

GS GUIDELINES

Introduction

Divinycell, Klegecell, and ProBalsa are processed into flat sheets of varying thickness. In order to create parts with compound curves, the core material must fit to the curved mold. The core material can either be cut into smaller pieces or thermoformed to fit the curved mold. To facilitate the production of curved parts without the need for thermoforming, grid-scored (GS) core material was developed. The core material is “scored” (cut) at finite intervals in the longitudinal and transverse directions with the finished cuts creating a grid pattern. The scores allow the material to bend around curves more easily than plain material, without the need for thermoforming. There are several types of scored material available so the builder can choose the right product for his application.

Score Types

Grid-Scored (GS) – a woven fiberglass scrim is adhered to the top face of the material with heat-activated styrene-soluble adhesive. Cuts are then made in the longitudinal and transverse directions, creating a grid pattern. The cuts are made through 90% of the bottom side of the material. The remaining material between the blocks is then broken, creating small blocks of core material. The scrim holds the blocks together, but still allows the sheet to bend.

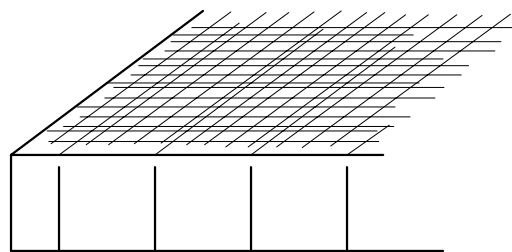


Figure 1: Grid-Scored (GS) core material with scrim

Double Contoured (DC) – the core material is scored in a grid pattern similar to GS style cuts. However, the cuts are only made through 40% of the thickness of the material. A second set of grid pattern cuts is made on the opposite face of the material at an offset to the original cuts. DC material is intended for use in areas requiring a smaller radius of curvature or “S”-type curves.

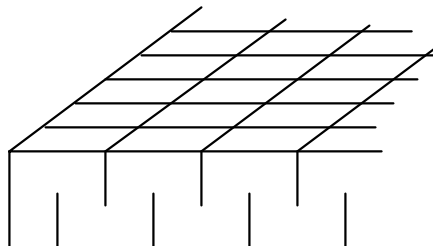


Figure 2: Double-Contoured (DC) core material



Cut Styles

Three styles of blades are used to create cuts of different widths in the scored material.

Wide Cut - Saw blades are used to create wide cuts in the material resulting in **GSW** or DCW. Wide cut material is intended for use with core bedding adhesives, such as Divilette, K-Lite, and ProBond, that require more cut volume to flow properly.

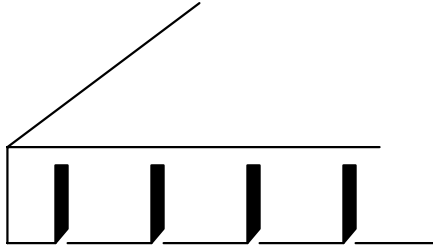


Figure 3: Grid-Scored, Wide Cut (GSW) core material

Narrow Cut – Knife blades are used to create narrow cuts in the material resulting in **GSN** or DCN. Due to its low resin usage, narrow cut material is intended for use in a hand-lay-up or vacuum bag process with a resin-rich chopped strand mat bedding layer. This cut is only available in densities up to 80 kg/m³ (5.0 lb/ft³) and up to 19 mm (0.75 in) in thickness.

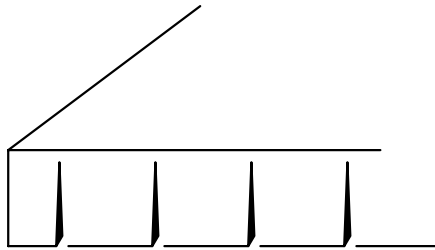


Figure 4: Grid-Scored, Narrow Cut (GSN) core material

Narrow Narrow Cut – Razor blades are used to create ultra-narrow cuts in the material, resulting in **GSNN** or DCNN. This material is intended for use in processes requiring very low viscosity resins such as resin transfer molding (RTM), vacuum infusion and their variants to keep resin usage to a minimum, resulting in very lightweight parts. With this type of core, thermoforming or hand fitting is not necessary as when using plain cores. For more information on thermoforming, see the Thermoforming Guide and HT Processing Guide.

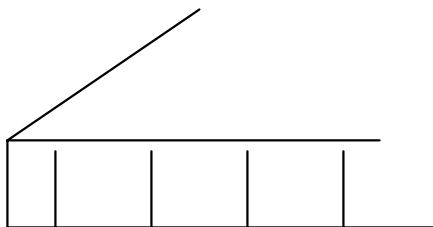


Figure 5: Grid-Scored, Narrow Narrow Cut (GSNN) core material



Dimensions

Length and width - Scored foam sheets are one-third the size of plain sheet material in the 45 to 80 kg/m³ (3.0 to 5.0 lb/ft³) density range. Scored sheets of higher density foam are approximately one-half the size of plain sheet material. Scored balsa sheets are the same size as plain balsa sheets.

Thickness - The maximum scored sheet thickness is 50 mm (2.0 in) for densities up to 100 kg/m³ (6.0 lb/ft³). Higher densities have a maximum scored sheet thickness of 25 mm (1.0 in).

Bedding Compounds

Resin-rich Chopped Strand Mat – In hand lay-up applications, a layer of continuous or chopped strand mat is used to maximize adhesion between the structural plies of sandwich skins and core material. When used as a core bedding layer, the fibers should make up approximately 20-27% of the layer by weight. Typical dry fabric weights for use as bedding are 230 g/m² (0.75 oz/ft²) to 900 g/m² (3.0 oz/ft²).

Core Bedding Adhesives (CBA) – As an alternative to using a resin-rich mat layer, lightweight polyester and vinylester based bedding compounds have been formulated by DIAB to bond core materials to cured polyester and vinylester laminates. DIAB Core Bedding Adhesives offer a lightweight, labor saving method of bonding DIAB core materials to recently cured FRP laminates.. See Core Bedding Adhesives guide.

Application

Scored core material can be used with many different manufacturing processes including hand lay-up, vacuum bag, infusion, and others. See HT Process Guide for using pre-preg fabrics with Divinycell.

Female mold hand lay-up - Resin-Rich Chopped Strand Mat Bedding Layer

Hand lay-up in a female mold is the most common application of scored material.

- 1) Outside skin and bedding layer** - In this process, gel coat is applied to the inner surface of the mold and allowed to cure. A “skin coat” layer is then applied to prevent “print through” of the structural fibers and the core. The structural plies are then applied, followed by a 300 g/m² (1.0 oz/ft²), or greater, resin-rich bedding layer of chopped or continuous strand mat. The bed layer weight is dependent on surface roughness and curvature of the part.
- 2) Pre-Wet Core and Apply** - The scored side of the core is coated with a light layer of catalyzed resin and applied directly to the uncured bedding layer. After coating, the surface of the core should not be shiny and the texture of the core should still be visible. The core is then pressed into the bedding layer. A vibrating roller can be used to insure proper core bedding.
- 3) Inside skin** - Once the core is installed, the inner plies can be applied to the core and allowed to cure. **Note:** When using ProBalsa, the bedding layer must be cured before applying the inner skin.



Note: It is difficult to completely fill the scores in the core when bedding with a resin-rich layer of chopped strand mat. If the scores are not filled, the overall shear strength of the core will be reduced due to the voids in the core material. DIAB highly recommends filling the scores below the waterline on submerged parts such as boats and tanks.

Female mold hand lay-up – Core Bedding Adhesive (Divilette, K-Lite, and ProBond)

The method used to apply core with an appropriate DIAB Core Bedding Adhesive is very similar to the standard resin-rich mat method described previously.

- 1) **Outside skin** – The outer skin is prepared as described previously. However, with this method, the resin-rich chopped strand mat bedding layer is omitted and the outside structural plies are allowed to gel before applying the core bedding adhesive.
- 2) **Bedding layer** - A DIAB Core Bedding Adhesive is applied to the newly cured laminate with a hand trowel or spray applicator. See Core Bedding Adhesive Guide for details.
- 4) **Pre-Wet core and apply** - The scored side of the core is coated with a light layer of catalyzed resin and applied onto the core bedding adhesive. After coating, the surface of the core should not be shiny and the texture of the core should still be visible. Once the core is in place, a vibrating roller is used to draw the adhesive into the scores in the core. **Note:** Pre-wetting is not necessary for low density PVC foam cores up to and including 80 kg/m³ (5.0 lb/ft³) when using Divilette 600 Core Bedding Adhesive.
- 3) **Inside skin** - Once the core is applied and rolled completely, the inner skin can be applied and allowed to cure. **Note:** When using ProBalsa, the bedding layer must be cured before applying the inner skin.



Resin/CBA Usage

It is highly recommended that the cuts in scored core material be filled with the laminating resin or core bedding adhesive to achieve maximum shear strength and eliminate air voids. The resin/CBA use of scored core depends on the thickness and cut style of the core. Figures 6.1 and 6.2 show the resin/CBA use of the two most popular types of scored core materials.

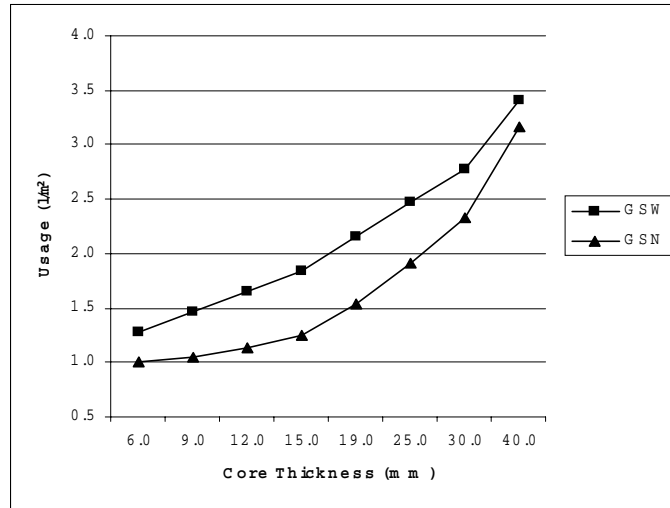


Figure 6.1: CBA/Resin Usage vs. Core Thickness for GSW and GSN style cuts (SI Units).

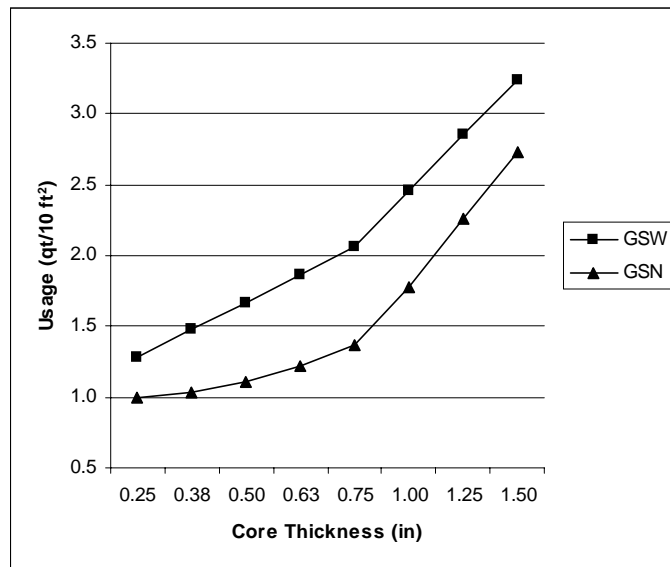


Figure 6.2: CBA/Resin Usage vs. Core Thickness for GSW and GSN style cuts (US Units).



See Core Bedding Adhesive Guide for bedding layer weights with scored material.

Cosmetic Finish

In most applications, the scored core will be applied with the scrim towards the inside skin of the part and the cut surface to the bedding layer of the laminate. With high-shrinkage resins and GSW core, it is possible to experience print-through, where the grid pattern of the core is visible on the surface of the laminate. The easiest way to prevent this is to use a high-quality, low-shrink resin system with controlled exotherm and low resin content.

For **non-dynamic areas only**, the core can be applied with the scrim towards the mold to minimize print through. When applying the core in this fashion, **wetting the scrim with catalyzed resin is essential to ensure proper wet-out.**

Note: the scrim adhesive is styrene soluble and will begin to release from the core material within ten (10) minutes of coming in contact with polyester or vinylester resins.

Further Information

Contact your local DIAB sales representative or DIAB Technical Services.

