Select the optimal finishing Get a competitive edge

Reduce cost, decrease weight and improve quality

Diab

Choosing the optimal finishing for a competitive edge

What is finishing?

Finishing refers to the machining of structural core materials. You can choose from a wide range of cuts, grooves and perforations in different patterns, each serving a specific purpose.

Why finishing?

The right combination of core material, laminate and finishing allows you to save time, money and resources, and affects the characteristics of your product.

Why a finishing solution from Diab?

Diab is a world-leading supplier of sandwich composite solutions with long experience in finishing for structural core materials. Together, we can find the optimal solution to fit your needs.

We know that there are no off-the-shelf, one-size-fits-all solutions, which is why this brochure, based on our expertise and experience from a variety of segments over the years, is just a springboard for more detailed discussions. However, there are three main influencing factors that will help you decide what you need:

- Key success factors
- Manufacturing process
- Shape

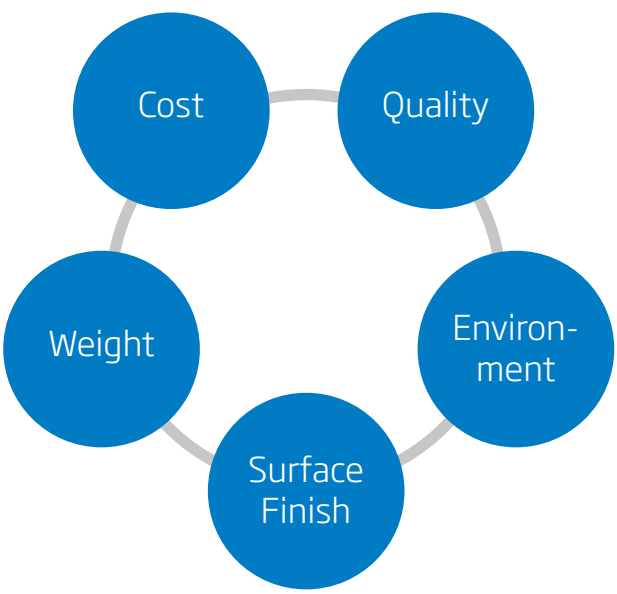
The following pages will give you a good basis for understanding and discussing the impact these factors have on your finishing selection.

Three factors influencing your choice of finishing

A focused analysis will help you choose the right finishing.

Key success factors

- Weight is of key importance in many applications. A finishing combination with low resin consumption might be your preferred choice. Weight requirements impact manufacturing speed and total cost of the composite component.
- Cost sensitivity requires a finishing combination suitable for faster manufacturing, involving short lay-up time and fast resin flow. Having cost as a main driver can impact the resin consumption, weight and surface finish.
- Surface finish is a subjective criterion and needs to be discussed thoroughly. To obtain a high surface finish, the lay-up time is usually a bit longer. The weight and resin consumption may be higher, as well as the cost for consumables and materials.
- Environmental regulations and demands must be taken into consideration. Using a closed process decreases the amount of waste and also improves the working environment.
- Quality is an important criterion and greatly affects the process selection, depending on the type of application, operational requirements and expected lifetime.



Manufacturing process

The finishing option significantly impacts the manufacturing process you choose and vice versa. The most common types of processes used in composite manufacturing are:

- Infusion and RTM: a pressure differential is applied to wet laminates and core with resin under vacuum.
- Hand lay-up: laminates are manually wetted out with a roller or brush in a mold. Multiple layers are laid and wetted until the intended thickness is achieved. The core layer is wetted with resin and bonded with core bonding paste.
- Vacuum bagging: additional process to hand lay-up used to draw out excessive resin and unwanted air while compressing the part to improve laminate quality and mechanical properties.
- Spray lay-up: using a chopper gun, a fiber rowing is simultaneously chopped up in short strands, wetted with resin and sprayed on the mold. The laminate is then compressed with a metal roller. The core layer is wetted with resin and bonded with core bonding paste.
- Prepreg: fibers are pre-impregnated with a controlled amount of resin; the laminate is cured on the mold under heat and vacuum pressure. The core layer is bonded with a pre-impregnated adhesive film co-cured with the laminate.
- Strip planking: planks of core are fixed on a framework to form the shape. The exposed surface is laminated with fibers and cured. The framework is then detached and the other skin is laminated on the core.

Shape

Each finishing option is best suited to a particular type of geometry/curvature. Diab has developed unique solutions especially suited to fit the needs of single and double curved geometries so you can get the best performance out of every design. You can have different finishing options within the same part if the geometry is not uniform. If the shape is very complex, we propose using Computer Numerical Controlled machining (CNC).

Overview of finishing options

Use this overview as a quick reference guide or as a springboard for discussions with our expert consultants. Note that the options below are most often used in combination.

Plain sheets: where finishing starts

Using a plain sheet is the most effective way to utilize a core. Through machining, it can be perforated, grooved or slitted to make it as functional as possible for the application.

Resin distribution options

- Perforations (PFC) avoid air from being trapped under the core, ensuring wet-out. This technique is commonly used when doing hand lay-up, vacuum bagging or when using core bedding adhesives. In an infusion process, the perforations will transfer resin from one side of the core to the other.
- Grooved and perforated cores (GRC, GRV, GPC) remove the need for additional infusion medium within the laminate or above it. These finishes can be successfully combined with formable options such as grid-scored or double cut.

Formable finishing options: creating curves

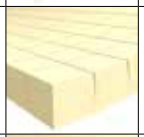
- Grid-scored finish (GS) makes the core conform easily to the mold for complex shapes. A square cut pattern creates small blocks that are held together by a lightweight fiberglass scrim. Cuts are made with saw blades to remove material and allow the core to bend inwards. The core will not spring back when placed in the mold.
- One-direction cut (OD) finish is similar to GS but with cuts in one direction only, creating strips of core.
- Double-cut finish (DC) allows curvature into panels without applying a scrim. The core is cut in a 0-90 grid pattern on both sides through more than half of its thickness, allowing air and resin to easily flow through the core. An option is to use razor blades (RC) to minimise resin absorption when the core is bent. The core will spring back when placed in the mold if not held down.
- Thermoforming shapes a foam core into the mold shape. This is a rather costly and time-consuming process, but when weight and quality are prioritized it becomes an interesting option.


MERCURY

Optimize your applications

Example of applications

Use for	Flooring & panels	Small series/ prototyping	Large series/ marine & industry	Wind blades/ single-curve	Nacelles/big-volume for industry
Main drivers	**Cost**	**Adaptable**	**Shape/finish**	**Cost**	**Cost**
Cost	Critical	Important	Important	Critical	Critical
Surface finish	Not critical	Not critical	Critical	Not critical	Not critical
Weight	Important	Not critical	Important	Important	Not critical
Resin uptake	Important	Not critical	Important	Important	Important
Process	Closed molding	Hand lay-up	Closed molding	Closed molding	Closed molding
Cycle times	Short	Not critical	Important	Important	Important
Suggestion	**GRC**	**GS, DC or RC**	**GS, DC or GPC**	**OD**	**GS/GRC**

Finishing		Description	Characteristics	Molding process
GPC		Grooves on one or both sides, combined with 2 mm diameter square grid perforations. Can be cut lengthwise and/or crosswise with 20 mm spacing between the grooves.	Provides optimum flow speed and secures wet-out of both surfaces.	Infusion and closed molding
GRC		Grooves on one or both sides. The grooves can be cut crosswise, longitudinal only or transverse only.	Allows resin to flow in closed molding applications and expels trapped air.	Infusion and closed molding
PFC		Perforations with a diameter ranging from 1.6 mm to 3.2 mm depending on core thickness and density.	Releases trapped air from under the core and/or allows resin to flow from one side of the core to the other.	• Prepreg • Hand Lay-Up • Closed Molding • Press Molding • Infusion
GS		Saw-cut pattern on one side of the core, both lengthwise and crosswise. The small blocks are held together by a lightweight fiberglass scrim, creating a very flexible core sheet with no spring back.	Bonding core to simple or slightly complex surfaces. Core is bent to close the gaps between blocks.Vacuum bagging or bedding into core bonding adhesive is recommended.	• Hand Lay-Up • Closed Molding • Press Molding • Vacuum Bagging
DC and RC		Cut pattern in which both sides of the core are cut in both directions to a depth greater than 50% of the core thickness, creating a flexible core sheet. Cuts can be razor cut (no removal of material) to minimize resin absorbtion.	Bonding the core to simple or complex shapes with tight curvatures. Vacuum bagging or bonding with core bedding adhesive is recommended.	• Hand Lay-Up • Closed Molding • Vacuum Bagging
OD		Cut in one direction only, reducing the amount of cuts by 50%. Bends in single-curve only. Cuts can be razor cut (no removal of material) to minimize resin absorbtion.	Used in blades – usually in combination with grooved material or a flow media.	• Infusion • Closed molding

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Diab is a world leader in sandwich composite solutions that make customers' products stronger, lighter and smarter. Diab provides a range of core materials, cost-effective kits, finishings and in-depth knowledge on composites. Diab also provides engineering services for composite technology through Composites Consulting Group (CCG). Diab is a participant of UN Global Compact.

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