Technical Notes

NANCY PLOWMAN ASSOCIATES, INC.

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GRAIN DIRECTION & PERFECT BINDING

Grain direction is very important to consider when perfect binding. To have the best chance of avoiding post-binding conditions such as gusseting and warping it is imperative to bind ALL papers with their grain direction parallel to the spine of the book.

The grain direction occurs on the paper machine when the fibers have a strong tendency to align together in the direction of the machine movement. "Grain Direction" is the direction in which the majority of the fibers are aligned within a sheet of paper, and can also be referred to as the "Machine Direction" of the paper.

Paper Fibers have different properties in the long grain (the length of the fiber) direction to those of the cross grain (the width of the fiber) direction. All paper fibers will shrink and grow as surrounding ambient conditions change. As ambient conditions with higher moisture prevail the fibers will absorb moisture and expand. As lower moisture conditions prevail the fibers will lose moisture and shrink. Typically the winter months have lower ambient moisture and the summer months have higher ambient moisture.

Paper fibers can expand or shrink as much as 3 to 4 times more in the cross grain direction than they will expand and shrink in the long grain direction. If you think of this expansion and shrinkage as movement, you will realize more movement in cross grain directions than in long grain directions. So if you have a piece of paper 8 ½ x 11" grain long (11") the movement of the paper will be most extreme in the 8 ½" direction (grain short). Properly bound, the 8 ½ x 11" sheet will expand and shrink most in the direction along the spine giving the paper the ability to move towards the outer page edge and maintaining lay flat. Improperly bound, the same sheet would have its greatest movement against the direction of the spine causing the spine to warp and gusset. By binding all paper grain long (parallel to the spine) the least amount of stress will be applied to the glues spine as ambient conditions change.

If there are different paper grades making up one book, it is likely that each grade may have a different rate at which it will expand and shrink. Therefore should the papers begin to move as ambient conditions change, it is important the papers be aligned so that the majority of the movement will place the least amount of stress on the spine. It is in this case that it is most important to adhere to rules of binding grain direction of ALL papers parallel to the grain.

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