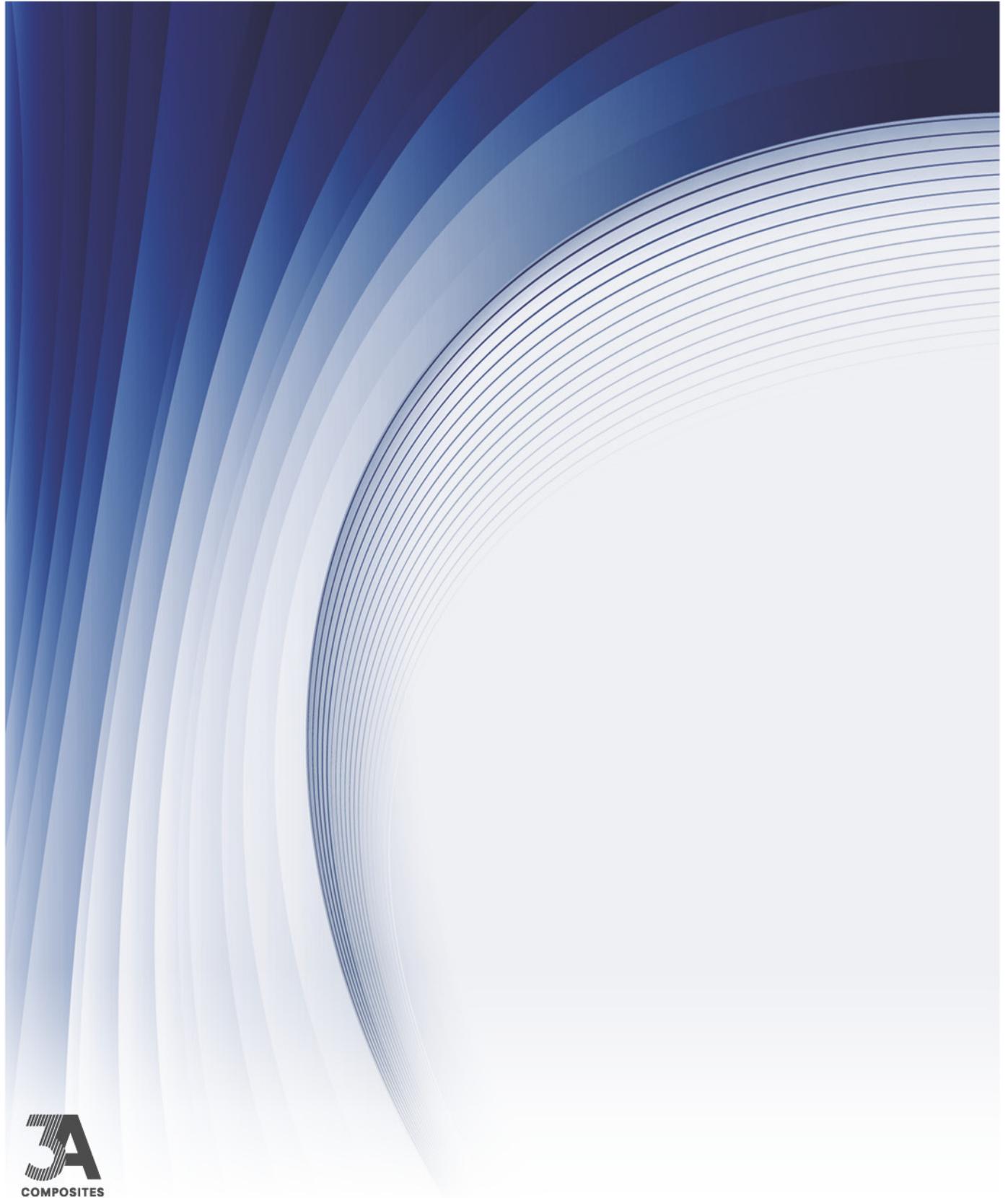


DISPA[®]

DISPLAY PAPER BOARD

PROCESSING GUIDELINES



PROCESSING GUIDELINES

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1 THE PRODUCT



DISPA® is a display board made of 100% FSC®-certified paper (FSC® C127595) with a unique core of embossed formed paper. Due to the patented manufacturing process the composite structure with its smooth, bright white surface offers high quality results for printing with optimal flatness, rigidity and stability. The manual processing of the material is efficient and easy as well as mechanically forming into three-dimensional structures. The core system of DISPA® has mainly isotropic properties. Due to the evenly arranged hemispheres of the core the characteristics of the panel remain equal for processing in all directions.

This is the difference between DISPA® and competing products, e.g. corrugated boards or fluted polypropylene sheets with anisotropic structures. The decisive advantage of DISPA® is that it can be used and processed in most cases in a direction-independent way. Thus a higher yield can be achieved from a standard size panel by optimising waste. Nonetheless, the paper itself has an anisotropic part with regard to the orientation of the paper fibres, which will be discussed in more detail in subsequent chapters.

The probably most decisive advantage of DISPA® is its final disposal into the waste paper.

Possibilities of processing / manufacturing / finishing:

- Printing
- Cutting
- Punching / Grooving
- Gluing / Laminating / Mounting
- Painting / Spray Painting

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2 AREAS OF APPLICATION

DISPA[®] is the perfect solution for short term promotional campaigns in indoor areas, such as hanging and standing signs, three-dimensionally formed POS/POP displays, promotional items or goods carriers.

3 TRANSPORT / HANDLING

To receive an optimal final product, please note the following:

- Carefully transport with protection material (especially at the edges and corners)
- We recommend the wearing of common white cotton gloves to avoid finger marks as well as the deposition of grease and dirt particles on the surface layers.
- When lifting the plates, apply as much palm as possible onto the panel in order to avoid pressure points and deformation. Under no circumstances touch and lift only on the corner.

4 STORAGE

We recommend to store the DISPA[®] sheets flat in indoor areas at a room temperature between 18-24 ° C and a relative humidity of 50-65%. Circumstances such as moisture and humidity have an impact on the paper being a natural material. In general you have to note that the drier the paper layers are, the more inhomogeneous the processing will be. For all processing technologies, please follow the usual processing recommendations for paper products.

5 PREPARATION OF THE MATERIAL

Remove the protection foil of the pallet and let the panels acclimatise prior to printing at the same room conditions as of the processing site for a period of at least 24 hours. The processing location should have the recommended temperature and relative humidity as described in chapter 4. Storage. If the temperature of the processing site diverges more than 10°C and / or the relative humidity differs more than 20% with regard to the storage location, an acclimatisation time of at least 72 hours is recommended.

For a good processing of the material, the paper moisture should be between 6-8%. Please carry out a measurement of the paper moisture with a suitable measuring device.

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6 PRINTING

DISPA® is ideal for both digital direct printing and screen printing and can be directly printed without pre-treatment. In general, the quality of the print result depends on the climatic conditions (including room environment, humidity and temperature), printing machine, ink type, image composition, colour management, processing speed and drying.

6.1 Direct digital printing

DISPA® is well-suited for digital printing due to the bright white paper surface and offers a faster throughput time on the printing machine than other substrates. To achieve an optimal print result please note the following hints:

- Maintain your printing machine and especially the UV lamps regularly and check the intensity of the UV radiation. Blow off the panel with ionised air before printing and consistently apply existing measures to reduce static charge.
- Use only printing inks that are suitable for printing on paper surfaces. If you want to fold DISPA® after printing, a flexible ink should be used for printing.
- By optimising the maximum amount of ink applied and the colour profile selected, you will achieve optimal results; this also includes the adaptation of both the printing speed and the performance of the drying unit. The drying of DISPA® can be expected to save energy compared to other substrates, as the drying lamps can be operated with less energy.
- Adjust the performance of the vacuum table to prevent collisions with the print head; If necessary, fix the edges of the panels with adhesive tape or cover free surfaces on the vacuum table to increase the suction power.
- Before further processing, the colours or inks must completely dry or harden according to the manufacturer's instructions.
- Since no corona pre-treatment is carried out with DISPA®, the use in digital printing is possible even after months of storage without any loss of quality.
- Please note our guidelines on transport, handling and storage mentioned above

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6.2 Screen printing

DISPA® sheets can be easily screen printed. For an optimal end product please note the following recommendations:

- Only by using a continuously calibrated printing process in screen printing respectively by using a suitable media profile for screen printing, you get the desired print result.
- For printing, the screen printing machine should be equipped with a pressure-controlled squeegee to minimise the compression of the material. The embossed core material of DISPA® has a recovery effect.
- Please calculate a thickness reduction of the material with every squeegee application and carry out appropriate tests in advance to readjust your machine if necessary.
- For double-sided printing, the first side must be completely dry before printing on the second side.

7 CONTOURING

Thanks to the almost isotropic properties of DISPA® core material, the uniform arrangement of the hemispheres in the core of the plate, the material can be processed equally well in all directions in most cases. The anisotropic part in the plate is the paper fibres which, due to their orientation in the paper composite, provide a direction which can lead to different behaviour of the DISPA® material during processing. The paper fibres are oriented in the direction of production of the DISPA® sheets. The more accurate the paper is in the given humidity range, the less influence the fibre orientation has on processing. Please note the common processing instructions for paper.

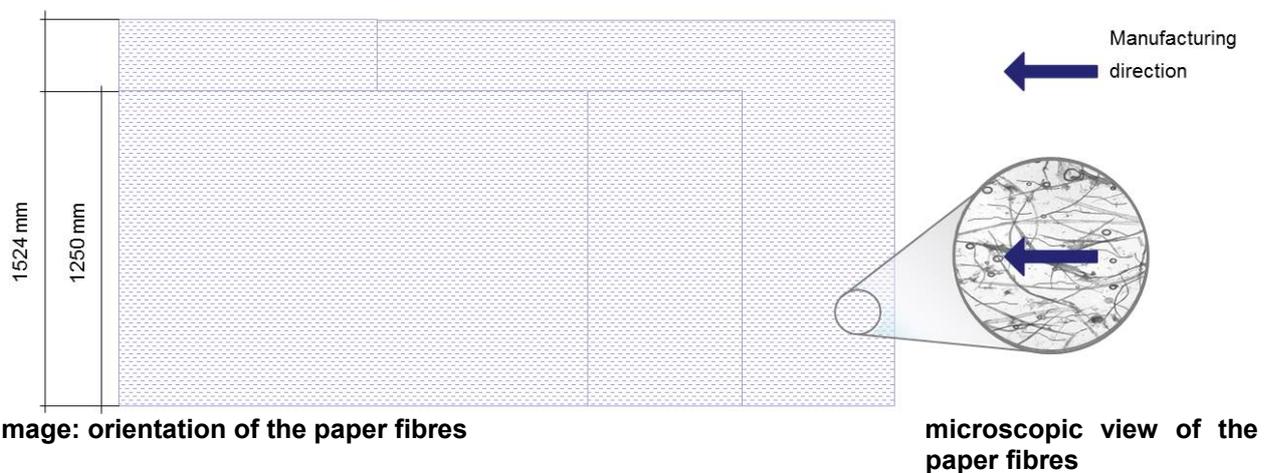


Image: orientation of the paper fibres

microscopic view of the paper fibres

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7.1 Manual Cutting

DISPA® panels can be easily cut with solid common working knives (cutter knives). Multiple, light cuts provide a better result than only one single, strong cut. The metal scale, which can be used as a stop rail for a straight cut, should be secured against slipping.

7.2 Cutting machines

A cutting machine with guillotine cutting can separate several plates with one cutting stroke, but there is a big difference when cutting DISPA® compared to solid paper materials. The pressure beam fixing the material stack to be cut, applies pressure on the material. The innovative material structure of DISPA® with its structurally stable core material reacts to this pressure in a different way than solid paper materials, it can be compressed much more. Therefore please note the following:

7.2.1 Pressure bar

The pressure of the bar should be minimised. By broadening the bar, the area of the contact pressure can be increased and thus the quality of the cut can be improved. Individual manufacturers offer optional extensions of the retainer bar. You can also produce it yourself out of a stiff sheet material such as ALUCORE®. Another possibility to obtain an optimal cutting result is to put an elastomeric foam below the retaining bar. Thus the top DISPA® layer does not slip and the overall pressure will be absorbed better.

7.2.2 Knives / Blades

It is recommended to use an HSS paper knife with an angle of 22 ° without bevel. The knife should not be curved at the back (premium quality)

7.2.3 Cutting procedure

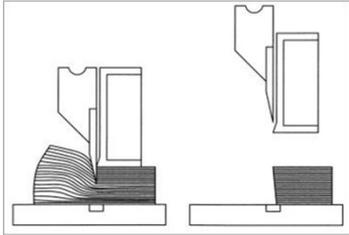
Place a suffer board (solid board) on the top plate of the stack in order to transfer the pressure of the retaining bar more evenly to the sheets and to prevent marks of the bar on the first DISPA® plate. It is advisable to cut the top plate with the back side upwards so that the pressure of the retaining bar will not be marked on the print motif on the front side.

You should cut a maximum of 6 unprinted sheets in the stack. For printed plates, the number of sheets to be cut should be reduced depending on the used printing ink.

We recommend a trial cut for demanding cutting work.

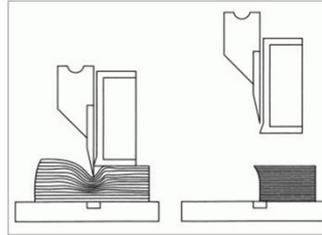
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Possible errors and causes during the cutting process:



Undercut

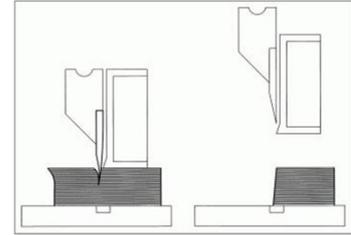
Too many sheets in the stack



Mushroom type cut

Insufficient clamping pressure

Blunt knife



Overcut:

Excessive clamping pressure

Angle of the knife is too lean

7.3 Digital Cutting Systems

DISPA® can be cut on a digital cutting machine with both a draw knife and an oscillating knife. For both knife versions we recommend to use the blades only for this material. If knives are worn out by other materials, the resulting blade irritations can result into scruffy cuts of the slender paper layers of DISPA® or in the worst case tear them off. With new blades and the right material moisture, the cutting result is clearly improved.

For cutting contours with radii, the best results are achieved with an oscillating blade unit. Please use a pointed oscillating blade for tough materials. For small radii, a blade compensation should be used. The manufacturer of your cutting system will provide you with the ideal setup parameters for the successful processing of DISPA®.

For straight cuts tangential knives can be used as well. This results in a higher feed rate. The use of tangential knives for more complex geometries is limited.

When creating cutting files, select the predefined parameters of corrugated cardboard material with a material thickness of approx. 4.5 mm. All information must be individually tailored to the machine used! If you have further questions in this respect, we ask you to contact the customer service of the respective machine manufacturer.

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7.4 Die cutting

When punching DISPA®, the entire final shape can be created with one stroke. This provides an advantage for high volume productions.



DISPA® after punching



Punching die

- The necessary punching tool can have toothed or smooth cutting lines.
- The machine settings for semi-automatic punching dies are the same as for solid board.
- To distribute the pressure evenly we recommend the use of foam rubber over the complete punching surface. Depending on the shape and radius of the contours, for large radii the use of sponge rubber on the edge of the cutting lines can be sufficient.

8 FORMING

DISPA® is ideal to create three-dimensional forms. Due to its five-layer structure, DISPA® has a very good homogeneity in all directions.

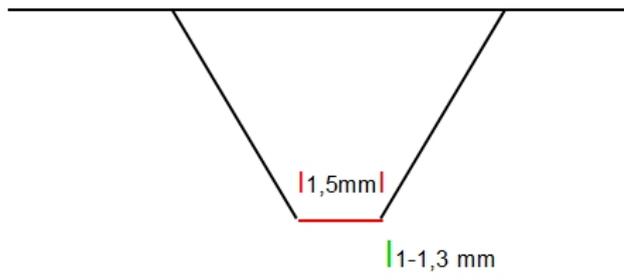
DISPA® can be shaped in two ways. Either with a material-removing process, the V-cut, or with an embossing technique in which the paper layers are compressed with a creasing wheel or punching tool. The material can be folded along the created folding line.

8.1 V-notch cut

To form DISPA® three-dimensionally by folding, V-shaped notches are cut and the waste material is removed. With a simple V-cut you can achieve a folding up to 90 °, with a double V-cut even up to 180 °. The waste can usually be taken off easily depending on the adhesive position of the core material with the cover layer. Please note the following:

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- We recommend to use only new and sharp blades for V-groove cuts. The blades should only be used for DISPA®
- V-cut depth approx. 2.5-2.8 mm
- V-cut width: Widen the V-cut gap to 1,5mm. This can be saved in the settings of the cutting system or already have been created as a double line in the cutting file



Taking off the waste

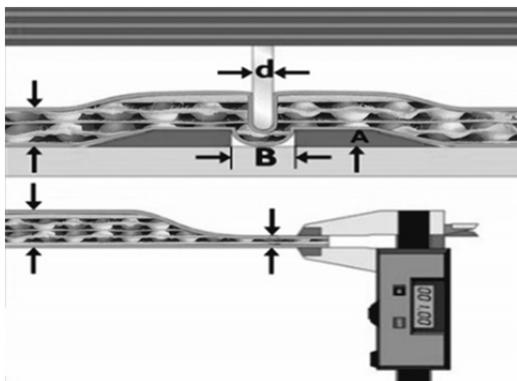
Recommendations for the V-Cut

8.2 Combined embossing and punching

In order to bring DISPA® into a three-dimensional shape, the combined processing of punching with simultaneous embossing (grooving = preparation of the fold edges) and subsequent folding is ideally suited. This is the most efficient way to shape DISPA® three-dimensionally in large series.

If embossing lines are used when punching, we recommend to use embossing channels on the opposite site of the punching die as well. The width of the embossing lines should be at least 2.5mm. Depending on the forming angle of the final product, an embossing line width of up to 5 mm (180 ° fold) should be used.

The channel grooves on the counter-punching plate should be selected according to the following formula:



$$B = (e \times 2) + d$$

B= Crease width
 e= compressed DISPA® = 1,2mm
 d=Thickness of creasing rule

For folds between 90 and 180 °, we recommend to fold the material at 180 ° first and then to set the desired folding angle.

Image: Calculation of the channel grooves

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8.3 Creasing wheel - Digital embossing with cutting systems

Another way to process and form DISPA® three-dimensionally is by using the technology of a creasing wheel. Common cutter systems are possessing not only blade or milling units but creasing wheels as well. The creasing wheel highly compresses the structure of the core material and creates a fold line. The material can then be folded along a linear, clean fold line. Creasing wheels are available in different versions.

For 90 ° as well as for 180 ° we recommend to use an embossing geometry, which leaves two parallel embossing lines in an outer distance of about 5mm into the DISPA®. As a result, the fibres of the outer paper cover layer are stressed less during the forming process and thus cracks are avoided. For a good folding result, we recommend that you first fold the material at 180 ° and then set the desired final folding angle.

For all types of folding the following geometry was developed for the DISPA® creasing wheel:

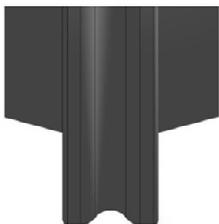


Image:

Detail of a creasing wheel with its special embossing profile for DISPA®

The pressure of the creasing wheel onto the substrate should be adjusted to a maximum compression but without causing cracks in the material. The ideal compression is about 80% of the initial thickness of DISPA®. As the material is pressed into the soft table support it adopts the geometry of the creasing wheel. When using this processing method the paper moisture must not be less than 7%. If the paper texture is too dry, small tears can be found on the creasing edge or at the outer edge after folding.



180° Folding



90° Folding

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9 LAMINATION / GLUEING

9.1 Lamination

The growth behaviour of paper is strongly depending on its moisture rate. Therefore only a double-sided mounting is recommended. For lamination, use an adhesive that has a low water content but is still liquid enough to be spread evenly.

- Acetate-based adhesives (PVA) work faster
- Starch adhesives (Dextrin) dry more slowly, thus reducing possible distortion of the panel

9.2 Glueing

Any type of adhesive suitable for papers can be used. For example: hot-melt adhesive, solvent-based and non-solvent based adhesive glue, acetate-based adhesive (PVA) or starch-based adhesive (dextrin).

DISPA® is a paper-based product. Paper shrinks and grows according to changes of the room climate. The more moisture the glue contains, the more DISPA® will change in size and flatness

10 WASTE DISPOSAL

DISPA® is made of 100% paper and therefore 100% recyclable. DISPA® can easily be disposed of in paper waste.

Allocation according to EN 643: 2014: group 3.13.00 - white, multi-ply cardboard, unprinted, containing sections of unused, white, multi-ply cardboard, woody or wood-free layers, but no grey or brown layers.