint walls, furniture, custom furniture, interior joinery, etc. of MDF panels. For these applications, the following processing steps are advised.

**Substrate treatment:**

**General preparation:**

The MDF surfaces must be clean and dust free. Any contaminations, e.g. fat or residual building products, must be removed.

Furthermore, the MDF panels are preferably conditioned before the paint finish is applied. Painting is carried out in more or less the same climatic conditions as those in which the MDF panels will effectively be used. In this way, cracks and stresses that might occur during strong temperature or moisture variations, can be avoided in the painted surface.

**Painting preparation:**

After filling and/or repair, the surface to be treated is preferably sanded with grit > P220 in order to obtain a smooth finish and good adhesion. After sanding the surface must be cleaned of dust.

Edges, if present, are preferably chamfered or radiused. It is further recommended to apply an additional primer coat to saw cuts, preferably a special filling primer or pore filler (e.g. Brushfiller from Boss Paints).

**Applying the primer coating:**

A white, low odour, insulating, physically drying paint is preferably used for the primer coating (e.g. Elastoprim from Boss Paints). The insulating primer coat prevents unequal absorption of the top coats and spreading of possible stains or colour irregularities from the substrate.

**Touch-up / Repair:**

Any damages must be repaired with materials that are compatible with the subsequent paint system e.g. polyester filler.

Next the surface must be slightly sandpapered (grit P180-P220), while also making sure to neatly remove the sanding dust.

---

**Possible problems and remedies:**

- **Fibre roughening:** Fibre roughening is caused by the absorption of moisture into the panel which causes the fibres to swell and rise up. Fibre roughening is a normal phenomenon when painting MDF, in particular when using water-borne paints. It can easily be prevented or remedied by slightly sanding the MDF surface and the various coats of paint with grit > P220. Some water-borne paints cause more fibre roughening, so that special attention will have to be paid to correct sanding if the same end result is to be obtained.

Fire retardant and moisture resistant MDF panels such as Firax, Firax Class 0 and Firax Light, Umidax® and Umidax® Light, are less subject to fibre roughing than the other MDF panels.

The problem of fibre roughening is not solely related to the average density of the MDF panel, because lighter MDF panels also have high surface density. Only MXL, the ultra light MDF panel, exhibits slightly more fibre roughening as compared to other MDF types when finished with a water-borne paint.

**Colour bleed-through:**

Certain MDF types are coloured in the mass to facilitate identification of the panels: Red indicates fire retardant properties, and green moisture resistant properties. During painting, colour bleed-through may occur, meaning that the colour of the background diffuses through the paint, even after a primer coat and e.g. two top coats have been applied. The risk of bleed-through of the background base colour is greatest under poor drying conditions, e.g. in too damp and/or too cold rooms.

**Poor adhesion:**

Poor adhesion may be due to inadequate drying conditions, e.g. too damp and/or too cold rooms, too short drying times, or wrong paint choice.

- **Absorption, paint consumption**

Moisture resistant MDF panels such as Umidax and Umidax Light exhibit far less water absorption after the application of water-borne paints as compared to e.g. MDF Standard or Fibrelab, so that up to 15% less primer is needed.

By contrast, fire retardant MDF panels such as Firax, Firax Class 0 and Firax Light exhibit, because of the presence of salts, higher water absorption as compared to MDF Standard or Fibrelab.
High gloss finish:

The current fashion trend includes a variety of high gloss finishes, both in walls and furniture. For the high gloss finishing of MDF, the panel is pretreated, coated with a primer, and finished with high gloss paint applied with a roller or spray gun (e.g. Boss Paints Carat). Experience shows that spraying produces a more beautiful and also more rigid effect. Depending on the desired result, at least two top coats are recommended. Intermediate sanding is, as a rule, not necessary.

The painter can, according to the customer’s requirements, influence the result by polishing the paint in order to remove any visible dust particles in the gloss layer. This can be done both between the coats of paint (instead of fine intermediate sanding) and after the final top coat. Surface sanding is done with an increasingly finer grit size, until all dust particles have disappeared. As a final finish, the surface can be polished. A polish is applied to make the material shine, so that the top coat regains its high gloss appearance.

Because high gloss paint highlights any impurities that are present, it is essential to prevent any dust deposit on the surface. The aim here is to ensure dust-free application of the high gloss paint. Also the drying times and all other specifications of the paint manufacturer must be strictly followed.

7.1.2. Industrial paint finish

Industrial paint finishing techniques include rolling, pouring and spraying. On an industrial painting line, a combination of these techniques is often applied.

Rolling:

In the rolling technique, paint is deposited via rolls on a flat MDF panel. The rolls are set so that a specified amount of paint is applied with each coat. This technique mainly employs UV paints, hydro-UV paints or water-borne paints, and drying is effected by UV lamps or hot air tunnels. This technique allows high production rates.

Pouring:

In the pouring system, a continuous paint curtain is set up. The panel passes at high speed under the curtain, and a large quantity of paint (approx. 70 g/m²) is applied with each coat, so that a sufficiently long drying time is required. Panels painted with this technique have a very rigid, level and smooth surface. Note that this production technique can only be used for flat MDF panels, but allows high production rates to be achieved.

Spraying:

Paint spraying is a well-known technique employing either a manual spray gun or an automatic spraying machine with multiple spray nozzles. Spraying has the advantage that it allows the finishing of profiled MDF panels, but has also the drawback of a significantly lower production rate.

Here, too, it is important that the MDF panels are conditioned prior to painting. In practice, the MDF panels are best placed in the room where they will actually be painted. Too strong temperature variations and alteration of the ambient moisture content may result in poorly painted or unequally painted surfaces.

For fire retardant MDF, and Firax, Firax Class 0 and Firax Light in particular, the additives may react with the paint, which might result in inadequate adhesion. It is recommended to first test the paint on a test specimen.

For coloured MDF, attention should be paid to colour bleed-through. Green moisture resistant MDF and red fire retardant MDF panels may require an additional coat to prevent bleed-through of the base colour.

If the first coat on MDF consists of water-borne paint, special attention should be paid to fibre roughening. The water-borne paint must always be allowed to cure sufficiently, before it is fine sanded and a new coat of paint can be applied. UV paints or hydro-UV paints are less subject to fibre roughening. The less moisture is applied to the panel, the less the fibres will roughen.

Paint consumption depends on the absorption of the MDF surface. MDF panel invariably has well compacted surfaces, the difference in weight by volume among different MDF types is caused primarily by the core. As a result, the surfaces of the different MDF densities exhibit comparatively equal absorption for paint. A slight increase in absorption is observed only for ultra light MDF.

Industrial painting via rollers ensures the application of a specific, minimum quantity of paint to the panel (e.g. 10g/m² as first coat). If a UV or hydro-UV primer is used which is cured with UV lamps (and/or extra heat) directly after roller application, absorption of the paint by the fibres is virtually excluded. A UV treated MDF panel (= lower average density) will then show only a minimal or no difference in terms of the amount of paint required to obtain the same covering power.

A water-borne paint cannot be cured as rapidly as a UV paint system, so there will a slightly higher absorption than with lighter MDF panels depending on the density of the MDF panel surface.

7.1.3. Preprimed MDF

To speed up and facilitate the paint finish, both for non-industrial and industrial paint finishes, a preprimed MDF can be used. The preprimed, white surface has the advantage that the first paint finishing operations have already been carried out, allowing a uniform paint finish to be rapidly obtained after application of the coloured final coats. This saves a substantial amount of time during the final finishing, and also results in a significantly lower paint consumption.

The advantages of an industrial preprimed MDF include time savings, lower paint consumption and avoidance of fibre roughening. Using preprimed MDF obviates the need for such time-consuming operations as pre-sanding, priming, and intermediate sanding to avoid fibre roughening.

To ensure good adhesion and a perfectly smooth end result, it is advisable to slightly pre-sand the preprimed MDF panel (with relatively fine grit 180 to 240), followed by thorough cleaning of the panel.

The panel is then directly finished with paint:

• Solvent-borne paints (e.g. Boss Satin Vos)
• Water-borne paints (e.g. Boss Hydromat, Boss Hydro Silk)
• Primer and latex paint (e.g. Boss Omniprim plus, finished with Boss Optimat)

Depending on the chosen paint, a brush, roller or spray gun can be used. Finishing should always be carried out in accordance with the elementary rules of paint finishing in order to avoid the deformation of overlapping paint strips, drop formation, etc.

Depending on the desired end result and the required colour coverage, at least two coats are applied.

Dekaply, our sister company, has a special type of melaminated panel in its Spanodecor range that is suitable for paint finishing: MDF DecoPrimer® White.

MDF DecoPrime® White

MDF DecoPrime® White is a high quality Spanolux MDF with lacquer film on both sides, suitable for direct finishing with lacquer paint, both water-borne and solvent-borne.
7.2. Powdercoating

Powder painting has been applied in the metal industry for the past twenty years, and guarantees a superior, durable and environment friendly finish. In recent years, it has also found application on MDF panels.

The powder painted MDF opens up new possible applications, e.g. office furniture, kitchens, bathrooms, doors, retail shop design, trade show stands, etc., while allowing a virtually unlimited freedom in design. Many furniture manufacturers can be seen to be switching from standard forms (e.g. rectangular, square…) to more complex forms (e.g. radiused, oval, radiused corners and edges, profiles…). Furthermore, there is a trend towards more seamless finishes, unlimited freedom in choice of colour and finish effects, which can all be accommodated by powder painted MDF.

A powder painted surface provides a high quality finish with good resistance to impact, abrasion, heat, extreme weather conditions, and bleaching due to UV sunlight. Furthermore, a powder painted surface can be executed in a wide variety of structures, from very smooth to a relatively grainy finish. In general, the rougher the surface, the less likely any small blemishes will be visible.

Table 25 gives a brief overview of possible seamless finishes of MDF.

<table>
<thead>
<tr>
<th>MDF Finish</th>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC foil</td>
<td>Beautiful wood decors</td>
<td>Limited 3D design options</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Less resistant in the longer run</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large amount of PVC waste</td>
</tr>
<tr>
<td>Wet paint</td>
<td>Low material cost</td>
<td>VOCs, toxic, odour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High labour cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Several coats, drying cycles</td>
</tr>
<tr>
<td>Powder paint</td>
<td>No VOCs, environment friendly</td>
<td>Not all types of MDF can be used</td>
</tr>
<tr>
<td></td>
<td>Low production cost</td>
<td>Good chemical and physical properties</td>
</tr>
</tbody>
</table>

Table 25: Comparison of different types of MDF finishes

Powder painting can be carried out in a single operation by applying a single layer of powder paint which is subsequently melted and cured. Standard wet paint finishes, by contrast, require a number of finishing steps in order to obtain the same result. Powder paint finishing can also be perfectly combined with differently finished surfaces such as melaminated or veneered panels.

7.3. Veneer

Veneer coated MDF panels offer an alternative to solid wood kitchen or bathroom cabinet doors. The excellent dimensional stability of MDF, as compared to solid wood, excludes the risk of openings and the splitting of edges when the panels are exposed to extremely humid or dry conditions.

Surface gluing of veneer on MDF panels is carried out with UF glue (e.g. Tempolite RL1100 from Bostik), the glue being applied by rollers. Alternatively, a white dispersion glue (PVAc glue) can be used. In practice, however, this solution is seldom used because it does not provide direct feedback on the gluing quality.

Edge finishing of profiled MDF panels coated with veneer is carried out after the spray application of a two-component, water base polyurethane glue (= PU glue).

For gluing on fire retardant MDF such as Firax, Firax Class 0 and Firax Light, Tempolite RL1150 from Bostik is recommended.

Wetted wood veneer becomes more flexible and easier to handle. When gluing the veneer on MDF, the wetted surface points upwards. When pressing, the rear side of the MDF panel must be provided with a backing. This veneer backing should have more or less the same thickness and water content as the veneer layer on the top side of the MDF panel in order to ensure the flatness of the finished panel. The wood veneer coated MDF panels must be stacked flat and preferably be allowed to cool for 8 hours prior to further processing.

For gluing wood veneer to MDF, the following parameters generally apply:

- quantity of glue: 80-120 g/m²
- pressure: 350-600 kN/m²
- pressing T°: 70-100°C for multilayer presses/100-130°C for single layer presses
- pressing time: 2–4 min., for multilayer presses / 30-60 s for single layer presses
- moisture content: MDF: 8 ± 3% Veneer: 10 ± 2%
7.4. Melamine

Pressing MDF with melamine resin impregnated paper produces an extremely resistant finish, allowing a wide variety of decorative finishes ranging from solid colours over fantasy to wood decors. Pressing with structured pressing mirrors allows a special structure and degree of gloss to be imparted to the melamine surface. A melamine coating is applied on industrial KT presses. Dekaply, our sister company, produces melaminated MDF panels that can be further processed to furniture components or customised formed parts.

For the melamine coating of MDF the following points must be observed:

- The surface of the MDF panel must have been sanded with grit P80 to P150.
- When using thin, white or light coloured paper, the colour of the MDF may influence the end result.
- MDF is preferably pressed on both sides with the same grammage of melamine paper to prevent warping.
- Pressing must be carried out under the following conditions:

  - MDF moisture content: 6-9%
  - Pressing temperature: 180-205 °C
  - Pressure: 2000-3500 kN/m²
  - Pressing time: 12-60 s
    (the pressing time depends on the impregnation and the paper type)

- To ensure good, uniform polymerisation of the resin, opening and closing of the press must be effected rapidly.
- After pressing, the panels must be cooled individually to approx. 70°C before they are stacked, in order to prevent hydrolysis of the panel.
- After cooling, the panels must be stored on a level base.

Coating MDF panels with melamine paper provides a durable surface with high wear resistance, scratch resistance and chemical resistance. Improved wear resistance is obtained by applying an additional transparent overlay, possibly reinforced with corundum.

Dekaply has two melamine presses capable of processing the following dimensions:

- **Press 1:**
  - Length: 2440 tot 3150 mm
  - Width: 1220 tot 2100 mm
  - Thickness: 8 tot 38 mm
  - For narrow sized MDF, a minimum thickness of 6 mm is possible.

- **Press 2:**
  - Length: 3610 tot 5200 mm
  - Width: 1220 tot 2100 mm
  - Thickness: 8 tot 38 mm
  - A minimum thickness of 6 mm is possible in the case of HDF.

The presses produce the following melamine press structures:

- **SR5:** Woodgrain
- **SR7:** Pearl
- **SR9:** Buro-soft
- **SR13:** Supermat
- **SR14:** Antislip: (only on press 2)
- **SR50:** Woodline
- **MAT:** Mat
7.5. Paper or plastic foil finish

Decorative paper and plastic foils are ideally suited for finishing MDF panels. The paper or plastic foil, either pretreated or not with glue primer, is glued to the MDF panel.

For good results, the following points are essential:

- The surface of the MDF panel must have been sanded with at least grit size P 100 or finer and be free of sanding defects and/or other irregularities that may extend through the foil.
- The MDF panels must be flat with a thickness tolerance of +0.2mm (or + 0.3 mm for thicknesses greater than 30 mm). All Spanolux MDF panels meet this requirement!
- The colour of the surface may influence the end result. Especially with very thin, white or light coloured foils, the colour of the MDF may shine through the foil.
- The surface must have the same absorptive capacity throughout. Especially with rapid pressing of the foil (with a very short pressing time), variations in surface absorption may lead to variations in adhesion of the foil.
- The surface and edges of the MDF panel must be sanded with at least grit size P 100 or finer and be free of sanding defects and/or other irregularities that may extend through the foil.
- The moisture content of the laminated MDF must be 8 ± 2%.

7.5.1. Paper gluing (laminating)

It is also possible to glue decorative paper foil on MDF panels. Thickness, structure and durability of the paper can be geared to the end user’s needs. Flat panel presses, normally used for pressing wood veneer, can be used for pressing heavier foils from 80 g/m² upwards. The advent of medium heavy and light foils has led to the development of a more modern technique, in which the MDF is provided with foil in a single continuous system. After cleaning the panel, UF resin glue, e.g. Tempolite RL1150 from Bostik), is applied to the MDF surface in a continuous press, allowing thicknesses of up to 0.8 mm to be achieved.

For gluing HPL/CPL to MDF panels, a white PVAc dispersion glue is used, e.g.
- class D2, not water resistant: ALFO DK40, ALFO DG45 (Bostik)
- class D3, water resistant glue: ALFO DN45, ALFO DN45 or ALFO DN45 (Bostik)
- class D4, water resistant glue: ALFO DR41 (Bostik)

For moisture resistant MDF panels (Umidx®, Umidx® Noir and Umidx® Light), a glue of minimum quality D3 is preferably used. For gluing to fire retardant MDF panels (Firex, Firex Class 0, Firex Light), a water-based, non-PVAc dispersion glue is advised (e.g. ALFO CT31 or modified UF resin glue, e.g. Tempolite RL1150 from Bostik).

7.5.2. Profile wrapping

In the profile wrapping technique, the MDF, as profile carrier, is provided with paper foil or plastic foil. The MDF profile carrier usually takes the form of a profiled narrow and long piece of panel / profile.

For profile wrapping with thin paper foil, an EVA based hotmelt glue can be used (e.g. ARDAL T8028 from Bostik). For thicker paper foil or veneer, type ARDAL T8228 from Bostik is recommended. For profile wrapping with PVC foil, a hotmelt polyurethane glue is recommended.

7.5.3. Plastic foil

An MDF finish with plastic foil, usually PVC foil, can provide a decorative appearance, varying from uni-colours to wood decors, and offers higher resistance than a paper foil finish.

Plastic foil gluing is generally carried out at room temperature in a roller press, using EVA copolymer dispersion paint (e.g. ALFO DR41 from Bostik). After pressing, the panels are stacked flat for a number of hours for glue curing purposes.

7.6. Transfer foil

Transfer foil is applied to a very smooth and level substrate such as plastic and metal, but can also be used on MDF.

Transfer foil consists of a 0.2 mm thick polyester film as carrier, on which a decorative layer (solid colour, wood structure, etc.) is deposited as follows: First, a solvent is applied, and then a transparent protective lacquer, the print, if used, a base colour and a thermoplastic glue are added. The total thickness of the decor foil is approx. 0.35 mm.

For laminating surfaces, the transfer foil is applied with the glued side to the MDF and pressed with a steel or silicone rubber-coated roller press at temperatures of 104 to 200°C and a pressure of 2 N/mm² (rubber rollers) to 10 N/mm² (steel rollers). The polyester carrier foil is released after pressing. Optionally, an additional coating can be applied over the lacquer layer, especially in the case of horizontal surfaces.

Laminating the edges is carried out in the same way, using rubber rollers in the form of the profiled edge and at a temperature of 200°C.

The MDF used must be level and smooth (also the edges whether profiled or not!), and free of sanding defects to avoid shine-through. To this end, the surface is preferably fine sanded using grit P120 or P150, followed by second sanding run with grit P180 or 180. For higher thickness tolerances (e.g. 0.2mm), it is recommended to press down the foil with rubber coated rollers.

The moisture content of the laminated MDF must be 8 ± 2%.

7.7. HPL=High Pressure Laminate / CPL = Continuous Press Laminate

High pressure laminate (HPL) is manufactured from several sheets of paper impregnated with thermostetting resin which are pressed under high pressure and varying temperatures. CPL is produced in a continuous press, allowing thicknesses of up to 0.8 mm to be achieved.

For gluing HPL/CPL to MDF panels, a white PVAc dispersion glue is used, e.g.
- class D2, not water resistant: ALFO DK40, ALFO DG45 (Bostik)
- class D3, water resistant glue: ALFO DN45, ALFO DN45 or ALFO DN45 (Bostik)
- class D4, water resistant glue: ALFO DR41 (Bostik)

For moisture resistant MDF panels (Umidx®, Umidx® Noir and Umidx® Light), a glue of minimum quality D3 is preferably used. For gluing to fire retardant MDF panels (Firex, Firex Class 0, Firex Light), a water-based, non-PVAc dispersion glue is advised (e.g. ALFO CT31 or modified UF resin glue, e.g. Tempolite RL1150 from Bostik).

7.8. Membrane pressing

MDF is perfectly suited for processing with the membrane pressing technique: the compact fibre structure ensures a good result after milling of the profiles in the surface and edges, and also guarantees excellent glue adhesion between MDF and the decorative foil material.

In membrane pressing, a foil is pressed under vacuum into the profile of the MDF panel by means of a 2 to 3 mm thick flexible membrane of synthetic or silicone rubber. Because of the high quality requirements for profiling, mainly high density MDF and MDF Membrane in particular, is used.

For the application of wood veneer, a white dispersion PVAc glue is used both on the surface and on the profiled sections. One side of the veneer is sprayed with water to obtain the required flexibility, after which the veneer is applied to the MDF panel with the wet side pointing upwards, and pressed at a temperature of 85°C for approx. 2 minutes.

Plastic foils become very flexible when heated, allowing the foil to be pressed over relatively sharp edges and into deep narrow grooves, thereby enabling the lamination of all four edges of the MDF panel. This method is eminently suited for the manufacture of kitchen, bathroom and bedroom cabinets.

For lamination with plastic foil, a two-component water-based polyurethane glue is applied to the profiled MDF panel or pre-glued foils are used. The plastic foil, of which the rear side has been treated to obtain better adhesion, is placed in excess amount on the workpiece and pressed at 85°C. To prevent warping of the panel, it is best to work with single-side melaninated MDF.

Figure 45: HPL gluing and pressing on Umidx®

Figure 46: Membrane pressing on MDF
7.9. Edge finishing

7.9.1. With edgeband

Edgeband (pre-glued or non-pre-glued) is applied either mechanically or with an industrial edge gluer, or glued manually. The design of the edge is limited by the flexibility of the edgeband, the gluing and pressing capabilities, and the strength of the glued joint.

Edgeband is generally glued with a hotmelt glue to the edges of MDF panels (even on fire retardant MDF, because there is no risk of coagulation).

Dekaply specialises in the processing of melamine-faced MDF to furniture components, allowing panels of up to 70 to 1250 mm wide to be laminated on two and four sides with 0.35 to 3 mm thick edgeband. In combination with its drilling machines, it also produces customised formed parts.

MDF can be finished with different types of edgeband:

• Paper:

Paper edgebands are available in a white and brown ‘unbleached’ MDF colour and can be directly painted. The paper edgeband replaces the primer layer or sealer, and allows a perfect end result to be obtained after two final coats.

White and ‘unbleached’ paper edgeband of 230 g/m² from KDM has been tried out on the different MDF types.

Paper edgebands can be glued with an EVA hotmelt glue (e.g. ARDAL T7631 from Bostik).

• Melamine:

The resin pre-impregnated melamine paper is used both for the surfacing and the edge finishing of MDF board material. Melamine edgebands are available in various thicknesses, from 0.23 to 0.5 mm and widths from 24 to 45 mm, and are glued with EVA hotmelt glue to the MDF panel (e.g. ARDAL T7631 from Bostik). The edgeband can perfectly match the decor (both decor, degree of gloss and structure).

HPL edgeband offers good resistance to e.g. scratching and moisture ingress, and has a high impact resistance. Here, too, various surface structures and thicknesses from 0.4 to 0.8 mm are possible.

HPL edgeband is glued with an EVA hotmelt (e.g. ARDAL T7631 or ARDAL T7691 from Bostik) after the application of primer to HPL or hotmelt 195 from Bostik, and does not require any pretreatment.

• Veneer:

Genuine wood veneer can also be used, and provides a virtually perfect transition between the veneer surface and the edge. Veneer edgeband is available in various layers, thicknesses and wood types.

Veneer is glued to MDF edges, preferably using an EVA hotmelt glue (e.g. ARDAL T7691 from Bostik).

• PVC:

Polypropylene is less used because it is more difficult to process. Like all the other plastic edges, PP is soft, but less stable than ABS. Edges are available in various colours, fantasy decors and degrees of gloss.

• ABS:

Polymer methacrylate or Plexiglas has for some ten years been used as edge material, and is available in a wide variety of optical and original structures. Here, too, various thicknesses and widths are available, even up to 63 mm wide e.g. for kitchen worktops.

• PMMA:

Polymethyl methacrylate or Plexiglas has for some ten years been used as edge material, and is available in a wide variety of optical and original structures. Here, too, various thicknesses and widths are available, even up to 63 mm wide e.g. for kitchen worktops.

For door panels, use is sometimes made of a filling consisting of MDF panels, which may or may not be light, in combination with wood laths serving as a frame. These solid wood laths of 5 to 10 mm thick are glued to the MDF panels with a special EVA hotmelt glue (e.g. T7071 N from Bostik).

Table 26: Overview table for MDF edge gluing with different materials.

<table>
<thead>
<tr>
<th>MDF edge gluing with different materials</th>
<th>Paper</th>
<th>Melamine</th>
<th>MDF Standard</th>
<th>ABS</th>
<th>Acryl-Butadiene-Styrene</th>
<th>PVC</th>
<th>Polymethyl methacrylate</th>
<th>Veneer</th>
<th>Solid wood laths</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDF-LA</td>
<td>Membrane</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>MDF-FA</td>
<td>Pure</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>MP-LA</td>
<td>MDF Standard</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>MDF-HL</td>
<td>Finel</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>MDF-HL-FA</td>
<td>Unicolor</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>MDF-HL-L</td>
<td>Unicolor Light</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>L-MDF</td>
<td>Finel</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>L-MDF-FA</td>
<td>Pure Light</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>L-MDF-H</td>
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</tr>
<tr>
<td>L-MDF-UL</td>
<td>MDF Ultra Light</td>
<td>+</td>
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<td>L-MDF-MS</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

+: = hotmelt, EVA based (=ethylene vinyl acetate) e.g. ARDAL T7631 (Bostik)

+: = hotmelt, EVA based, preceded by the application of a primer to the HPL edges: e.g. ARDAL T7631 or ARDAL T7691 (Bostik) OR a special hotmelt glue, in which case pretreatment with a primer is not necessary: e.g. Hotmelt 195 (Bostik)

+: = special EVA (=ethylene vinyl acetate) hotmelt glue: e.g. T7071 N (Bostik)
7.9.2. Pore fillers / Sealers

The edges of MDF are sawn or milled and may have a fuzzy appearance after treatment. Any traces of treatments on the edges are sanded off with grit P80 or P100, after which the edges are resanded with grit P120 or P150 in order to obtain a smooth surface.

Pore fillers or sealers can be applied when an extreme fuzzy appearance is present, e.g. with light MDF or complex, profiled shapes, e.g. a highly chamfered edge.

The profiled edges of MDF exhibit higher absorption than the flat top and bottom sides of the panel, so that more paint will be needed on the edges to ensure a proper finish. The absorption of the sides is dependent on the weight by volume: the lighter the density of the MDF panel, the more porous the edges. To prevent unequal absorption, sealers, insulating layers or pore fillers are applied in order to fill up the pores so as to obtain a smooth surface. Such pore fillers are preferably applied in accordance with the following general instructions:

- Application by means of a squeegee, roller or spray gun.
- The pore filler must be allowed to cure for a sufficient time, as specified by the manufacturer, preferably at room temperature. A shorter curing time is possible if the temperature is raised accordingly.
- After curing the pore filler is sanded down with grit P360.
- An ideal result is achieved when the pore filler is applied in several layers, each time following the above instructions to avoid cracking and irregularities. The lower the density of the MDF panel, the more layers will have to be applied.

Once the pore filler has been applied, and the edges are completely closed, the edges can be finished transparently or with colour with one or two coats of paint.

For a coloured edge finish as end result, a transparent or coloured pore filler can be used (e.g. Brushfiller from Boss Paints).

Test Brushfiller Boss Paints:

The one-layer filling white paste, Brushfiller, is applied with a squeegee. After drying, the pore filler is sanded with grit P360 and finished with two coats of regular coloured paint. Photo X shows the difference in paint quality on edges with and without Brushfiller.

This filling Brushfiller also produces good results on light MDF types such as Fibrabel®, MDF Ultra Light, and MXL.

Figure 49: Coloured edge finish with (left) and without (right) pore filler: Brushfiller from Boss Paints

For a transparent edge finish as end result, only a transparent pore filler can be used. A transparent pore filler has a lower solids content than a pigmented pore filler.

Test PU Aerts:

The two-component polyurethane (PU) insulating paint from Aerts has a filling effect on Standard MDF and Fibrabel® after the application of two coats, and on MDF Ultra Light after three to four coats.

Test PUR Hesse Lignal:

Hesse PUR from Hesse Lignal has been tried out on the edges of the different light MDF types. A filling effect is obtained on Standard MDF and Fibrabel® after the application of two coats. For MDF Ultra Light, three to four coats are required.

Figure 49: Coloured edge finish with (left) and without (right) pore filler: Brushfiller from Boss Paints

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Hesse PUR from Hesse Lignal has been tried out on the edges of the different light MDF types. A filling effect is obtained on Standard MDF and Fibrabel® after the application of two coats. For MDF Ultra Light, three to four coats are required.
7.9.3. Thermoglätten (thermal smoothing)

An alternative edge finish of MDF is the relatively new technique of "Thermoglätten" (or thermal smoothing). This technique has been developed to deal with the problem of the minuscule upright fibres that are left on the MDF surface after milling and/or sanding. These upright fibres are responsible for the higher absorption as compared to the flat section, and disturb the homogeneous surface finish. Thermoglätten is a non-cutting operation carried out after the cutting operation, whereby the surface is plasticised and densified under the influence of temperature and pressure. The tool has the same profiling shape as the tool used for the milling operation. The smooth surface thus obtained provides a number of solutions in particular for wet and powder painting and for the perfect finishing of low-density MDF:

- Optically perfect final quality
- Reduced machine and energy costs
- Forming freedom: new design possibilities
- Replaces manual / industrial resanding
- Reduced drying time and process time
- Increased surface hardness
- Reduced paint or lacquer consumption

Thermoglätten comes in three different applications:

- Rolface: continuous finish
- Fixface: finish with a CNC-controlled surface milling cutter at temperatures of up to 350°C and speeds from 10 to 40 r.p.m.
- Sonicface: use of high-frequency ultrasonic vibration instead of heat or temperature.

The technique has been found to produce excellent results, but has the drawback that an additional tool is required for each cutter geometry. This limits the flexibility and also accounts for the substantial investment cost.

For detailed information you can visit: www.thermoface.com

7.10. Special: MDF Design

MDF Design is a high quality MDF with a customisable 3D relief surface that is suitable for industrial processing in the field of interior design and furniture production. MDF Design is a Spanodecor product of Dekaply, our sister company.

The single-sided 3D relief surface offers a plethora of possibilities for exclusive interior designs. For architects, this product opens up a new world of possible applications. The panel receives an additional visual dimension, a truly pleasant touch feel and special optical effects. A permanent collection of 8 patterns has been created and is available from stock, but exclusive patterns can also be supplied upon request. A company logo executed in 3D relief on the MDF panel can produce spectacular decorative results.

Depending on the application, MDF Design can upon request be obtained in all available MDF qualities from the Spanolux programme, including waterproof, fire retardant, low formaldehyde or powder paint quality.

For foil wrapping, MDF Design can upon request be obtained with melamine facing on one side.

Here, too, and even more than with other panels, there is a great variety of finishing options: wet paint, powder paint, PVC foil, etc.

The dimensions of MDF Design are shown in Table 27 below.

Table 27: Dimensions MDF Design

<table>
<thead>
<tr>
<th>Dimensions MDF Design</th>
<th>Gross size (mm)</th>
<th>Net size (mm)</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock size</td>
<td>1220 x 2440</td>
<td>1200 x 2440</td>
<td>18</td>
</tr>
<tr>
<td>Production format</td>
<td>1220 x 4890</td>
<td>1200 x 4890</td>
<td>18</td>
</tr>
</tbody>
</table>

Dekaply has high capacity saws that support all sawing dimensions. In principle, all thicknesses and lengths/widths that fall within the press capabilities are available.

The MDF Design panels consist of repetitive sections that allow the build-up of panels with an infinitely continuous pattern. The long sides of the panels have a 1cm excess on both sides to allow straightening of the panel without loss of the tileable pattern. This is illustrated on Figure 55.
Today, MDF has found many applications in the construction and furniture industries, e.g. for interior design, furniture, as carrier for interior doors, as substrate for flooring strips, etc. There is as yet no end in sight for the potential applications of MDF.

Two points that must always be taken into account when processing MDF are the conditions in which MDF will be installed and the specific properties of the MDF board material.

Table 28 indicates the types of Spanolux MDF that are available for the various fields of application.

### 8.1. Interior

The technical characteristics of MDF panels for interior design must comply with the minimum panel parameters described in EN 622 Part 1 & 5 (see also CE marking). The specified minimum values for e.g. transverse tensile strength, modulus of elasticity or screw-holding power will vary according to the nominal thickness of the panel and according to whether or not the panel is intended for use in dry or humid conditions.

<table>
<thead>
<tr>
<th>Spanolux MDF</th>
<th>MOISTURE-RESISTANT</th>
<th>FIRE-REPELLENT</th>
<th>INTERIOR-DECORATION</th>
<th>CONSTRUCTION- &amp; FLOORING</th>
<th>HEALTH-ENVIROMENT</th>
<th>LIGHT-PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDF-LA</td>
<td>Membrane</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Pure</td>
<td></td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>MDF Standard</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Firax</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Umidax®</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Umidax® Noir</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Firax Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Pure Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Firax Class 0</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Firax Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Umidax® Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>MDF Ultra Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>MDF Ultra Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>MDF Ultra Light</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td></td>
<td>v</td>
<td>v</td>
</tr>
</tbody>
</table>

Table 28: Overview of Spanolux MDF types for the various applicable Wood Based Solutions

#### 8.1.1. Walls

For regular walls, where MDF is nailed onto a wooden support structure, all MDF types can in principle be used. For rooms with e.g. a higher ambient humidity, such as kitchens or bathrooms, the use of moisture resistant MDF such as Umidax®, Umidax® Noir or Umidax® Light is recommended.

#### 8.1.2. Wall systems

Wall systems consist of a combination of finished panels, possibly MDF, with a supporting structure, which together form a fixed wall, a partition or a movable wall system. For wall systems with functional or aesthetic cut-outs or drilled holes, MDF is the ideal carrier panel. Walls with improved fire resistance are covered by Firax, Firax Class 0 or Firax Light and find application in e.g. schools, hospitals, conference rooms, museums, public buildings, airports, stairway halls, etc.
8.1.3. Doors

The use of MDF for interior doors allows a multitude of finishing options such as direct paint finish, paint finish after surface milling, or varnish finish on veneer. The light MDF types (Fibrabel®, MDF Ultra Light and MXL, Pure Light, Umidax® Light and Firax Light) are ideal as “filling” in doors, reducing both the weight and the cost. The lower weight facilitates installation and requires fewer hinges.

Interior doors in buildings with specific fire properties can be manufactured from fire retardant MDF. Types Firax, Firax Class 0 and Firax Light are applied in fire retardant doors e.g. for public buildings, hotels, schools, museums, etc.

Photo 59 shows a composite panel of two glued 20mm MXL panels used as filling in an interior door.

In combination with the interior doors in MDF, the associated frames are also made of MDF.

8.1.4. Wainscoting

MDF can also be used for wainscoting. The original purpose of wainscoting was to cover the lower part of walls as a protection against rising dampness in the walls. Today, wainscoting is installed primarily as a decorative element or as an enclosure e.g. for radiators. MDF is perfectly millable, allowing a multitude of profiles to be designed. Wainscoting is usually finished with wet paint.

8.1.5. Enclosures

Enclosures of disturbing interior elements (radiators, old chimneys, pipework, etc.) are easily constructed from MDF board material and can be finished with wet paint.

8.1.6. Wrapped / Painted profiles

Profiles in MDF offer unlimited form profiling possibilities. Depending on the profiled form, the MDF profile can impart another look and be used as an interior element in its own right. The profiles (paper wrapped, painted, prepainted…) are used as decorative or finishing frames in interior applications.
8.1.7. Laminate flooring
Laminate flooring has HDF (= High Density Fibreboard) as base, with an average density of approx. 820 kg/m³, and are finished with laminate, melamine with overlay or with wearproof paint. The Vielsalm-based Balterio has a wide and extremely innovative range of click laminate.

8.1.8. Acoustic walls and ceilings
Acoustic walls and ceilings can be constructed from perforated or milled MDF. The pattern of perforations on the back are finished with an acoustic felt. Such acoustic MDF panels are used e.g. in concert halls, cinema halls, meeting and conference rooms.

Acoustic walls and ceilings can also be constructed by combining MDF and acoustic insulation or by using MDF with a different mass.

8.1.9. Total design: interior
MDF is the preferred material of the interior architect for the total design of interiors of e.g. retail shops, trade fair stands with associated displays, showrooms, restaurants, bars, hotels, bedrooms, living rooms, offices. Its high quality and versatile finishes enable the interior architect to put his creative ideas into reality.

Also in private interior design, increasing use is being made of fire retardant MDF such as Firax and Firax Light. It is commonly used for the inner lining of chimneys, with or without the associated cabinet wall.

Figure 64: Laminate floor ‘Reflection Plus’ - ©Balterio

Figure 65: Office room design: all office automation equipment integrated into the cabinet - © Interior Design Descheemaeker

Figure 66: Shop design baby clothing - © Interior Design Descheemaeker
Figure 67: Customised multifunctional cabinet wall in painted Fibrabel® - © Interior Design Descheemaeker

Figure 68: Shop design in Firax, finished with melamine from the Spanodecor collection - © Vergalle Interieurs

Figure 69: Shop design in Firax, finished with melamine from the Spanodecor collection - © Vergalle Interieurs

Figure 70: Shop design in Firax, finished with white melamine from the Spanodecor collection

Figure 71: Shop design in Firax, finished with white melamine from the Spanodecor collection

Figure 72: Shop design in painted Fibrabel® - © Interior Design Descheemaeker
8.1.10. Caravan construction

For the interior finishing of caravans, light MDF (Fibrabel®, MDF Ultra Light and even MXL) have the significant advantage that they reduce the total weight of the caravan. For additional requirements such as moisture resistance, fire resistance or particularly low formaldehyde emission, the Umidax® Light, Firax Light or Pure Light types can be used respectively.

8.1.11. Shipbuilding

Just as with caravan construction, light MDF can be applied in shipbuilding to reduce the total weight. The complete interior, with built-in cabinets, tables, etc. can be executed in light MDF.

8.1.12. Stand construction (trade fairs)

For stand construction at trade fairs, the various Spanolux panel types offer a wide variety of possibilities. Here, too, light MDF types offer the advantage of weight reduction during transport and handling.

Not only the walls, but also many of the other associated elements can be constructed from MDF: desk, cabinets, tables, shelves, displays, etc.

MDF Design is used to bring out special effects or to customise the stand. The 3D effect of MDF Design enables the design of exclusive creations, turning a stand into a genuine eye-catcher.

8.1.13. Museums

In public buildings is fire-retardant MDF often used for interior decoration, for example in museums.
8.2. Furniture

MDF board material has for many years been successfully applied in the production of table tops, door panels, profiled cabinet fronts and framework. Its smooth and stable surface provides an excellent substrate for paint applications, veneer and decor foils, whilst its stability, good machinability and high strength make it a suitable alternative to solid wood in various applications.

8.2.1. Furniture fittings

Due to its high screw pull-out resistance, MDF provides, in comparison to e.g. particleboard, excellent adhesion for furniture fittings. Only with ultra light MDF such as MXL should special attention be paid to mounting the furniture fittings in the softer panel edges.

8.2.2. Veneered MDF

Wood veneer has been used since ages in the manufacture of furniture to provide the surface with a more aesthetic appearance. MDF provides the ideal substrate for the application of veneer, whilst the core permits profiling and has a high screw pull-out resistance.

A special effect is created when the veneered MDF is combined with non-veneered and profiled edges. These edges are stained to the correct colour, so that the MDF resembles solid wood in appearance.

Veneered MDF finds wide application in table tops, doors, cabinet and drawer fronts, possibly in combination with a solid wood edge lath.

8.2.3. Profiled and wrapped MDF

A cost-effective alternative to solid wood profiles are MDF profiles wrapped with a wood veneer or a plastic or paper foil. These profiles serve as furniture elements, but also as interior design elements. Applications include frames for glass doors, frames for mirrors and paintings, decorative frames around cabinets, load-bearing elements in kitchens and the sides of drawers.

Wrapped MDF profiles have many advantages as compared to the use of e.g. particleboard or solid wood:

- Unlike solid wood, MDF has no irregular thread pattern, so that deformations (deflection, torsion and skewness) are excluded.
- MDF is available in larger lengths (up to 6300mm) and with the correct moisture content.
- The dimensional stability of MDF virtually equals that of other wood-based board materials.
- MDF is easy to machine, saw and profile, and the edges do not exhibit any holes after machining as is the case with e.g. particleboard.

Finishing the ends of the wrapped MDF is often carried out with a suitable transfer foil.

Wrapped MDF is ideally suitable for the edges of panel doors.

8.2.4. MDF formed parts

Veneered or melamine-faced MDF can be milled and profiled to formed parts, with the edges being finished with edgeband, stain or paint. In the case of smaller formed parts, MDF is often wrapped with veneer or paper / plastic foil.

8.2.5. Tables

MDF can be used both for the table top and the legs.

Table tops in MDF can be simple and rectangular or they can be shaped in a special profiled design. The edges can be specially finished, e.g. with colour stain and transparent lacquer, highly chamfered towards the bottom to optically imitate a thin worktop. Light MDF has the big advantage of effecting a significant weight reduction of the table.

Various surface finishes are possible such as melamine with overlay, painted or powder painted.
8.2.6. Bedroom furniture

MDF board material, both veneered, melamine-faced and painted, is used for cabinets, cabinet walls, doors and drawers, toilet table tops, etc.

Figure 82: Custom made children’s bedroom - © Interior Design Descheemaeker

8.2.7. Furniture for baby and children’s rooms

Essential requirements for children’s furniture is that it is robust, free of toxic substances, and safe for children. For these applications, low formaldehyde MDF panels Pure or Pure Light are recommended. In addition, the corners can be radiused and the edges are able to withstand impact loads. Apart from children’s beds, MDF panels are used for applications in small cabinets, desks, tables, chairs and other fun furniture for children.

Figure 83: Custom made children’s bedroom - © Interior Design Descheemaeker

Figure 84: Custom made bedroom furniture - © Esprit Interieurinrichting

Figure 85: Cabinet for the baby room
8.2.8. Custom made kitchens

MDF is used for kitchen cabinet bodies, shelves and fronts, and can be painted or finished with melamine, laminate, veneer or foil. Moisture resistant MDF such as Umidax® or Umidax® Light is preferably used.

For work and kitchen tops, typically two MDF panels (Umidax® or Umidax® light, possibly MDF Ultra light or MXL) are glued to each other to obtain a relatively thick panel, to which HPL is applied in postforming.
8.2.9. Bathroom furniture

Bathroom furniture is preferably produced using moisture resistant Umidax®, Umidax® Noir or Umidax® Light. Surfaces and profiled edges that may come into contact with water or be exposed to high relative humidity are preferably sealed with polyurethane or moisture resistant paint.

Figure 91: Bathroom furniture: Umidax® with melamine finish from the Spanodecor collection - © Vergalle Interieurs

Figure 92: Bathroom furniture painted / melamine: Umidax® with profiled cabinet fronts - © Balmani

Figure 93: Bathroom furniture to be painted by the customer: body Umidax® - profiled fronts Membrane - © Balmani
8.2.10. Book shelves and cabinets

Book shelves and cabinets can be manufactured from MDF. To limit deflection of shelves, it is important to determine the thickness as a function of the load and the spacing of supports. Deflection calculations must take into account the shelf dimensions, the stiffness (E-modulus) of the MDF, the spacing of the supports, and the creep correction factors, \( k_{\text{mod}} \) and \( k_{\text{def}} \).

Deflection and creep can be reduced by finishing the shelves on both sides with veneer or decorative foil.
8.2.11. Gemelamineerde MDF

Spanolux MDF is the ideal base panel for a melamine finish. Melamine-faced MDF is scratchproof, resistant to chemical products and can be washed hygienically. The variety of decors and structures turns melamine-faced MDF into an extremely decorative product. MDF Membrane can be melamine-faced on one side, allowing the panel to be finished with foil. Only MDF Ultra Light and MXL have insufficient pressure strength for correct melamine facing.

8.2.12. Painted MDF

MDF is quite often painted, in combination with many other surface finishes. Paint allows, for example, the use of a trendy colour. Painted MDF panels can be used everywhere: cabinet walls painted in a neutral colour, an interior detail painted in a striking accent colour, etc. Painted MDF panels can be applied in an infinite number of ways.

Figure 96: Shop desk: bent Standard MDF with melamine finish in Spanodecor wood decor

Figure 97: Dentist’s office: cabinets in Firax, finished with Spanodecor white melamine

Figure 98: Cabinet doors, finished with Spanodecor wood decor

Figure 99: Barber shop furniture and interior design in Umidax®, finished with uni-colour white in combination with Spanodecor wood decor
8.3. MDF on the construction site

Spanolux MDF is commonly used on construction sites.

MDF is often applied for lining walls and the installation of wall systems or ceilings. Standard MDF, Umidax®, Firax or Firax Class 0 is used in the construction of floating floors. The type example of floating floors are the Balterio laminate floors, for which HDF is used as base material.

Window sills and roller shutter casings are preferably made in Umidax® or Umidax® Light; alternatively, Pure and Firax can be used.

In combination with interior doors, door frames can be constructed from e.g. Fibrabel®, Umidax® or Umidax® Light.

Stair steps can also be manufactured from Umidax®, Standard MDF, Firax, Firax Class 0 or Pure.
8.4. Which type of Spanolux MDF to use for which application?

<table>
<thead>
<tr>
<th>Spanolux MDF</th>
<th>MDF-LA</th>
<th>FR-MDF-LA</th>
<th>MDF-HLS</th>
<th>L-MDF</th>
<th>L-MDF-FR</th>
<th>L-MDF-HLS</th>
<th>UL2-MDF</th>
<th>Special</th>
</tr>
</thead>
</table>

| Moisture Resistant | v | v | | v | v | | | |
| Fire Retardant | v | v | | v | v | | | |

- Bathroom
- Kitchen design
- Walls w. T&G
- Wall systems
- Bathroom furniture
- Kitchen cabinets
- Bathroom cabin fronts
- Bathroom cabinet fronts

**Table 29: Cross reference table for choosing the right type of Spanolux MDF for a specific application**
9. Environmental and quality labels, certification

9.1. CE marking

Since 1 April 2004, all wood-based panels for use in construction are required to be labelled with a CE mark (pursuant to standard EN 13986 ‘Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking’). This mark is affixed to the panel itself, via a label, to the packaging or to the accompanying sale documents.

This official CE mark certifies that the marked wood-based panels comply with all legal regulations and are suitable for use in construction.

The Construction Products Directive ensures that all construction products are functionally suitable and comply with the following six essential requirements throughout a reasonable, economically feasible lifetime:

- Mechanical resistance and stability
- Safety in case of fire
- Hygiene, health and environment
- Safety in use
- Protection against noise
- Energy economy and heat retention

The CE mark is mandatory for wood-based board materials, whether or not coated, veneered or provided with a protective cover coating, used in both non-load-bearing and load-bearing applications (e.g. partitions, floors, roofs, doors, lowered ceilings, etc.).

The CE mark is not only an obligation for the manufacturer, but also places a great deal of responsibility on the merchant. It is in fact the task of the merchant to examine, with the consumer, which type of panel is best suited for a particular application. Non-marked panels intended for use in construction may no longer be sold since 30 September 2004.

All data related to the mechanical and physical properties for MDF construction panels are contained in EN 622-5 "Fibreboards – Specifications – Part 5: Requirements for dry process boards (MDF)".

A tree structure (see Figure 110) can be used to determine which MDF panel is needed for a particular application. The various MDF types are classified according to standard EN 622-5.

![Figure 108: CE logo](image)

Figure 108: CE logo

![Figure 109: Markings on Spanolux MDF panels: the CE logo](image)

Figure 109: Markings on Spanolux MDF panels: the CE logo

![Figure 110: Tree structure to rapidly determine which Spanolux MDF panel is needed for which application](image)

Figure 110: Tree structure to rapidly determine which Spanolux MDF panel is needed for which application

<table>
<thead>
<tr>
<th>Panel type</th>
<th>Quality specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDF-LA</td>
<td>Structural applications in dry conditions (all load classes cf. EN 1995-1-1)</td>
</tr>
<tr>
<td></td>
<td>Membrane</td>
</tr>
<tr>
<td></td>
<td>Pure</td>
</tr>
<tr>
<td></td>
<td>MDF Standard</td>
</tr>
<tr>
<td>FR-MDF-LA</td>
<td>Structural applications in dry conditions, with fire retardant properties (permanent loads, cf. EN 1995-1-1)</td>
</tr>
<tr>
<td></td>
<td>Firax Class 0</td>
</tr>
<tr>
<td></td>
<td>Firax</td>
</tr>
<tr>
<td>MDF-HLS</td>
<td>Structural applications in humid conditions</td>
</tr>
<tr>
<td></td>
<td>(only instantaneous or short-term loads cf. EN 1995-1-1)</td>
</tr>
<tr>
<td></td>
<td>Umidax®</td>
</tr>
<tr>
<td></td>
<td>Umidax® Noir</td>
</tr>
<tr>
<td>L-MDF</td>
<td>Light MDF, for general applications in dry conditions</td>
</tr>
<tr>
<td></td>
<td>Fibrabel®</td>
</tr>
<tr>
<td></td>
<td>Pure Light</td>
</tr>
<tr>
<td>L-MDF-FR</td>
<td>Light MDF, for general applications in dry conditions, with fire retardant properties</td>
</tr>
<tr>
<td></td>
<td>Firax Light</td>
</tr>
<tr>
<td>L-MDF-H</td>
<td>Light MDF, for general applications in humid conditions</td>
</tr>
<tr>
<td></td>
<td>Umidax® Light</td>
</tr>
<tr>
<td>UL2-MDF</td>
<td>Ultra Light MDF, for general applications in dry conditions</td>
</tr>
<tr>
<td></td>
<td>MDF Ultra Light</td>
</tr>
<tr>
<td></td>
<td>MXL</td>
</tr>
</tbody>
</table>

Note: The addition of the letters ‘FR’ designates fire retardant applications, but is not included in the standard.

All Spanolux MDF panels carry the CE label.
9.2. PEFC

Spanolux supports sustainable forest management and is PEFC and FSC certified under the Chain of Custody system.

The PEFC label (Programme for the Endorsement of Forest Certification Schemes) was introduced by Europe in 1999, and is based on international standards developed in cooperation with industrial organisations in the wood sector, environmental and consumer associations, and the scientific community. The advice from PEFC is inspired by the Helsinki criteria in the area of sustainable forest management. These criteria are a subtle mix of the forest’s production functions and the preservation of eco-systems. Companies that want to sell labelled products must also be audited by an independent chain of custody.

In Wallonia (Belgium), where Spanolux is also based, about 50% of the forests are PEFC certified.

9.3. FSC

The FSC International label is the abbreviation of Forest Stewardship Council. FSC is committed worldwide to ecologically, socially and economically justified forest management. The FSC standards have been implemented in some 70 countries. The FSC ‘eco’-label gives the buyer the certainty that the wood comes from soundly managed forests, with the chain of custody being audited by an independent organisation. The chain of custody monitors each stage of the woodworking process, from the forest over the saw mill to the consumer, which is required to satisfy ten specific criteria.

The FSC label is either painted or burned on the wood, or administratively awarded to the product.

9.4. Der Blaue Engel

The Blaue Engel is a German environmental label, which specifies why the MDF panel is less environmentally harmful than similar products. Pure and Pure Light low formaldehyde panels have been awarded the Blaue Engel label for their extremely low emission of formaldehyde.

9.5. Minisitrial approval

Pure and Pure Light have the Japanese environmental label Ministerial Approval “F****” (also called Super E0 quality).

10. Spanolux MDF product range

The next table gives an overview of the stock programme of all Spanolux MDF, with all thicknesses. The MDF panels are available in different sizes and thicknesses.

Consult the website www.spanogroup.be to check the up-to-date stocklist with the available thicknesses and sizes.

<table>
<thead>
<tr>
<th>Spanolux MDF</th>
<th>thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDF-LA</td>
<td>3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 22 23 24 25 26 28 30 35 40 45 50 55 60 65 70</td>
</tr>
<tr>
<td>Pure</td>
<td>Pure</td>
</tr>
<tr>
<td>MDF Standard</td>
<td>MDF Standard</td>
</tr>
<tr>
<td>Firax Class 0</td>
<td>Firax Class 0</td>
</tr>
<tr>
<td>Firax</td>
<td>Firax</td>
</tr>
<tr>
<td>Umidax®</td>
<td>Umidax®</td>
</tr>
<tr>
<td>Umidax® Noir</td>
<td>Umidax® Noir</td>
</tr>
<tr>
<td>Pure Light</td>
<td>Pure Light</td>
</tr>
<tr>
<td>Pure Light</td>
<td>Pure Light</td>
</tr>
<tr>
<td>Firax Light</td>
<td>Firax Light</td>
</tr>
<tr>
<td>Umidax® Light</td>
<td>Umidax® Light</td>
</tr>
<tr>
<td>MDF Ultra Light</td>
<td>MDF Ultra Light</td>
</tr>
<tr>
<td>MDF</td>
<td>3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 22 23 24 25 26 28 30 35 40 45 50 55 60 65 70</td>
</tr>
</tbody>
</table>

Table 30: Stock programme of all Spanolux MDF
10.1. Moisture resistant MDF
- Umidax®
- Umidax® Light
- Umidax® Noir

10.2. Fire retardant MDF
- Firax
- Firax Class 0
- Firax Light

10.3. Low formaldehyde MDF
- Pure
- Pure Light

10.4. Light MDF
- Fibrabel®
- MDF Ultra Light
- MXL
- Umidax® Light

10.5. Specialities
- MDF Design (Spanodecor)
- MDF Prime®

10.6. Standard MDF
- MDF Standard
- Membrane
11. Relevant standards

EN 120:1993  Wood-based board materials – Determination of the formaldehyde content – Extraction method called the perforator method

EN 316:1999  Fibreboard – Definition, classification and designations

EN 317:1993  Chipboard and fibreboard – Determination of thickness increase by swelling after immersion in water

EN 335-1:2004  (Draft) Durability of wood and wood-based products – Definition of use classes – Part 1: General


EN 622-1:2003  Fibreboards – Specifications – Part 1: General requirements

EN 622-5:2006  Fibreboards – Specifications – Part 5: Requirements for dry process boards (MDF)

EN 717-1:2004  Wood-based board materials – Determination of formaldehyde emission – Part 1: Formaldehyde emission according to the chamber method

EN 12369-1:2001  Wood-based board materials – Characteristic values for structural design – Part 1: OSB, particleboards and fibreboards

EN 13501-1:2003  Fire classification of construction products and structural parts – Part 1: Classification based on results of fire behaviour tests

EN 1990  Eurocode 0 – Basis of structural design

EN 1991-1-2002  Eurocode 1 - Actions on structures


EN 1058:1995  Wood-based board material – Determination of the characteristic values of the mechanical properties and of the density

ENV 1156:1999  Wood panels – Determination of the load duration and creep number

EN 12871:2008  Wood-based board materials – Performance requirements and specifications for load-bearing panels for use in floors, walls and roofs