

The advantages and disadvantages of multi-ply paperboard products in laser cutting are shown in the following table:

| Paperboard type            | Advantages                                                                                                                                                                                | Disadvantages                                                                                                                                                |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Folding Box Board (FBB)    | Low density compared to thickness means less energy needed for cutting (economical production).                                                                                           | Lower strength than SBB                                                                                                                                      |
|                            | Single side coated FBB will have less discolouration from the coating. The amount of coating compared to the thickness is less than for alternative grades that are coated on both sides. |                                                                                                                                                              |
| Solid Bleached Board (SBB) | The strong network in an SBB baseboard permits a design with finer details (better strength in the most fragile designs than alternative grades).                                         | Double side fully coated SBB gives more discolouration, since the coating amount is higher compared to the thickness than for single side coated paperboard. |

Multi-ply paperboard has several major advantages when using laser cutting compared to alternatives such as coated wood-free paper or WLC (White Lined Chipboard).

- Coated wood-free paper has a higher coating/baseboard ratio and usually contains fillers (for opacity). Relatively more energy is therefore needed to cut the same thickness (longer production time). Due to the high amount of coating and fillers, the discolouration is also more pronounced than for paperboard.
- WLC contains impurities from recycled material. This may cause a discolouration closer to black than light brown. Depending on the type of WLC its lower tearing resistance and tensile strength may also limit your ability to produce a highly detailed design.

### General recommendations

The interaction between the machines, cutting tools and paperboard differs depending on the cutting method, the design, the previous surface treatment (e.g. lamination), and the choice of paperboard product selected for each specific application.

- Generally speaking, flatness and dimensional stability are crucial for achieving high runnability.
- Moisture content is equally crucial. Too high a level of moisture will make the paperboard too strong to cut, while too low a moisture level will make the paperboard too brittle.
- Strength is always necessary in the paperboard for good runnability and good formability. The most important strength properties are tearing resistance and tensile strength.
- If white cut edges are required, paperboard made solely from bleached chemical pulp must be used.

### Creasing and folding in practice

Paperboard should always be creased before being folded. This increases the visual impression of high quality because you achieve distinct, durable and narrow fold lines with no disfiguring cracks on the printed, varnished or laminated folds. The creasing operation facilitates the folding operation and provides the conditions for the graphic product to obtain its shape and function. Thanks to the multi-ply construction of graphic paperboard you achieve optimal creasing. The best result is obtained when the paperboard is delaminated into as many thin, undamaged layers as possible.



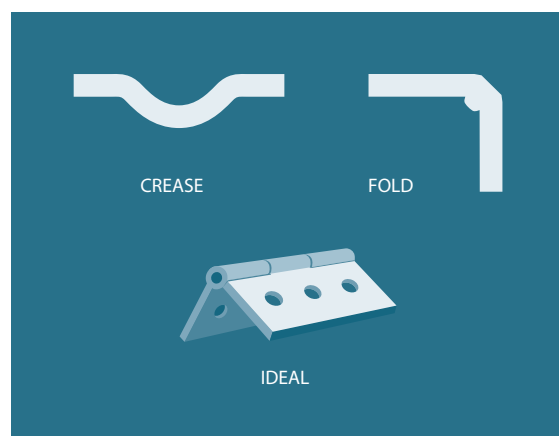


The creasing operation.

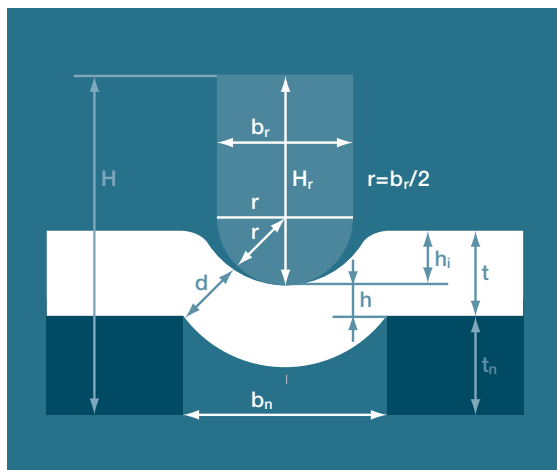
## The creasing operation

To achieve a perfect crease, the relationship between its width and depth is very important. The paperboard's quality and the construction and performance of the creasing tools are crucial for the correct placement of the crease and achieving the best results. The crease should be deep and narrow in order to obtain an accurate fold with low folding resistance.

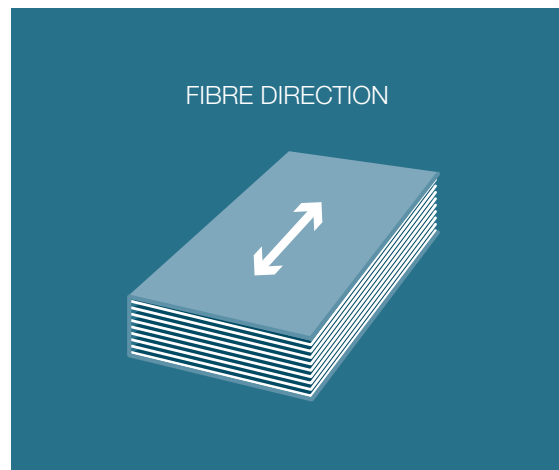
The best creases are obtained by using flat-bed equipment. To form the crease, the paperboard is pushed by the creasing rule into an accurately cut groove in the make-ready (matrix or counter-die), on which the paperboard sheet is located.



Deep and narrow creases act as hinges.



Creasing tool geometry.



A crease parallel to the fibre direction is always best.

## Recommendations

It is always easier to produce a perfect crease parallel to the fibre direction of the paperboard than parallel to the cross fibre direction. If there is a need to have many creases close to each other, it is advisable to have them parallel to the fibre direction. For best results in complex jobs we recommend that you adapt your tooling before doing cross-direction creases.

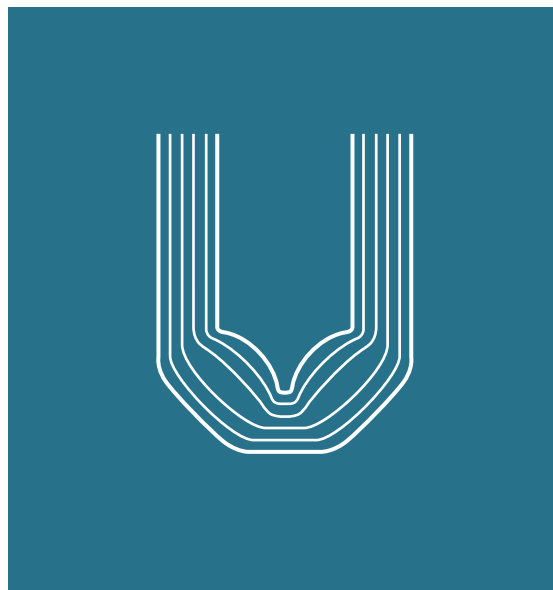
## Paperboard type and thickness

To obtain the best results, the creasing tools should be designed to suit the chosen paperboard type and its thickness. The thickness is the most important variable. However, different types of paperboard require different tool geometries, since they have different thickness/grammage relationships and different physical properties. For each type of paperboard, there are recommendations in our **Product Catalogue** to help you to obtain the best result when creasing.

## Creasing tools

Factors essential for good creasing are:

- height and width of the creasing rule
- thickness of the make-ready
- groove width
- accuracy and hardness of the make-ready
- pressure of the creasing rule.



When converting extremely thick material the use of double creasing is a normal procedure.

## Folding

To achieve the best function, folding should always be done towards the bead. In a flat-bed operation, creasing should therefore be done with the print side up. Otherwise the fold will be less durable and the print will be more exposed to wear.

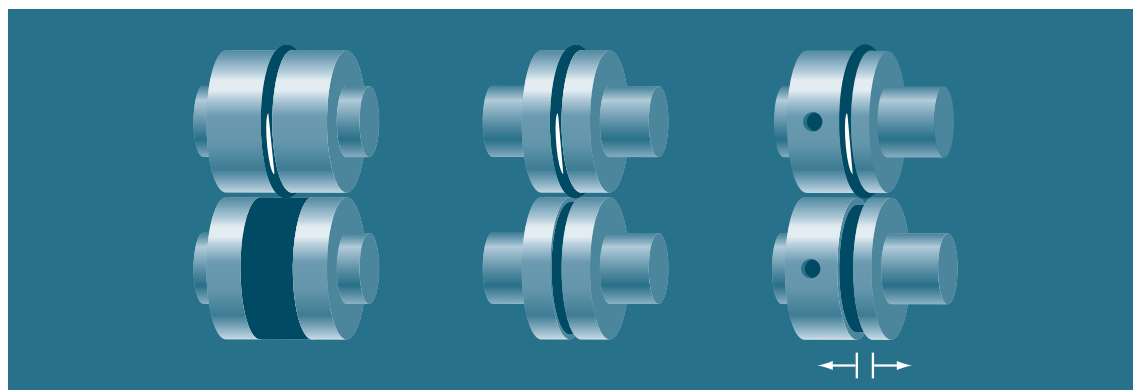
## Scoring

The bookbinding industry is developing in many fields. Demands for shorter make-ready time, shorter runs and higher speeds make the traditional creasing technique less profitable. The prevailing technique is to use inline scoring in the binder for both soft cover production and saddle stitching as well as for folders.

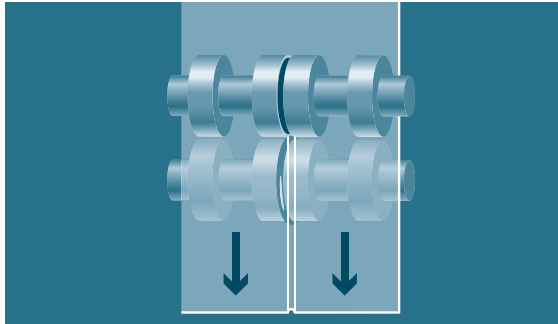
## The scoring operation

The paper or paperboard travels through a set of counter-rotating tools with a male and female part which press a permanent groove into the substrate.

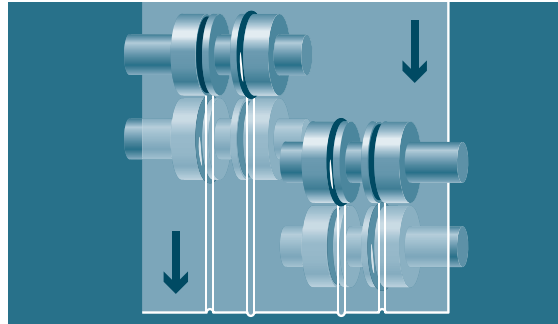
At the cover station of a saddle stitcher the cover is gripped and fed around a rotating drum with a male scoring wheel. At the cover station of the perfect binder the covers are fed through two sets of shafts with tools. Tools for spine grooves as well as decorative grooves for front and back covers are fitted in an opposing manner.



Different tool configurations for scoring. The best folding function is achieved by using an adjustable female tool.



In the folder the substrate travels through the tools mounted on shafts before going through the knife folding unit.



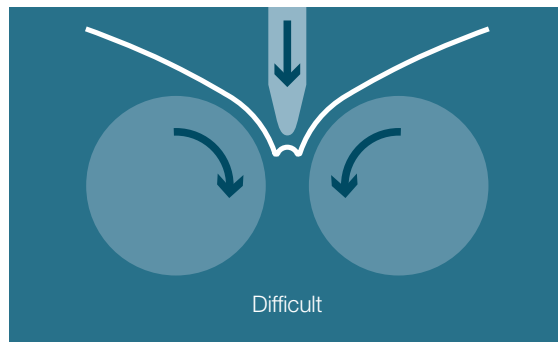
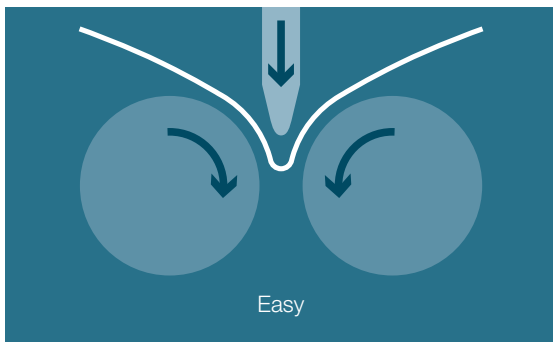
At the cover station for soft cover production the paperboard is scored with four scores, two facing inwards and two outwards.

### Scoring in practice

The main difference between traditional scoring and carton blank creasing is the direction of the score. Whereas the bead is always directed inwards into the fold in carton creasing, scoring for books and brochures is mainly done in the opposite way. There are two reasons for this:

First, the technique is mainly used for thinner fine paper when the prospect of creating a well defined delamination within the structure to facilitate a good fold with low resistance is poor due to the paper's monolayer construction and high internal bond.

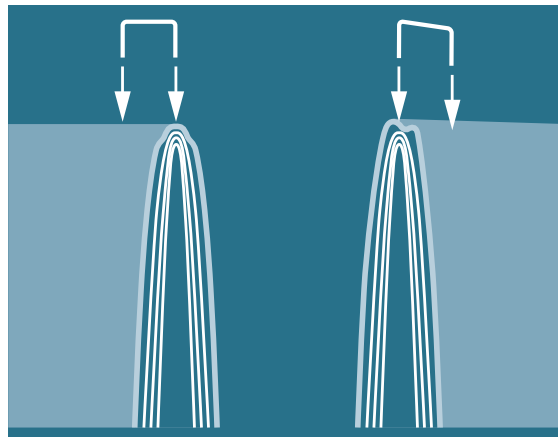
Second, there are clear practical reasons in different cases: When folding the bead would, if facing the "correct" way, obstruct the accuracy of the folding knife in the folder when the knife hits the bead to push the cover between the folding rollers. This could lead to misregister and variations through the run.



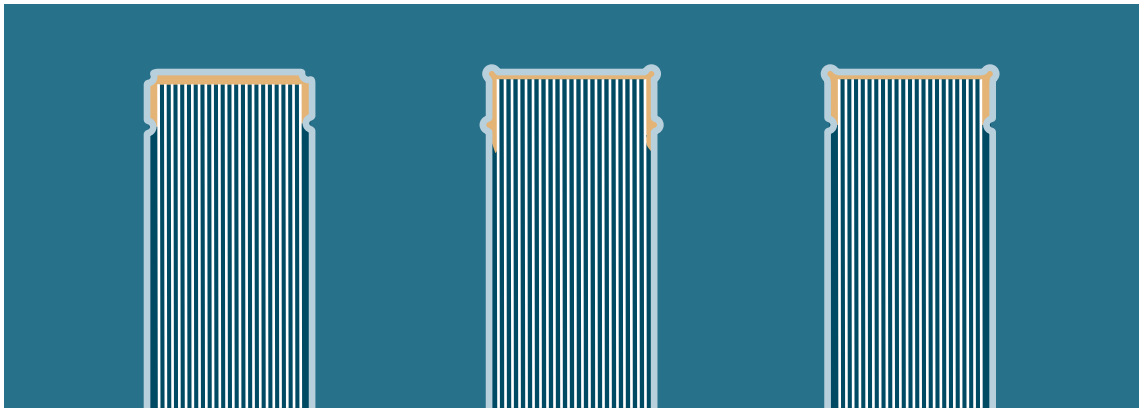
The traditional direction of a crease with the bead facing inwards in a fold may obstruct proper folding in a knife folding operation.

If the bead is folded towards the insert of the magazine, the alignment of the insert in relation to the cover could be obstructed. This could lead to misregister between artwork which spreads over both cover and insert, and reduce the possibility of having a controlled and consistent operation.

When applying the cover onto the insert in a perfect binder, the bead will obstruct either the tight fitting of the spine or the integrity of the side glue seam on the front and back of the cover.



Creasing the cover from the face side will produce a bead that may obstruct the alignment of the cover with the insert.



Different configurations of creases for a perfectly bound cover. In some cases the crease obstructs a tight fitting of the cover on the insert.

The result of the scoring process can be expected to be shallower and wider than the creased material. Traditional creasing results in a deeper and narrower crease, which improves the folding performance. When scoring, the tooling and settings need to be adjusted to negative penetration (according to the DIN standard) and the width of the female tool needs to be set to an absolute minimum without inflicting a cut in the surface.

We recommend scoring tools with a defined female part. The use of plain rubber counter rollers without a groove will not result in a groove that is sufficiently deep and narrow to facilitate high-quality folds.

### Ply construction

Optimal creasing can be achieved when using multi-ply paperboard. The best result is obtained when the paperboard is delaminated into as many thin, undamaged layers as possible along a well defined fold line. For successful creasing the surface layers and coating layers must be strong.



Please note that folding should always be done towards the bead. Otherwise the fold becomes less durable and more exposed to wear.

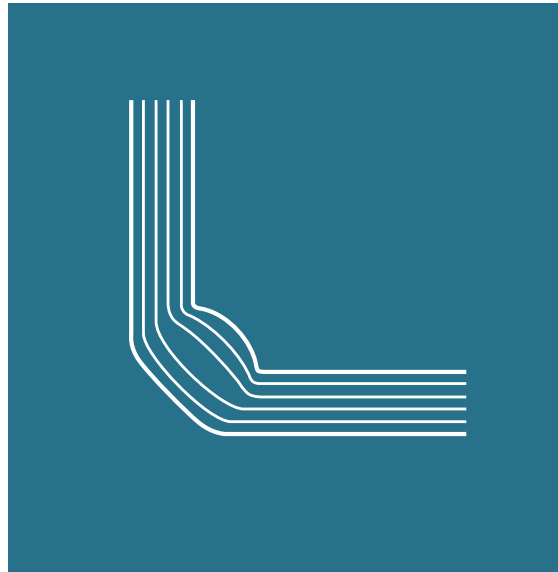
The creasing demands should be carefully matched with a suitable paperboard. The two main types of paperboard, Solid Bleached Board and Folding Box Board, differ as follows:

Solid Bleached Board (SBB) is a dense and resilient paperboard with strong layers throughout for demanding creasing jobs:

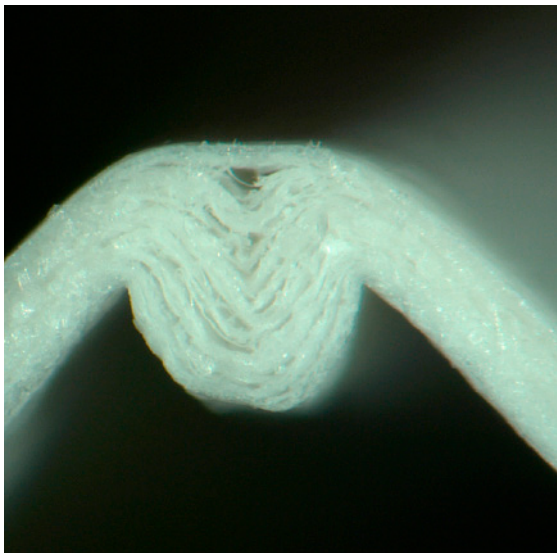
- SBB develops well defined permanent creases easily
- SBB gives creases with low folding resistance and good foldability over a wide range of crease geometries
- SBB accepts very narrow and deep creases without damage.

Folding Box Board (FBB) is a low density, stiff paperboard with strong surface layers to withstand creasing stress and deformation:

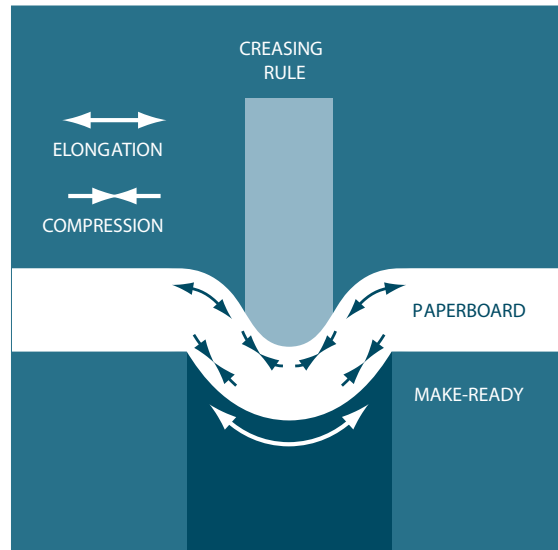
- FBB develops well defined creases
- FBB has high stiffness in relation to its folding resistance, which gives good foldability
- FBB has a compressible interior, which gives less permanence of the crease as defined by the tools.



Multi-ply construction is an important contribution to the creasability and foldability, which are basic features for achieving folds with no cracks.



Optimal creasing is achieved when the paperboard is delaminated into as many thin and undamaged layers as possible along a well defined fold line.



During creasing and subsequent folding the paperboard is subjected to severe stresses and deformation.

### Folding factor

Paperboard's folding ability is expressed by the folding factor. Folding factor 0 corresponds to uncreased paperboard, while folding factor 100% corresponds to a perfect hinge. The higher the folding factor attained without the surface cracking, the better the creasability and runnability. The creases are subjectively evaluated for defects, cracks, etc. The effectiveness or inadequacy of a crease should be checked by bending it at an angle of 180°. The folding factor should be above 50%.