

MANUAL DE PRODUCTOS

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Alta temperatura
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Dúctil
Ferroviario y transporte público
Aplicaciones submarinas y boyas
Aislante – Transporte gas líquido nitrógeno

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VAC – TAC es un sistema de adhesivo hotmelt único, libre de componentes solubles, y con un poder de fijación muy superior al de aerosoles tradicionales. Este sistema ha sido desarrollado específicamente para la sujeción de fibras, núcleos de espuma y madera de balsa, tejidos pelables, films separadores, redes de distribución...

El adhesivo se aplica con la pistola neumática TEC 6300, con la posibilidad de regular la salida en forma de spray, o bien como un cordón, de forma que se adapta perfectamente a las necesidades particulares de cada trabajo. No hay desperdicio de material, ni obturación de la boquilla, ya que el adhesivo se deshace de nuevo cada vez que se conecta la TEC 6300.

4.2 EQUIPO AUXILIAR

Trampas de resina

Detector de fugas

Bombas de vacío

Reguladores de presión

Tijeras ergonómicas de alto rendimiento para aramida y vidrio

Válvulas vacío

Enchufes rápidos

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4.3 MATERIALES DESCARTABLES

Masillas de sellado "Tacky-tape"
Tejidos pelables "Peel.ply"
Bolsas de vacío, amplia gama.
Redes de distribución
Films separadores perforados y no perforados
Tubos polietileno para infusión
Tubos polietileno en espiral para infusión
Mangueras de vacío anticlapso
Cintas de poliéster, teflón, doble cara
Conexiones en T y L

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SERVICIOS DISPONIBLES

1. ASESORAMIENTO TÉCNICO

NUESTRO SERVICIO TÉCNICO PUEDE ASESORAR EN LA ELECCIÓN Y DEFINICIÓN DEL SISTEMA CONSTRUCTIVO, MATERIALES Y PROCESO

2. CÁLCULO ESTRUCTURAL

A PARTIR DE LOS PARÁMETROS Y EXIGENCIAS NECESARIAS, LA OFICINA TÉCNICA DE DIAB EN SUECIA PUEDE REALIZAR EL CÁLCULO ESTRUCTURAL Y LA ESPECIFICACIÓN DE CONSTRUCCIÓN

3. ASESORAMIENTO EN INFUSIÓN

NUESTRO PERSONAL TÉCNICO PUEDE INTRODUCIR A SU COMPAÑÍA EN LAS TÉCNICAS DE INFUSIÓN. DESDE LA DEFINICIÓN DEL MATERIAL E INSTALACIONES NECESARIAS, HASTA LA PIEZA LAMINADA; INCLUYENDO EL DISEÑO DE LA ESTRATEGIA A SEGUIR, SUMINISTRO DE LOS MATERIALES NECESARIOS Y FORMACIÓN TEÓRICA Y PRÁCTICA.

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1. NÚCLEOS PARA CONSTRUCCIONES SANDWICH

1.1 ESPUMAS RÍGIDAS DIVINYCELL Y KLEGECELL

Las espumas rígidas Divinycell y Klegecell, son fabricadas mediante un proceso de expansión, estabilización y procesado.

Las diferentes formulaciones de las materias primas, permiten obtener distintos productos adaptados a los requisitos ambientales, estructurales o del proceso de fabricación.

Algunas de las características generales de todas las espumas rígidas Divinycell y Klegecell son:

- Célula cerrada
- Auto extingible
- Termoformable
- Disponibles en diversas densidades
- Suministrado en láminas o con distintos acabados
- Libre de CFC



Tipos disponibles:

- | | | |
|------------------|----------------|--------------------------------|
| • Divinycell H | • Klegecell R | Baja y media Temperatura |
| • Divinycell HT | | Alta Temperatura |
| • Divinycell HP | | Pre Impregnado |
| • Divinycell HD | | Dúctil |
| • Divinycell HCP | | Aplicaciones Submarinas, Boyas |
| • Divinycell IPN | • Klegecell CY | Aislante - Transporte LNG |

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BAJA Y MEDIA TEMPERATURA

DIVINYCELL H - KLEGECELL R

Se trata de espumas rígidas estructurales de uso general, con excelentes propiedades mecánicas, para sistemas con resinas poliéster, viniléster, epoxi o fenólicas; laminadas por vía húmeda o en procesos en los que la temperatura de post curado no excede los 80º o 90ºC.

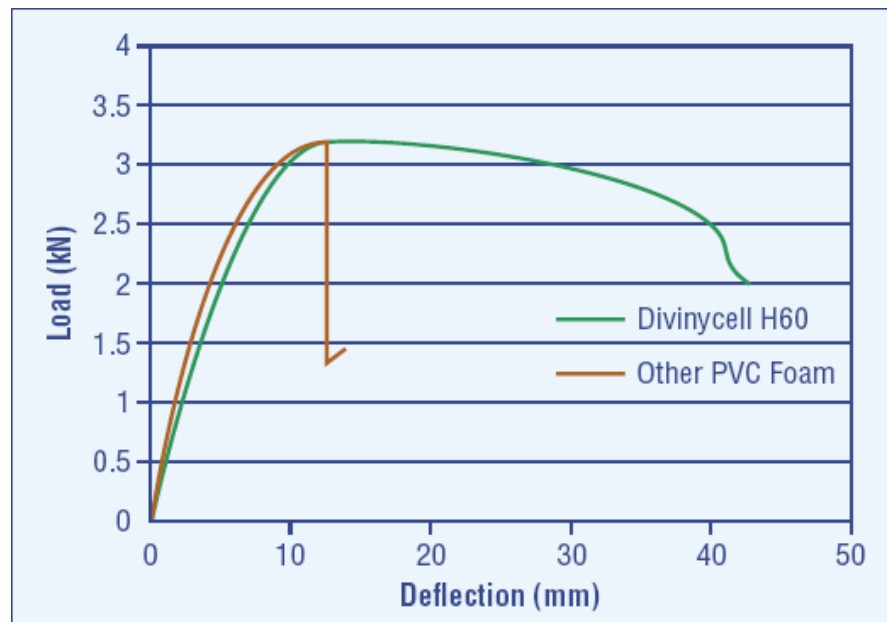
Divinycell H Disponible en densidades entre 45 y 250 kg/m³.

Klegecell R Disponible en densidades entre 45 y 200 kg/m³.

Las aplicaciones mas frecuentes son: embarcaciones deportivas y profesionales, componentes de buques cargueros y ferrys, mobiliario ligero, trenes, mamparos, suelos, módulos, etc.

La nueva formula mejorada del Divinycell H y Klegecell R, supone un incremento de un 10% de sus propiedades mecánicas, un 20% en la resistencia a la flexión y del 50% en su módulo de elongación.

La ductibilidad, así como la estabilidad térmica y dimensional también han sido claramente mejoradas. Ahora se puede procesar a una temperatura de hasta 80ºC para Klegecell R y 90ºC para Divinycell H, frente a los 70ºC de la formulación anterior.



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ALTA TEMPERATURA

DIVINYCELL HT

Divinycell HT

Desarrollada para el mercado aeronáutico, cumple con las exigencias de las distintas compañías. Este material puede ser procesado mediante sistemas pre impregnados con temperaturas de post curado de 120°C.



Sus aplicaciones principales son: interiores de aviones, hélices de helicóptero, etc. Disponible en cuatro densidades: 50, 70, 90 y 110 kg/m³. Las tolerancias en densidad y espesor están ajustadas a la demanda de los diseños actuales. Divinycell HT es termoformable y auto extingible.

PRE IMPREGNADOS

DIVINYCELL HP

Divinycell HP

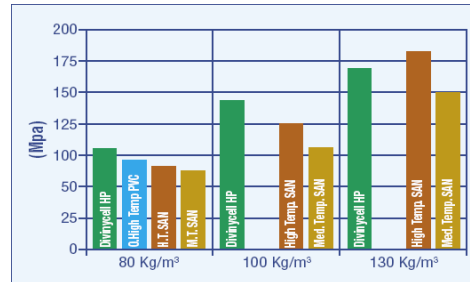
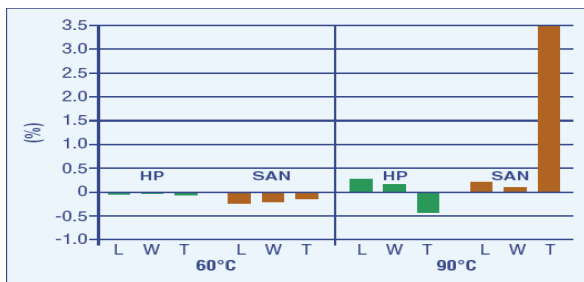
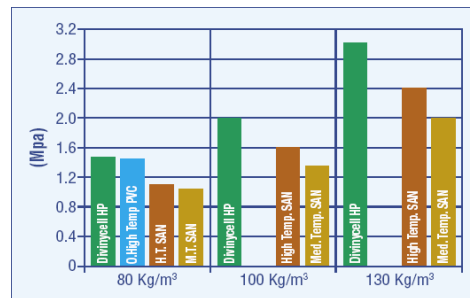
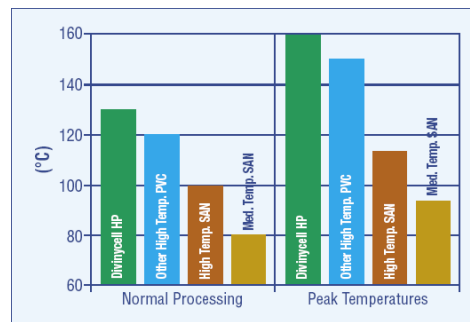
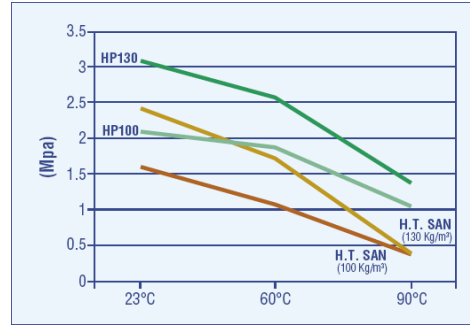
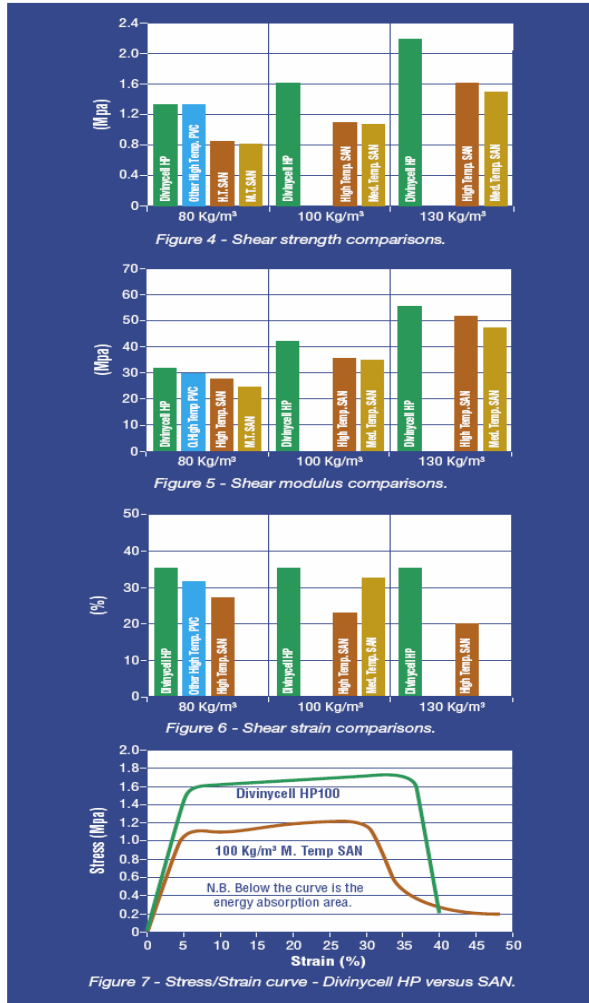
Espuma para procesos con sistemas de resina pre – impregnada con epoxi y temperaturas de post curado de hasta 130°C con puntas exotérmicas de hasta 160°C, con una excelente adherencia entre el núcleo y el laminado (peel strength).

Divinycell HP ha sido especialmente formulada para el sector eólico, para procesos con fibras preimpregnadas con resina epoxi. La temperatura de post curado puede ser de hasta 130°C durante un máximo de 2 horas; y la resistencia al deslaminado capaz de soportar los esfuerzos de palas de generadores eólicos de mas de 40 metros.



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Tablas comparativas Divinycell HP vs SAN.



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DÚCTIL

DIVINYCELL HD

Divinycell HD

Desarrollada para situaciones donde se requiere una excelente resistencia al impacto y pantocazos. Su estructura lineal le confiere gran ductilidad y elasticidad. Válida para procesos en los que la temperatura no excede los 80°C. Se encuentra disponible en cuatro densidades: 100, 130, 180 y 250 kg/m³. Puede operarse en temperaturas entre -200°C y +50°C sin debilitarse o degradarse. Es termoformable y autoextinguible. Para mejorar la adherencia entre el núcleo y el laminado se recomienda imprimir la superficie antes de la laminación. Resinas que contengan estireno deben ser catalizadas para proporcionar un máximo de 25 minutos de 'gel time'. Algunas aplicaciones son: embarcaciones de alta velocidad (no recomendada sobre la línea de flotación), piezas de automóviles de competición, tablas de surf y windsurf, etc.



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FERROVIARIO Y TRANSPORTE PÚBLICO

DIVINYCELL H – KLEGECELL R

Divinycell H
Klegecell R

También concebida para aplicaciones industriales, transporte y marinas. Disponible en densidades entre 45 y 200 kg/m³. Puede operar en temperaturas entre -200°C y 90°C sin debilitarse ni degradarse. Es termoformable y autoextinguible. Su clasificación según NF F16-101 es M1/F4 (según espesor). Las aplicaciones más corrientes son: trenes, tranvías, autobuses, metro; y en general los medios destinados al transporte de pasajeros.



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APLICACIONES SUBMARINAS Y BOYAS

DIVINYCELL HCP

Divinycell HCP

Concebida para proporcionar flotabilidad en aplicaciones submarinas, capaz de soportar presión de agua hasta 100 Bar. Su estructura parcialmente reticular, le confieren una gran elasticidad y una excelente resistencia al impacto. Sus aplicaciones mas corrientes son: submarinos, tuberías, boyas, estructuras de protección al impacto; para proporcionar flotabilidad y aislamiento.



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AISLANTE - TRANSPORTE GAS LÍQUIDO NITRÓGENO

KLEGECELL CY - DIVINYCELL IPN

Klegecell CY Desarrollada para su uso como aislante en depósitos de gas líquido, donde las temperaturas son extremadamente bajas.

Divinycell IPN Material aislante con baja permeabilidad al vapor de agua, para entornos de extremo frío a caliente.



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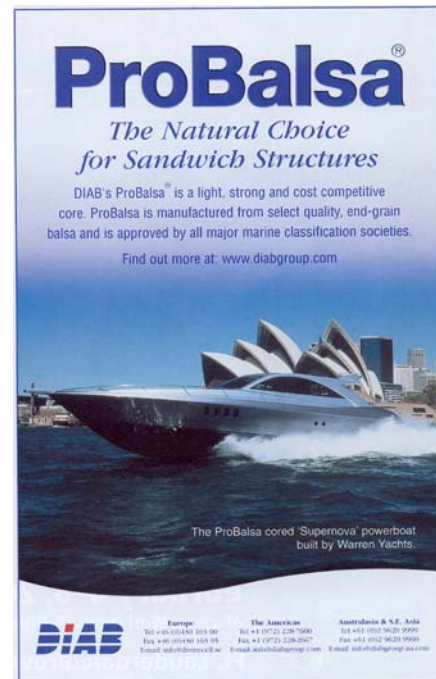
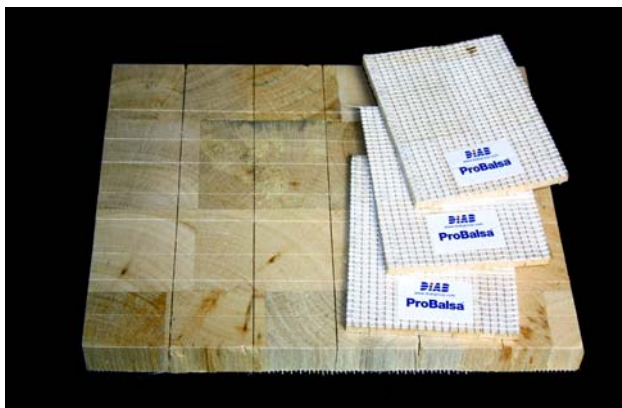
1.2 MADERA DE BALSAS

Pro Balsa es la madera de balsa del grupo Diab, secada al horno, adecuada para su uso como núcleo estructural en construcciones tipo sándwich. La madera de balsa es un recurso renovable, que proviene de plantaciones en Ecuador. De crecimiento rápido, entre 4 y 6 años, los árboles son cortados, secados en horno y seleccionados para ser convertidos en planchas de Pro Balsa de las tres distintas densidades disponibles. La orientación de las fibras, proporciona unas excelentes propiedades a la compresión y cizalla. Además se obtiene aislamiento térmico y acústico.

Pro Balsa Plus, es una versión en la que la superficie es imprimada para mejorar la facilidad de uso, reduciendo el tiempo de aplicación y la absorción de resina.



Los materiales para núcleo Pro Balsa se encuentran homologados por las principales sociedades de clasificación: American Bureau of Shipping, Lloyd's Register of Shipping, Det Norske Veritas, y Germanischer Lloyd's. Las aprobaciones implican que los productos Pro Balsa están reconocidos y cumplen con los requisitos estructurales de estas sociedades de clasificación.



ProBalsa®
*The Natural Choice
for Sandwich Structures*

DIAB's ProBalsa® is a light, strong and cost competitive core. ProBalsa is manufactured from select quality, end-grain balsa and is approved by all major marine classification societies.

Find out more at: www.diabgroup.com

The ProBalsa cored 'Supernova' powerboat built by Warren Yachts.

DIAB
CORPORATION

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1.3 PROCESADOS DISPONIBLES

PROCESADOS SOBRE HOJA LISA

Los bloques de espuma son cortados en hojas lisas (láminas) de distintos espesores según necesidad del cliente, con una tolerancia de ± 0.5 mm. Estas hojas pueden someterse a una serie de procesos, para adecuarse al uso para el que van a ser destinadas. Los principales acabados son:

GS El material es cortado en cuadrados de 30 x 30 (corte con cuchilla) o de 40 x 40 mm (corte con sierra), soportados mediante un tejido de fibra de vidrio ⁽¹⁾. Este acabado permite una excelente adaptación del material a superficies con curvatura en uno o dos sentidos.

Debido a que el corte se realiza en la totalidad del espesor, permite la salida del aire en la operación de encolado. Válido para espesores de hoja de 6 milímetros o mas.



K Mat o GSM El material es cortado con cuchilla en cuadrados de 10 x 10 mm, soportados mediante un tejido de fibra de vidrio ⁽¹⁾. Este acabado permite una excelente adaptación del material a superficies con curvatura en uno o dos sentidos.

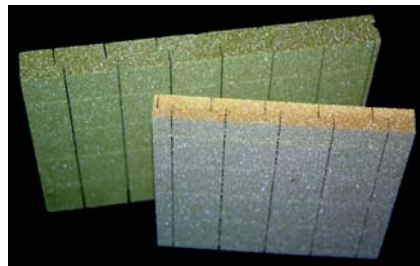
Debido a que el corte se realiza en la totalidad del espesor, permite la salida del aire en la operación de encolado. Válido para espesores inferiores a 6 milímetros.

(1) El soporte de fibra de vidrio no está pensado para su uso con resinas epoxídicas o fenólicas, puesto que el adhesivo empleado está basado en estireno. El resultado de su uso con estas resinas puede resultar en un detrimento de la adherencia entre el núcleo y el laminado.



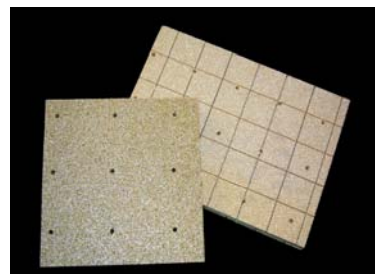
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DC **Doble corte.** El material es cortado por ambas caras en ambos sentidos, cada 40 mm. Los cortes penetran unos 2/3 del espesor, y los cortes están desplazados 20 mm entre ambas caras. El corte permite la salida del aire en la operación de encolado, y confiere un mayor grado de flexibilidad al material en un sentido.



PB **Perforada.** El material se perfora en orificios de 3 mm, distanciados 45 mm entre sí, para permitir la salida de aire.

La combinación DC PB, dan como resultado una plancha con doble corte y perforada, según las especificaciones anteriores.

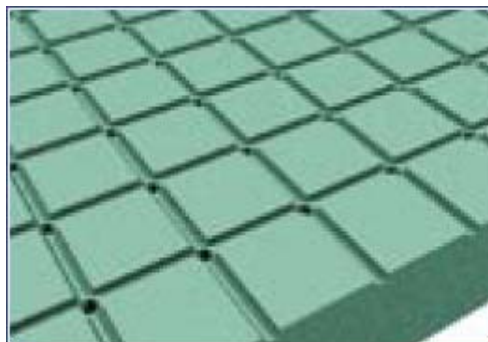


G **Grooved o Ranurado.**

La plancha puede ser suministrada con ranuras de 1 mm de ancho por 2 mm de profundidad, cada 50 o 100 mm; por una o ambas caras.



Infusión Para los sistemas de laminado mediante procesos de infusión, Diab ha elaborado diversos tipos de mecanizado y perforado en la espuma, para conseguir la rápida y homogénea distribución de la resina a través del laminado sin la necesidad de un medio conductor, abaratando el proceso.



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LISTONES DE ESPUMA CÓNCAVO-CONVEXO

CLP “Composite Light Plank” o listón cóncavo-convexo, de unos 2.5 mts de longitud por una variedad de anchuras y espesores. La selección del ancho viene determinado en función de la curvatura del casco.

Desarrollado para la construcción “One Off” o a la unidad, donde sobre unas cuadernas espaciadas entre 800 mm y 1.2 mts, se disponen los listones encolados con adhesivo. El laminado de la fibra se realiza siempre sobre el núcleo, asegurando de esta manera el buen contacto entre ambos componentes.



Solicite nuestro CD Rom “Strip Planking a one-off 73’ ”, para visualizar claramente el funcionamiento del sistema.

KITS

La espuma puede suministrarse cortado en kit, para adaptarse a una gran variedad de formas, incluyendo cascos y cubiertas de embarcaciones, trenes, palas y cabinas de molinos de viento, etc.

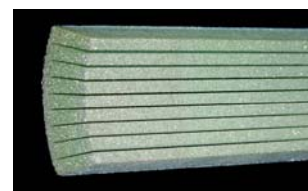
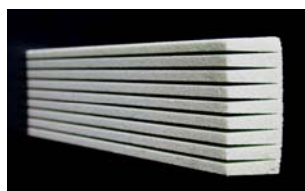
Las ventajas fundamentales son la reducción del tiempo de producción y del desperdicio de material.

El proceso de fabricación de kits puede incluir además del corte de las planchas en determinadas formas, el perforado, ranurado, termoformado, achaflanado, etc.



Cada kit viene entregado en una caja individual, con las piezas identificadas. Los kits pueden desarrollarse a partir de dibujos en CAD suministrados por el cliente, o a partir de plantillas obtenidas por nuestro personal técnico.

Para piezas de mayor elaboración, se dispone de máquinas de control numérico, para el corte y mecanización de piezas en 2D y 3D.

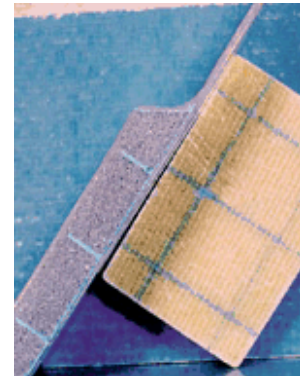


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1.4 ADHESIVOS PARA ENCOLAR EL NÚCLEO

Para que el concepto sándwich funcione correctamente, es de vital importancia la unión entre el núcleo (espuma) y las pieles (laminado). La falta de adherencia o deslaminación entre ambas partes, implica una importante reducción de las propiedades estructurales.

Como resultado de la demanda por parte de los constructores de disponer de un adhesivo fiable y homologado por las sociedades clasificadoras, Diab ha desarrollado una variedad de adhesivos basados en resinas poliéster y viniléster; para el encolado de la espuma al laminado catalizado.



Algunas de las características de estos adhesivos, son las siguientes:

- La resina está coloreada de forma que resulta fácilmente visible su penetración por los cortes de la espuma, asegurando la adherencia entre ambos laminados.
- Su viscosidad, que puede ser modificada según la temperatura ambiente a la que se trabaje, permite una fácil circulación al aplicar presión por vacío.
- Existen espátulas y medidores de espesor, que facilitan la medición y aplicación de la cantidad de adhesivo necesario. La falta del mismo podría producir zonas de pobre o nula adherencia; y el exceso un coste innecesario.

Tipos disponibles:

- Divilette 600
- Divilette SQ
- Divilette NQ G1
- Divilette NQ G1 HV
- Pro Bond



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Divilette 600

Es un adhesivo de baja viscosidad, comunmente empleado con Divinycell[®] y Klegecell[®] GSW. Se recomienda su aplicación mediante espátula calibrada y su consolidación mediante vacío (especialmente en superficies no horizontales).

Divilette SQ - Divilette NQ G1

Adhesivos de media viscosidad, principalmente empleados para uniones estructurales de mamparos y "butt joints" (uniones en ángulo recto).

Divilette NQ G1 HV

Adhesivo de alta viscosidad para construcciones avanzadas.

Los materiales mencionados han sido homologados como "adhesivos para núcleo" por las siguientes Sociedades de Clasificación:

- [Det Norske Veritas](#) (DNV)
- Lloyds Register of Shipping (LRS)
- Germanische Lloyds (GL)
- [Korean Register of Shipping](#) (KRS)
- Nippon Kaiji Kyokai (NKK)
- Bureau Veritas (BV)
- [American Bureau of Shipping](#) (ABS)
- Registro Italiano Navale (RINA)

Los cuatro tipos de Divilette[®], se caracterizan por su baja densidad, baja exotermia y buenas propiedades a tracción.

Existen fichas técnicas y de seguridad de todos los productos. No dude en solicitarlas.

Pro Bond[®]

ProBond es un adhesivo ligero de base poliéster que contiene microesferas; desarrollado específicamente para ser usado con ProBalsa[®]. ProBond se caracteriza por su baja densidad, baja exotermia y buenas propiedades a tracción. Puede ser aplicada fácilmente con pistola o bien mediante espátula.

ProBond está aprobada por el American Bureau of Shipping.



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1.5 REFERENCIAS DE APLICACIONES

- Náutica Deportiva, naval, oceanográfica, pesca y militar
- Eólico Palas y carcasas
- Transporte Ferroviario, autobuses, camiones frigoríficos, etc
- Industria Unidad de radar, depósito de compost, ópera de Gotemburgo, cabina simuladora, contenedor militar 20', coche de bomberos, etc
- Depósito LNG Depósitos de gas líquido nitrógeno y metaneros.

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2. FIBRAS TÉCNICAS CARBONO, ARAMIDA, VIDRIO Y POLIETILENO

Seal es una compañía químico textil, líder en la producción de sistemas con materiales compuestos, para protección balística y estructuras en materiales compuestos avanzados. Para la elaboración de sus productos, se emplean las siguientes materias:

- Fibras de carbono
- Fibras de vidrio
- Fibras aramida (Kevlar[®], Twaron[®])
- Polietileno H.T. (Dyneema[®])
- PBO (Zylon[®])

Así como la combinación entre ellas para obtener híbridos con características específicas.

Las cinco líneas de producción son:

- **Texindustria[®]** Productos elaborados con carbono, vidrio y aramida; para el sector náutico, aplicaciones deportivas, herramientas de maquinaria, automóvil, aeronáutica, ferroviario, robots, biomedicina, ingeniería civil y construcción
- **Texipreg[®]** Productos elaborados con carbono, aramida y vidrio, pre impregnados con resinas epoxy, fenólicas y viniléster. Las aplicaciones mas comunes son: deportivas, cañas de pescar, herramientas de maquinaria, robotica, protección balística, automóvil, aeronáutica, ferroviario y biomedicina.
- **Saatilar[®]** Productos para protección balística y resistentes al fuego. Las aplicaciones mas comunes son: chalecos antibalas, cascos para policía y ejército, mantas antibalas y refuerzos estructurales.
- **Texilar[®]** Paneles para protección balística y reducción de impacto. Para chalecos antibalas, protección de armamento, blindaje (vehículos, tanques, aviones, barcos)
- **Concreflex[®]** Productos innovadores para construcción y restauración de edificios, a base de productos de vidrio, aramida y carbono con adhesivos epoxy. Las ventajas principales son un menor peso, alta resistencia a presión y tracción, etc

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2.1 REFUERZOS TEXINDUSTRIA®: FIBRAS, TEJIDOS, MULTIAXIALES Y BANDAS

FIBRA DE VIDRIO

TIPOS DE VIDRIO

Según la variación de los componentes que forman el vidrio, existen tres tipos empleados para refuerzos estructurales:

- Vidrio E Es el mas comúnmente empleado. Tiene buenas propiedades eléctricas, buena resistencia a tracción, compresión y rigidez. Mala resistencia al impacto y precio bajo.
- Vidrio C Tiene buena resistencia al ataque químico, empleado principalmente como velo de superficie o en las capas interiores de laminados de depósitos y tuberías.
- Vidrio R También denominado S o T, según el fabricante. Son fibras de vidrio con valores de resistencia a tracción y módulo superiores al vidrio E. El menor diámetro del filamento facilita la impregnación y mejora las propiedades mecánicas. Desarrollado para aplicaciones de protección balística y aeronáutica.

FICHAS DE PRODUCTOS

Consultar las Fichas de Productos disponibles siguientes:

- Tejidos en Fibra de vidrio Tejidos en vidrio E desde 24 gr/m2 hasta 770 gr/m2, balanceados y no balanceados.
- Tejidos en vidrio R de 250 gr/m2 y 500 gr/m2, no balanceados.
- Multiaxiales Biaxiales balanceados $-45^{\circ}/+45^{\circ}$ y $0^{\circ}/90^{\circ}$, en vidrio E, entre 300 y 900 gr/m2.
- Triaxial $0^{\circ}/-45^{\circ}/+45^{\circ}$, en vidrio E, de 600 y 900 gr/m2. El de 900 puede suministrarse con un mat cosido de 300 gr/m2, para obtener un combinado de 1200 gr/m2.
- Triaxial $-45^{\circ}/90^{\circ}/+45^{\circ}$, en vidrio E, de 825 gr/m2.
- Cuadriaxial $0^{\circ}/-45^{\circ}/90^{\circ}/+45^{\circ}$, en vidrio E, de 1160 gr/m2.; y de 640 gr/m2 con un mat cosido de 100 gr/m2, para obtener un combinado de 740 gr/m2.
- Bandas Bandas en vidrio E, de 200 y 1034 gr/m2; desde 50 a 120 mm de anchura

Todos los productos pueden ser suministrados impregnados con los diversos sistemas de resina (ver Ficha de Productos Pre Impregnados).

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ARAMIDA

Las fibras aramidadas son poliamidas aromáticas, de color amarillo brillante. Se caracterizan por su alta resistencia, baja densidad y buena resistencia al impacto así como una buena resistencia a la abrasión, química y degradación térmica. Sin embargo su resistencia a la compresión es sólo similar a la del vidrio E.

Los nombres comerciales más corrientes son Kevlar®, de la casa DuPont; y Twaron® de Akzo Nobel. Están disponibles en forma de roving.

FICHAS DE PRODUCTOS

Consultar las Fichas de Productos disponibles siguientes:

Tejidos en Aramida	Tejidos de fibra Aramida Kevlar 49® – DuPont, desde 61 gr/m2 hasta 520 gr/m2, balanceados y no balanceados.
Multiaxiales	Biaxiales balanceados $-45^{\circ}/+45^{\circ}$, de fibra Aramida, de 450 gr/m2.
	Triaxial $-45^{\circ}/90^{\circ}/+45^{\circ}$, de fibra Aramida, de 360 gr/m2.
	Cuadriaxial balanceado $0^{\circ}/-45^{\circ}/90^{\circ}/+45^{\circ}$, de fibra Aramida, de 360 gr/m2.
Bandas	Bandas de fibra Aramida, de 175 y 200 gr/m2; desde 50 a 120 mm de anchura

Todos los productos pueden ser suministrados impregnados con los diversos sistemas de resina (ver Ficha de Productos Pre Impregnados).

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CARBONO

La mayoría de las fibras de carbono provienen de un poliacrilonitrilo (PAN), pudiendo obtenerse fibras desde alta resistencia (a 2.600°C) hasta las de alto módulo (a 3.000°C); y generalmente se agrupan de la siguiente forma:

Alta Resistencia	HS	Modulo estándar < 190 GPa
Alto Módulo	HM	190 – 260 GPa
Ultra Alto Módulo	UHM	> 260 GPa

La fibra de carbono tiene la mayor resistencia específica de las fibras disponibles en el mercado, una alta resistencia a tensión y compresión y una alta resistencia a la corrosión y fatiga. Sin embargo la resistencia al impacto es menor que la fibra de vidrio o aramida, siendo el HM y UHM particularmente frágiles o quebradizos.

FICHAS DE PRODUCTOS

Consultar las Fichas de Productos disponibles siguientes:

Tejidos en Fibra de Carbono	Tejidos en fibra de Carbono desde 94 gr/m2 hasta 920 gr/m2, balanceados y no balanceados, con distintos módulos: HS 1K, HS 3K, HS 6K, HS 12K y HM 55J 6K. Tejidos en fibra de Carbono y Poliéster, de 206 y 480 gr/m2, en 3K, 12K y 334(PES).
Multiaxiales	Biaxiales balanceados $-45^{\circ}/+45^{\circ}$, en carbono, entre 300 y 600 gr/m2. Triaxial balanceado $-45^{\circ}/90^{\circ}/+45^{\circ}$, en carbono, de 900 gr/m2.
Bandas	Bandas en carbono, de 200 gr/m2; desde 50 a 120 mm de anchura. Bandas unidireccionales desde 200 hasta 1000 gr/m2, en 3, 6 y 12K, y soporte de vidrio o poliéster.

Todos los productos pueden ser suministrados impregnados con los diversos sistemas de resina (ver Ficha de Productos Pre Impregnados).

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POLIETILENO

Las fibras de polietileno, tienen unas propiedades mecánicas algo superiores a la fibra de vidrio E, pero inferiores a las del aramida o carbono. La dificultad de crear un buen laminado, hace que estas fibras no se usen de manera aislada sino en forma de híbrido. La marca comercial mas conocida es Dyneema®.

FICHAS DE PRODUCTOS

Consultar las Fichas de Productos disponibles siguientes:

Tejidos en Dyneema® SK 60	PE Alto Módulo. Tejidos balanceados de 166 gr/m2 y 190 gr/m2.
Tejidos en Dyneema® SK 65	PE Alto Módulo. Tejidos balanceados de 84 gr/m2 y 150 gr/m2.
Tejidos en Dyneema® SK 66	PE Alto Módulo. Tejidos balanceados de 150 gr/m2 y 325 gr/m2.

Todos los productos pueden ser suministrados acoplados con film termoplástico de 12, 30 y 60 µm.

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HIBRIDOS

Los híbridos, son productos que combinan fibras diferentes con el objetivo de obtener un resultado que se ajuste mejor a las necesidades requeridas.

FICHAS DE PRODUCTOS

Consultar las Fichas de Productos disponibles siguientes:

Tejidos Híbridos	Carbono - Aramida (CK). Combinación de carbono 3K o 12K con aramida 21.5, 127 o 158. Gramajes desde 151 hasta 435 gr/m2. Vidrio E – Aramida (EA). Combinación de vidrio E con aramida. Gramajes desde 72 hasta 466 gr/m2. El EA 390, puede suministrarse con un mat de 225 gr/m2 cosido. Vidrio – Polietileno (PE). Combinación de vidrio E con Dyneema®. Gramajes de 255 y 298 gr/m2.
Híbridos Unidireccionales	Carbono – Vidrio E (CG). Combinación de carbono 3K, 6K o 12K con vidrio. Gramajes desde 125 hasta 600 gr/m2. Aramida - Vidrio E –(KG). Combinación de vidrio E con aramida. Gramajes de 205 y 295 gr/m2.
Multiaxiales Híbridos	Biaxial balanceado $-45^{\circ}/+45^{\circ}$ Carbono – Vidrio E (CEBX) de 180 gr/m2 (22% carbono – 78 % vidrio). Biaxial balanceado $-45^{\circ}/+45^{\circ}$ Aramida - Vidrio E –(KEBX). Combinación de vidrio E con aramida de 390 gr/m2 (22% aramida – 78% vidrio). Puede suministrarse con un mat de 250 gr/m2 cosido.

Todos los productos pueden ser suministrados impregnados con los diversos sistemas de resina (ver Ficha de Productos Pre Impregnados).

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NOMENCLATURA

Tipos de fibra:

C	Carbono
E	Vidrio E (nomenclatura anterior: R)
R	Vidrio R o S
A	Aramida (Kevlar 49® o Twaron HM®) (nomenclatura anterior: K)
P	Polietileno (Dyneema®)

Vocabulario del tejido:

WARP	Urdimbre
WEFT	Trama
WEAVE	Tejido
STRAND	Hebra
YARN	Hilado
ROVING	Hilo de vidrio
Tex	Peso en gramos por cada 1000 mts lineales

Tipos de tejido:

PLAIN	Llano
TWILL 2/2	Cruzado cada dos en ambos sentidos
TWILL 3/1	Cruzado
TWILL 4/4	Cruzado cada cuatro en ambos sentidos
5 H SATIN	Satén
8 H SATIN	Satén
HS	High Tensile Strength
HM	High Modulus

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2.2 REFUERZOS TEXIPREG®: PRE IMPREGNADOS EPOXY Y FENÓLICOS

Esta línea de producción abarca los tejidos, multiaxiales y unidireccionales de Texindustria y Saatar, impregnados con los distintos sistemas de resinas epoxy y fenólicas.

Las fibras son impregnadas con una resina pre-catalizada, mediante una máquina. A temperatura ambiente, estos sistemas reaccionan muy lentamente, proporcionando un tiempo de trabajo entre varios días y algunos meses. Para conseguir un curado completo, deben calentarse a la temperatura prescrita.

Estos sistemas permiten el uso de resinas de alta viscosidad y propiedades mecánicas, que no sería posible impregnar en un sistema húmedo manual.

SISTEMAS DE RESINAS

Los distintos sistemas están resumidos en la Ficha de Productos de Sistemas de Resinas.

Los datos que aparecen en esta ficha son los siguientes:

Resina	Tipo de resina empleada para el pre impregnado: epoxy o fenólica.
Presión	Presión durante el ciclo de curado, en bar.
Temperatura	Temperatura durante el ciclo de curado, en °C. Algunas resinas tienen diversas temperaturas en función del tiempo.
Tiempo	Tiempo del ciclo de curado, en °C. Varía en función de la temperatura.
Tg	Tg o "Glass Transition Temperature", en °C. Es la temperatura a la que una resina curada se vuelve semi flexible, viendo reducidas sus propiedades mecánicas.
Vida	Vida útil del material a 20°C (en días) y a -18°C (en meses).
Características	Tipo de acabado superficial, rango de temperatura de polimerización, resistencia al fuego, etc.
Aplicaciones	Mercados para los que está previsto cada producto: automóvil, artículos deportivos, náutica, naval, industrial, ferroviario, médico, aeronáutica, moldes, etc.

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UNIDIRECCIONALES PREIMPREGNADOS DE ALTA RESISTENCIA Y ALTO MÓDULO

Los unidireccionales disponibles en Alta Resistencia (HS), Alto Módulo (HM) y Ultra Alto Módulo (UHM), están resumidos en las Fichas de Productos.

Los datos que aparecen en esta ficha son los siguientes:

Artículo	Tipo de resina empleada para el pre impregnado: epoxy o fenólica.
Ancho	Anchura del rollo, en cm.
Peso seco	Peso de la fibra, su soporte y el total, en gr/m2 según UNI 5114-82.
Contenido de Resina	En porcentaje de peso.
Peso total	Peso de la fibra y de la resina.
Espesor	Espesor del laminado, en mm según ISO 5084.
Características mecánicas	A tracción, según ASTM D 3039-76; resistencia en Mpa, módulo en Gpa y elongación en %. A flexión, según ASTM D 790-90; resistencia en Mpa y módulo en Gpa.
I.L.S.S.	Según ASTM D 2344-84; en Mpa.

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2.3 FICHAS DE PRODUCTOS

- Tejidos en fibra de vidrio
- Tejidos en aramida
- Tejidos en carbono
- Tejidos en Dyneema
- Bandas en vidrio, aramida, carbono e híbridos
- Tejidos híbridos
- Híbridos unidireccionales
- Multiaxiales
- Sistemas de resinas para pre-impregnados
- Unidireccional pre-impregnado de carbono HS
- Unidireccional pre-impregnado de carbono HM y UHM

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3. MADERAS

3.1 TECA BIRMANA

- Envío directos de tronco desde Birmania.
- Boul
- Tablón
- Tablilla Golden sin defectos. 1ª Calidad.
- Chapa decorativa de 1ª Calidad
- Tableros de teca maciza calafateada. Diferentes tamaños y espesores.



(Cubierta de Teca realizada por Futurnautic. Listones de 65x18mm. y de 5 a 6,5 metros de largo)

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3.2 TABLEROS

- **Tableros marinos.** Todos los paneles responden rigurosamente a las normas internacionales más estrictas.
Clase II según la norma europea.
- **Tableros decorativos** para el acondicionamiento y decoración de interiores de barcos de recreo, aportando la riqueza y el calor de la madera (escaleras, cocinas, literas, cuartos de baño). Además de los paneles estándar, pueden ser cortados a la medida deseada, según pedido.
- **Paneles sándwich PVC** Este tipo de producto permite mejorar las construcciones, aligerar el peso hasta el 80 % con respecto a un contrachapado, y aumentar el rendimiento de los barcos.

La espuma PVC se utiliza como alma en la fabricación de estructuras sándwich. Ocupa un puesto único en el mercado internacional de materiales compuestos por varias razones:

- Espuma de celdas cerradas con una estructura de redes tridimensionales que le otorgan una estabilidad dimensional y térmica.
- Excelentes propiedades mecánicas. Los valores de aislamiento son constantes gracias a un control muy preciso del procedimiento de expansión que permite disponer de celdas cerradas al 100 % e impermeables.
- No soporta la combustión y se apaga espontáneamente.

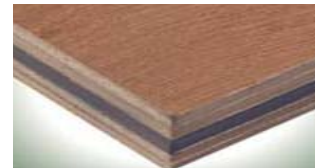
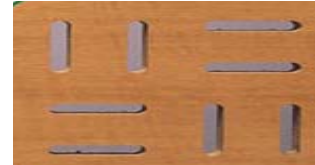
Clasificación al fuego M1.

- No contiene gas freón.
- Resistencia a los hidrocarburos, álcalis, ácidos, alcohol metílico, agua de mar, gasolina y gasoil, y puede ser empleada con resinas de poliéster, vinilester y epoxi.
- Sin CFC.



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- **Tableros industriales**, perforados, con núcleo de plomo, para revestimiento de paredes, antirotura, ...
- Para carrocerías, cámaras frigoríficas, aislamiento acústico y contra las radiaciones (entorno médico, hospitalario y radiológico, electrónica, militar, sala de motores...).
- **Tableros flexibles**
 - Contrachapado desenrollado curvable; fabricado en madera de fromager (Ceiba), para la preparación de elementos curvados.
 - Contrachapado de 2mm. y 3 capas, para ser curvado. Disponibles en madera de Teca - Roble - Haya blanca - Olmo - Cerezo Americano - Arce moteado - Zebrano,...



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4. COMPLEMENTOS

4.1 APLICADOR DE ADHESIVO HOT MELT EN SPRAY

VAC – TAC es un sistema de adhesivo hotmelt único, libre de componentes solubles, y con un poder de fijación muy superior al de aerosoles tradicionales. Este sistema ha sido desarrollado específicamente para la sujeción de fibras, núcleos de espuma y madera de balsa, tejidos pelables, films separadores, redes de distribución...

Gracias a su “ventana de secado” de 5 minutos, los materiales pueden ser ajustados y posicionados cuidadosamente, ofreciendo mucha más flexibilidad al usuario.

El adhesivo se aplica con la pistola neumática TEC 6300, con la posibilidad de regular la salida en forma de spray, más o menos denso, de forma que se adapta perfectamente a las necesidades particulares de cada trabajo. No hay desperdicio de material, ni obturación de la boquilla, ya que el adhesivo se deshace de nuevo cada vez que se conecta la TEC 6300.



Una vez posicionados los materiales de refuerzo, podemos sujetar los tubos de espiral, entrada de resina, conos o bases fácilmente, ahorrando mucho tiempo es esta parte del proceso. Para este proceso se puede utilizar la pistola TEC 700, con aplicador en forma de cordón. Es una pistola más liviana y manejable, que se utiliza con el adhesivo CABLE-TAC. También puede utilizarse la TEC 6300 con el adhesivo VAC TAC si se desea.



Los aerosoles tradicionales pueden comportar serios riesgos de salud y/o medioambientales. Con el nuevo adhesivo VAC-TAC, no solo se solucionan los problemas de salud y medioambiente al no tener materiales solventes, sino que además se eliminan problemas de transporte y almacenaje.



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El VAC-TAC System tiene varias ventajas sobre otros adhesivos convencionales:

- Notablemente más económico que los spray convencionales.
- Alta adherencia, precisa de menor cantidad de adhesivo que las alternativas existentes.
- Respetuoso con el medio ambiente. Libre de materiales solventes, no contiene gas ni genera materiales descartables.
- No tiene fecha de caducidad.

El VAC_TAC System comprende:

- TEC 6300 aplicador neumático
- Cables de alimentación de 6 metros.
- Caja de transporte
- Adhesivo VAC-TAC.



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4.2 EQUIPO AUXILIAR

Todos los útiles necesarios para el proceso de infusión y vacío.

- **Trampas de resina.** Fundamentales para el proceso de infusión, evitan que la resina pueda llegar a la bomba de vacío, asegurando la buena conservación del equipo.
- **Detector de fugas.** Herramienta ideal para la detección de fugas de aire en la pieza, agujeros en la bolsa de vacío o bien defectos en el sellado de la misma.
- **Bombas de vacío.** Capaces de generar el vacío necesario para el proceso de infusión. Estas deben estar dimensionadas al tamaño de la pieza que queramos infundir. Pueden estar dotadas de un tanque, que nos permitirá almacenar vacío.
- **Reguladores de presión.** Nos permitirán regular la potencia del vacío que queremos aplicar en la pieza, dependiendo del momento del proceso.
- **Válvulas vacío y enchufes rápidos.** Gracias a estas válvulas y enchufes rápidos podremos realizar las conexiones entre las mangueras y la bomba de vacío así como con las trampas de resina de forma segura y rápida.
- **Tijeras ergonómicas de alto rendimiento** para aramida y vidrio. Imprescindibles para cortar cómodamente y sin esfuerzo cualquier tipo de tejido. Con el recambio de hojas especiales para cortar aramida podremos cortar esta incómoda fibra sin complicaciones.



4.3 MATERIALES DESCARTABLES

- **Masillas de sellado “Tacky-tape”**

- **ST 90** Masilla para procesos de hasta **121°C**.
Medidas 1.6x9.5mm.
Cajas de 20 rollos (300m/lin). Rollos de 15 m/lin.
Color negro.
- **AT 200 Y** Masilla para procesos de hasta **204°C**.
Medidas 3.2x19mm.
Cajas de 40 rollos (304m/lin). Rollos de 7.62 m/lin.
Color negro.



- **Tejidos pelables “Peel.ply”**

- Rollos de diferentes anchos y largos para adaptarse a las necesidades de cada pieza. También disponible en bandas. Este tejido pelable nos permitirá obtener una superficie homogénea y lista para procesos posteriores, ya sea de laminado o pintado, evitando la siempre incómoda tarea del lijado.



- **Films separadores perforados y no perforados**

- Diferentes tipos, en ancho 1,52 mt. y 25 micrones, tanto perforados como sin perforar.

- **Bolsas de vacío**

- Amplia gama con anchos desde 1,52 mt. hasta 12,00 mt. Y espesores desde 37 hasta 70 micrones. Bolsas tubulares y semitubulares.



- **Redes de distribución**

- Sencillas compuestas y de alta velocidad. Disponibles en anchos desde 1,04 mt. hasta 3,66 mt.

- **Tubos polietileno para infusión**

- Disponibles en ¼', ½', ¾' y 1'. Permitirán la conducción del vacío, y la entrada de resina.



- **Tubos polietileno en espiral para infusión**

- Disponibles en ¼', ½'. Permiten la aspiración del aire de la pieza.

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- **Mangueras de vacío anticolapso**

- Disponibles en ½', ¾' y 1'. Evitan que la manguera se colapse. Normalmente se utilizan para la entrada de resina a la pieza.

- **Cintas**

- Cintas de poliéster para alta temperatura.
- Cinta multiuso para alta temperatura.
- Cinta de teflón.
- Cinta de presión.
- Cinta de presión doble cara.

- **Conexiones en T y L**

- Para la unión entre diferentes tubos de espiral y/o mangueras.



Divinycell H Grade can be used for the vast majority of composite applications where both hand laminating and closed moulding processes such as infusion are employed. With the upgraded H Grade, major improvements have been made in all critical performance areas. Strength properties have been increased by an average of 10% whereas the shear properties have seen even higher gains. Elongation to break has risen by up to 50% and the ductility has also been markedly improved. Both the thermal and dimensional stability have also seen significant improvements. Divinycell H can now be processed at up to 90°C with minimal dimensional changes. The chemical resistance has also been enhanced. Another major improvement is a reduction in the core's cell size. Divinycell H is available in a very wide range of densities as standard sheets or fabricated to customers specification as kits.

Technical Data for Divinycell H Grade

 = Preliminary Technical Data

Property	Unit	H 45	H 60	H 80	H 100	H 130	H 160	H 200	H 250
Nominal Density ISO 845	Kg/m ³	48	60	80	100	130	160	200	250
Compressive Strength* ASTM D 1621	MPa	0.6	0.9	1.4	2.0	2.9	3.4	4.5	5.8
Compressive Modulus* ASTM D 1621	MPa	50	70	90	130	170	230	310	400
Tensile Strength* ASTM D 1623	MPa	1.4	1.9	2.5	3.4	4.7	5.4	7.0	8.8
Tensile Modulus* ASTM D 1623	MPa	55	75	95	140	170	170	230	300
Shear Strength ASTM C 273	MPa	0.56	0.8	1.2	1.6	2.2	2.6	3.3	4.5
Shear Modulus ASTM C 273	MPa	18	22	30	40	50	73	90	108
Shear Strain ASTM C 273	%	12	20	30	35	35	30	30	30
Thermal Conductivity (+20°C) ASTM C 518	W/Mk	0.030	0.030	0.030	0.033	0.033	0.033	0.033	0.033

* Perpendicular to the plane. All values measured at +23°C.

Continuous operating temperature is -200°C to +70°C. The foam can be used in sandwich structures, for outdoor exposure, with external skin temperatures up to +85°C. Operating conditions must be taken into consideration for the very low and high temperatures. Maximum processing temperature is dependent on time, pressure and process conditions. Normally Divinycell H can be processed up to +90°C with minor dimensional changes. Please contact DIAB for advice before use. Coefficient of linear expansion ASTM D 696: Approx. 45 x 10⁻⁶/°C

Klegecell R Grade offers cost-effective performance for the vast majority of sandwich applications where there is a need for a lightweight/high strength core material. It offers an outstanding strength to weight ratio, excellent ductility properties, good dimensional stability, excellent moisture resistance and good thermal properties.

It is available in a wide range of densities (45 to 200 kg/m³) to enable designers, engineers and builders to choose the most appropriate material for their specific application.

Technical Data for Klegecell R Grade

■ = Preliminary Technical Data

Property	Unit	R 45	R 60	R 80	R 100	R 130	R 200
Nominal Density ISO 845	Kg/m ³	48	60	80	100	130	200
Compressive Strength* ASTM D 1621	MPa	0.58	0.85	1.35	1.90	2.80	4.70
Compressive Modulus* ASTM D 1621	MPa	50	70	90	120	160	440
Tensile Strength ASTM D 1623*/ ISO 1926**	MPa	1.3*	1.8*	2.3*	3.3*	4.6*	6.1**
Tensile Modulus ASTM D 1623*/ISO 1926**	MPa	55*	75*	95*	130*	160*	215**
Shear Strength ASTM C 273	MPa	0.54	0.75	1.15	1.55	2.15	3.00
Shear Modulus ASTM C 273	MPa	17	21	28	38	45	85
Shear Strain ASTM C 273	%	11	20	28	33	33	NA
Thermal Conductivity +20°C ASTM C 518	W/Mk	0.03	0.03	0.03	0.033	0.033	0.04

* Perpendicular to the plane.

**Parallel to the plane

All values measured at +23°C.

Continuous operating temperature is -200°C to +70°C. Operating conditions must be taken into consideration for the very low and high temperatures. Maximum processing temperature is dependent on time, pressure and process conditions. Normally Klegecell R can be processed up to +80°C with minor dimensional changes. Please contact DIAB for advice before use.

Coefficient of linear expansion ASTM D 696: Approx. 45 x 10⁻⁶/°C



www.diabgroup.com

This data sheet may be subject to revision and changes due to development and changes of the material. The data is derived from tests and experience. The data is average data and should be treated as such. Calculations should be verified by actual tests. The data is furnished without liability for the company and does not constitute a warranty or representation in respect of the material or its use. The company reserves the right to release new data sheets in replacement.



Divinycell[®]

DATA SHEET

HT

GRADE

*High performance
core material
for sandwich construction*

Divinycell®

HT Grade

THE ULTIMATE CORE FOR SANDWICH CONSTRUCTION

Divinycell has a unique position in the international composite market as a core material in multifunctional sandwich constructions. The Divinycell HT grade in this folder is used in a wide range of compatibility and in high temperature applications where there is a need for a strong, lightweight construction material with excellent mechanical characteristics.

Divinycell HT is widely used and found in e.g. helicopter rotor blades, aircraft (interior and exterior), and temperature loaded constructions. Divinycell HT grade is available in a range of densities as standard sheets or fabricated to customer specification.

Divinycell HT Sandwich Core Material

Average properties for the nominal density and minimum values within the brackets for the minimum density. All values are measured at +23°C.

Property	Unit	HT 50	HT 70	HT 90	HT 110
Density - nominal*		50	70	90	110
Density - maximum*	kg/m ³	55	77	99	121
Density - minimum*		45	63	81	99
Compressive Strength** ASTM D 1621	MPa	0.7 (0.6)	1.15 (1.0)	1.6 (1.4)	2.1 (1.9)
E-modulus** Crosshead Movement ASTM D 1621	MPa	30 (20)	44 (38)	65 (55)	78 (58)
E-modulus** Extensometer ASTM D 1621	MPa	75 (60)	100 (80)	125 (100)	175 (150)
Tensile Strength** ASTM D 1623	MPa	1.5 (1.0)	2.1 (1.6)	2.7 (2.2)	3.3 (2.8)
Tensile Strength*** ISO 1926	MPa	0.9 (0.7)	1.5 (1.2)	2.0 (1.6)	2.5 (2.0)
Shear Strength*** ASTM C 273	MPa	0.55 (0.4)	0.9 (0.7)	1.25 (1.1)	1.6 (1.4)
Shear Modulus*** ASTM C 273	MPa	19 (13)	26 (18)	33 (26)	40 (35)
Shear Strain*** ASTM C 273	%	13 (6)	17 (10)	21 (15)	25 (15)
Dimension Stability - L/W 120°C, 1 hour T	%	≤ 1 ≤ 3	≤ 1 ≤ 3	≤ 1 ≤ 3	≤ 1 ≤ 3

* = Measured on maximum size, trimmed blocks with a typical thickness of 50-70 mm. Sheets, especially in low thickness, may have lower or higher density than specified above. Low density sheets will still meet the minimum properties stated above.

** = Perpendicular to the plane.

*** = Parallel to the plane.

Operating temperature is -200°C to +90°C. Lifetime must be taken into consideration for the very low and high temperatures. Maximum processing temperature is dependent on time, pressure and process conditions. Normally Divinycell HT can be processed up to 120°C without dimensional changes. Please contact DIAB for advice before use.

Coefficient of linear expansion ASTM D 696:

Approx. $35 \cdot 10^{-6}/^{\circ}\text{C}$

Poissons ratio:

0.32

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Divinycell HP has been developed to be fully compatible with low and medium temperature prepreg and RFI systems. Divinycell HP's elevated temperature performance also extends to its 'in service' life as it will retain a high percentage of its mechanical properties despite exposure to high ambient temperatures.

The mechanical properties of HP have not been compromised in order to achieve its elevated temperature performance. It offers higher values than other commonly used 'elevated temperature cores' in all significant areas including its shear and strength properties, elongation to break, ductility, peel strength, fracture toughness and dimensional stability.

Technical Data for Divinycell HP Grade

= Preliminary Technical Data

Property	Unit	HP 80	HP 100	HP 130
Nominal Density ISO 845	Kg/m ³	80	100	130
Compressive Strength* ASTM D 1621	MPa	1.55	2.0	3.0
Compressive Modulus* ASTM D 1621	MPa	105	140	170
Tensile Strength* ASTM D 1623	MPa	2.8	3.5	4.8
Tensile Modulus* ASTM D 1623	MPa	105	145	175
Shear Strength ASTM C 273	MPa	1.3	1.6	2.2
Shear Modulus ASTM C 273	MPa	32	41	55
Shear Strain ASTM C 273	%	35	35	35

* Perpendicular to the plane. All values measured at +23°C.

Continuous operating temperature is -200°C to +80°C. The foam can be used in sandwich structures, for outdoor exposure, with external skin temperatures up to +90°C. Operating conditions must be taken into consideration for the very low and high temperatures. Normally Divinycell HP can be processed up to +130°C with peaks up to +160°C with minor dimensional changes. Maximum processing temperature is dependent on time, pressure and process conditions. Please contact DIAB for advice before use.





Divinycell[®]

TECHNICAL
SPECIFICATION

HD
GRADE

*High performance
core material
for sandwich construction*

Divinycell HD Grade

THE ULTIMATE CORE FOR DYNAMIC LOADED SANDWICH CONSTRUCTION

Divinycell has a unique position in the international composite market as a core material in multifunctional sandwich constructions. The Divinycell HD grade in this folder is intended for use in primary marine structures subjected to extreme slamming or shock loading. Divinycell HD is not intended for use above the waterline. To improve the adhesion between the core and the laminate and to produce a defect free bondline, DIAB recommends resin priming of the Divinycell HD surface prior to lamination. Primer resins containing styrene should be catalysed to achieve a maximum of 25 minutes gel time on the foam surface to prevent styrene migration. Please contact DIAB for further information.

Divinycell HD Sandwich Core Material Average Physical Properties

Quality		HD 100	HD 130	HD 180	HD 250
Density ASTM D 1622	kg/m ³	100	130	180	250
	lb/ft ³	6.1	8.0	11.0	15.3
Compressive Strength* ASTM D 1621	MPa +23°C	1.3	2.1	3.5	5.8
	Psi +72°F	190	305	510	840
Compressive Modulus* ASTM D 1621	MPa +23°C	90	140	220	355
	Psi +72°F	13,050	20,300	31,900	51,475
Tensile Strength* ASTM D 1623	MPa +23°C	2.1	3.2	5.4	8.7
	Psi +72°F	305	465	785	1,260
Tensile Modulus* ASTM D 1623	MPa +23°C	80	105	175	280
	Psi +72°F	11,600	15,225	25,375	40,600
Tensile Strength** ISO 1926	MPa +23°C	2.1	3.0	4.3	6.2
	Psi +72°F	305	435	625	900
Tensile Modulus** ISO 1926	MPa +23°C	60	90	150	220
	Psi +72°F	8,700	13,050	21,750	31,900
Shear Strength** at max. strain ASTM C 273	MPa +23°C	1.1	1.6	2.7	4.1
	Psi +72°F	160	230	390	595
Shear Strength** at 5% strain ASTM C 273	MPa +23°C	0.4	0.8	2.1	3.3
	Psi +72°F	60	115	305	480
Shear Modulus** ASTM C 273	MPa +23°C	16	32	65	110
	Psi +72°F	2,320	4,640	9,425	15,950
Shear Strain** ASTM C 273	% +23°C	60	55	55	55
	% +72°F	60	55	55	55

* = Perpendicular to the plane.

Continuous operating temperature range:

Maximum processing temperature:

Coefficient of linear expansion ASTM D 696

Poissons ratio:

** = Parallel to the plane.

-200°C – +50°C (-325°F – +95°F)

+80°C (+176°F)

Approx. $35 \cdot 10^{-6}/^{\circ}\text{C}$ ($2 \cdot 10^{-5}/^{\circ}\text{F}$)

0.32

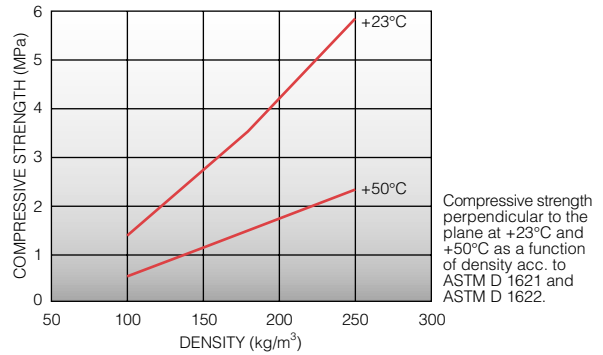
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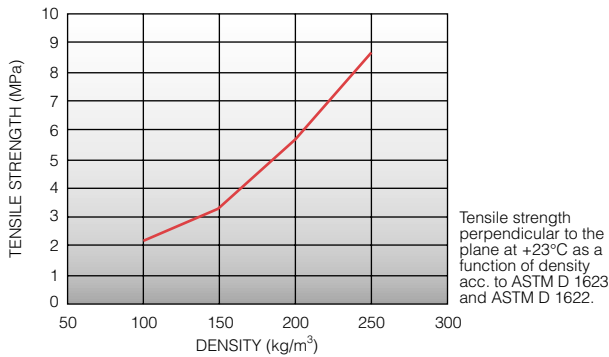


Divinycell HD exhibits good mechanical and physical properties which result in enhanced dynamic loading characteristics.

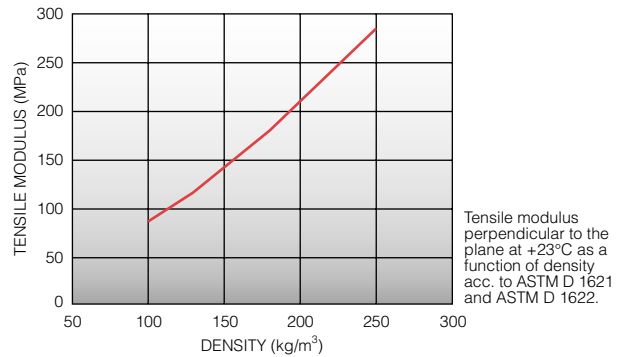
Compressive strength. The high compressive strength of Divinycell HD sandwich panels makes them able to withstand high crushing and impact loadings.



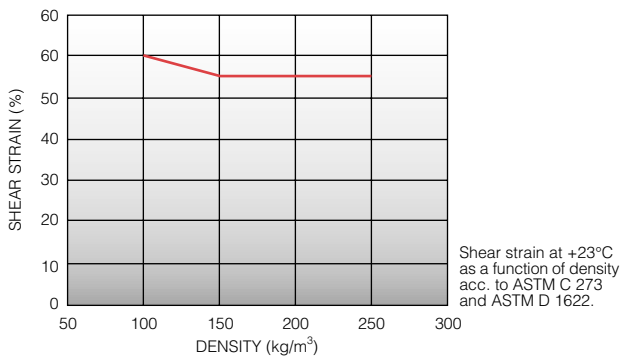
Tensile strength. Tensile strength is always higher than compressive strength.



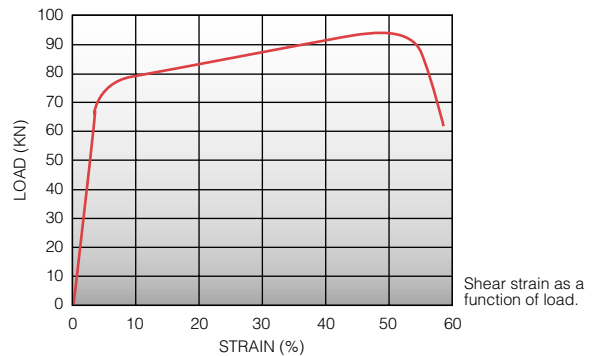
Tensile modulus. Divinycell HD's excellent tensile modulus prevents face wrinkling and shear crimping of a sandwich panel, therefore increasing the buckling resistance of sandwich structures.



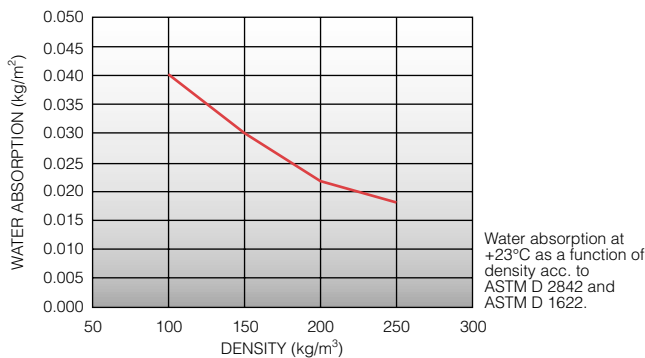
Shear strain. Optimum shear strain is one of the main contributors to Divinycell HD's resilience.



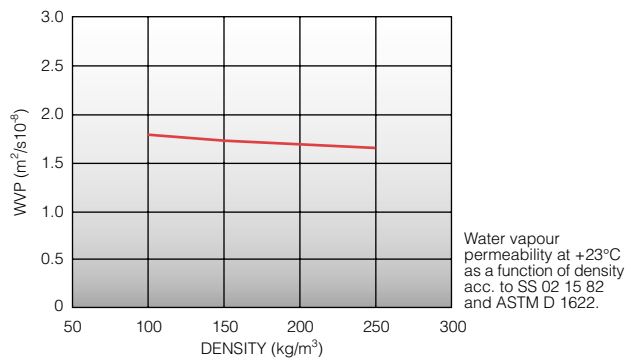
Load vs strain. Clearly demonstrates the resilience of Divinycell HD and its ability to absorb large quantities of energy.



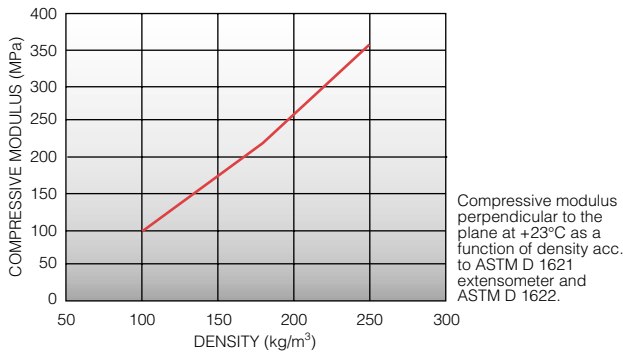
Water absorption. Due to Divinycell HD's closed cell structure, water absorption is minimal and is related only to the surface cells opened during machining of sheets.



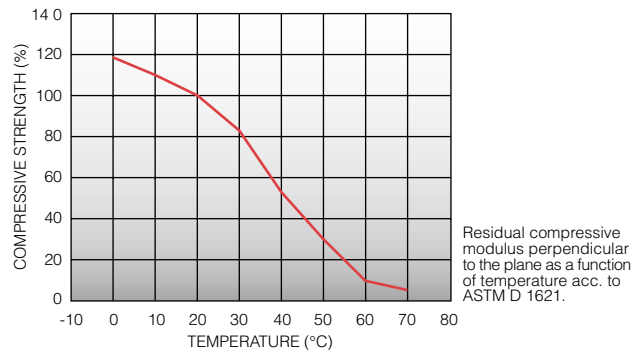
Water vapour permeability. Divinycell HD is characterized by a very low vapour permeability which results in steady dielectric and insulation properties long term.



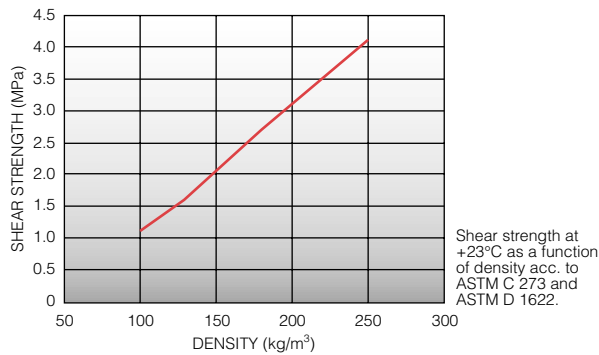
Compressive modulus. Divinycell HD's high compressive modulus prevents face wrinkling and shear crimping of a sandwich panel, thereby increasing the buckling resistance of sandwich structures.



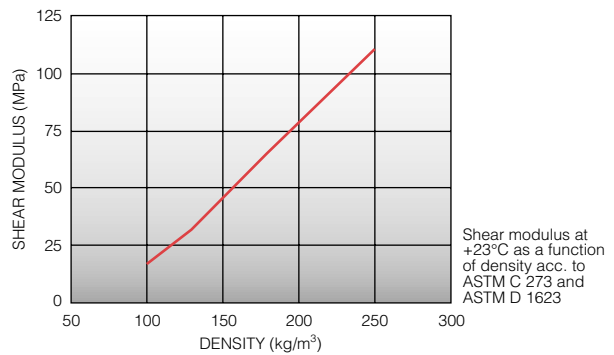
Compressive modulus vs. temperature. Illustrates that at +40°C Divinycell HD retains 60% of the modulus it has at +23°C.



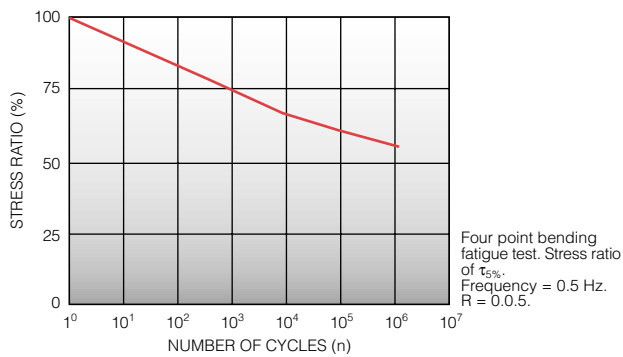
Shear strength. The relatively high shear strength of Divinycell HD is of particular value when designing sandwich panels which are subject to bending.



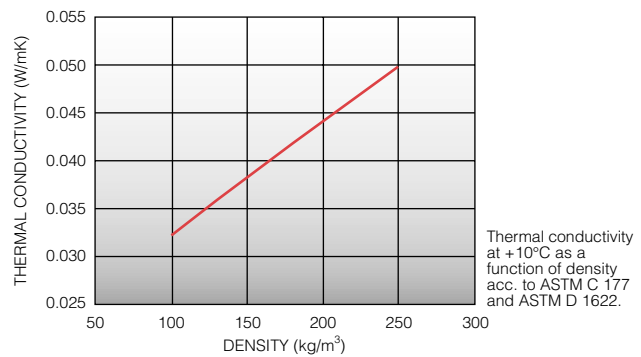
Shear modulus. Divinycell HD's high shear modulus contributes to the low deflection of a sandwich panel under load.



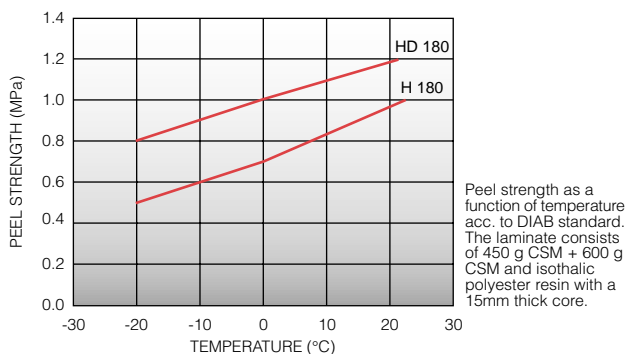
Fatigue properties. Divinycell HD performs extremely well under dynamic loading and shows no sign of creep or relaxation.



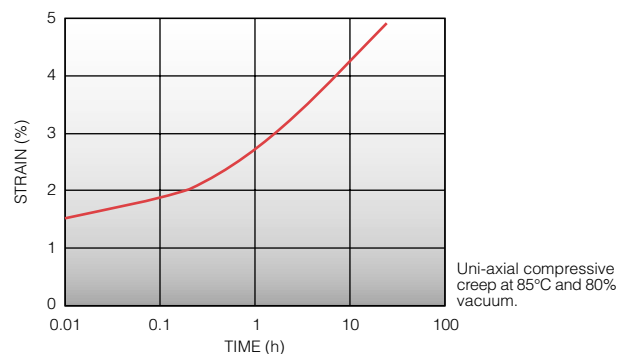
Thermal conductivity. Divinycell HD is an excellent and reliable thermal insulation material due to its superior vapour absorption properties, despite a CFC free expansion.



Peel strength. Divinycell HD has a significantly higher peel strength compared to standard H grades.



Uni-axial compressive creep. Good creep resistance and dimensional stability make Divinycell HD a suitable core material for vacuum bagging production processes with cure temperatures up to 85°C.



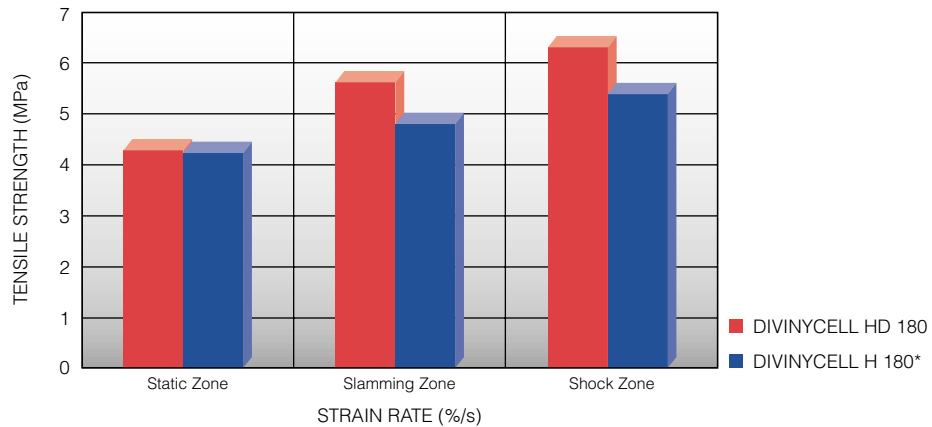
Divinycell HD Grade

Features a unique combination of excellent dynamic properties, high ductility and good processing properties.

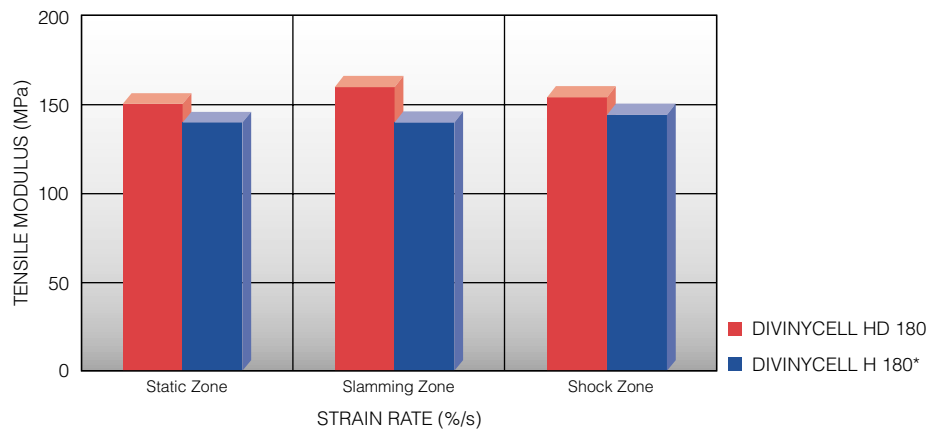
Divinycell H grade has for many years provided overall optimum properties for the marine industry - in hulls, decks and superstructures. The current and future trend for faster craft has created a need for a core even more durable than H grade, which can efficiently cope with severe slamming, impact and shock environments. Divinycell HD is designed to provide the solution to these problems.

Strain rate related properties give the best illustration of a core material's ability to survive under extreme dynamic loadings. The diagrams below display typical mechanical characteristics of Divinycell HD and H grades when exposed to low, medium and very high loading rates.

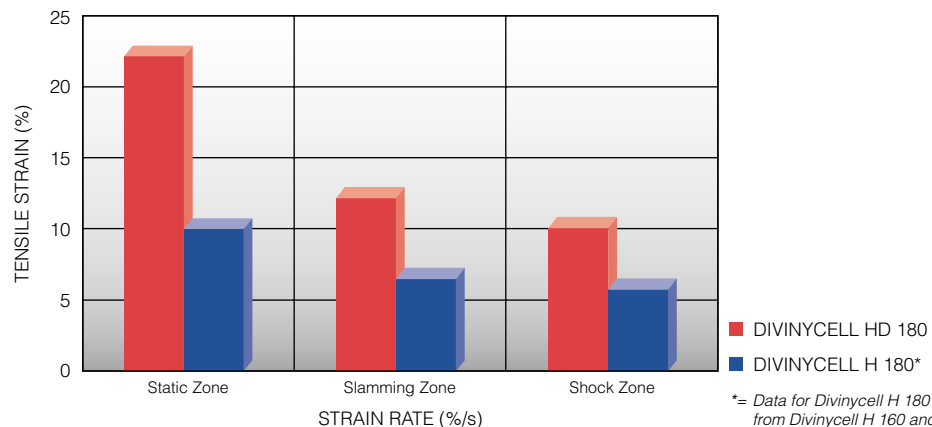
Tensile Strength as a function of Strain Rate



Tensile Modulus as a function of Strain Rate



Tensile Strain as a function of Strain Rate



*= Data for Divinycell H 180 is derived from Divinycell H 160 and H 200

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Divinycell[®]

DATA SHEET

HCP

GRADE

*High performance
core material
for sandwich construction*

Divinycell®

HCP Grade

THE ULTIMATE CORE FOR SUBSEA APPLICATION

Divinycell HCP grade has been developed to meet the demand for a high-performance, lightweight buoyance material with excellent characteristics. It is widely used in pipelines, floatation units, diving bells and impact protection structures. As a result of its excellent hydraulic compressive properties and closed cell structure, it has very low buoyancy loss and water absorption under long-term loading conditions.

HCP stands for *Hydraulic Crush Point* indicating the most important feature of this class of materials. HCP is defined as the point of pressure in Bar, where the material when subjected to an increasing pressure of 1-2 Bar/sec has lost 5% of its initial volume. The design of subsea buoyancy applications is complex and consideration has to be given to the required buoyancy loss and updrift over the expected lifetime and service conditions, with respect to long and short term hydraulic compressive creep, water absorption and hydraulic fatigue. Please contact DIAB for design proposal.

Divinycell HCP Sandwich Core Material

Average properties for the nominal density and minimum values within the brackets for the minimum density. All values are measured at +23°C.

Property	Unit	HCP 30	HCP 50	HCP 70	HCP 90	HCP 100
Hydraulic Crush Point	Bar	>30	>50	>70	>90	>100
Density - nominal		200	250	300	360	400
Density - maximum*	kg/m ³	210	265	315	380	420
Density - minimum**		190	240	285	345	380
Compressive Strength (23°C+/-2°)		4.5 (3.7)	6.0 (5.4)	7.8 (7.0)	9.9 (9.0)	11.0 (10.0)
Compressive Strength (80°C+/-2°)	MPa	(2.0)	(2.7)	(3.5)	(4.5)	(5.0)
ASTM D 1621						
E-modulus (crosshead movement)		150 (105)	190 (140)	240 (180)	300 (225)	340 (255)
E-modulus (extensometer)	MPa	370 (275)	470 (350)	600 (450)	750 (560)	850 (635)
ASTM D 1621						
Tensile strength \perp ***		7.0 (5.5)	8.8 (6.5)	9.2 (7.0)	10.5 (8.4)	12.0 (9.6)
Tensile Strength =	MPa	4.8 (3.8)	6.4 (5.1)	8.0 (6.4)	10.00 (8.0)	11.5 (9.2)
ASTM D 1623						
Shear Strength****	MPa	3.3 (2.8)	4.6 (3.8)	5.7 (4.7)	6.7 (5.6)	7.4 (5.8)
ASTM C 273						
Shear Modulus	MPa	85 (60)	110 (80)	130 (100)	162 (120)	180 (135)
ASTM C 273						
Shear Strain	%	30 (18)	30 (18)	30 (18)	30 (18)	30 (18)
ASTM C 273						
Buoyancy loss	%	TBD depending on design allowables				

* = Maximum average density for a delivery of a minimum of 100 blocks. Maximum density for a block is not stated.

** = Minimum density for a block within a delivery.

*** = The values refer to the foam. Depending on the type of adhesive, the bondline may have lower strength.

**** = Conservative values due to adhesion problems to the steel plates.

Operating temperature is -200°C to +80°C. Lifetime must be taken into consideration for the very low and high temperatures. Maximum processing temperature is dependent on time, pressure and process conditions. Normally Divinycell HCP can be processed up to 90°C without dimensional changes. Please contact DIAB for advice before use.

Coefficient of linear expansion ASTM D 696:

Approx. $35 \cdot 10^{-6}/^{\circ}\text{C}$

Poissons ratio:

0.32

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ProBalsa®

ProBalsa core is select quality, kiln-dried end-grain balsa wood suitable for structural core material in composite sandwich construction. ProBalsa Plus is surface primed ProBalsa, which will improve installation time and reduce resin absorption.

Material Properties				
Quality		LD7 Light Weight	PB Standard	HW Heavy Weight
Density ASTM C 271	kg/m ³ lb/ft ³	90 5.6	155 9.7	220 13.8
Compressive Strength ASTM C 365	MPa (+22°C) psi (+72°F)	5.4 783	12.7 1842	21.9 3176
Compressive Modulus ASTM C 365	MPa (+22°C) psi (+72°F)	1850 268250	4100 594500	6840 991800
Tensile Strength ASTM C 297	MPa (+22°C) psi (+72°F)	7.0 1015	13.5 1958	20.6 2987
Shear Strength ASTM C 273	MPa (+22°C) psi (+72°F)	1.6 232	3.0 435	4.5 653
Shear Modulus ASTM C 273	MPa (+22°C) psi (+72°F)	96 13920	166 24070	237 34365

Refer to the ProBalsa Technical Manual for more detailed information.

Nominal Moisture Content:	12%	
Coefficient of linear expansion (ASTM D-696):		
Longitudinal	1.1 x 10 ⁻⁶ / °C	2 x 10 ⁻⁵ / °F
Radial	8.0 x 10 ⁻⁶ / °C	4.6 x 10 ⁻⁵ / °F
Tangential	12.0 x 10 ⁻⁶ / °C	6.8 x 10 ⁻⁵ / °F

*Shrinkage and swelling of wood due to moisture changes will overshadow thermal expansion

ProBalsa core materials are approved by all major marine classification societies including American Bureau of Shipping, Lloyd's Register of Shipping, and Det Norske Veritas and Gemanischer Lloyd. Our type approvals mean ProBalsa products are recognized and meet the physical and structural standards established by these classification societies.



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ProBalsa®

ProBalsa core is select quality, kiln-dried end-grain balsa wood suitable for structural core material in composite sandwich construction. ProBalsa Plus is surface primed ProBalsa, which will improve installation time and reduce resin absorption.

Thermal Properties				
Quality		LD7 Light Weight	PB Standard	HW Heavy Weight
Density ASTM C 271	kg/m ³	90	155	220
	lb/ft ³	5.6	9.7	13.8
Thermal Conductivity ASTM C 377 +10°C	W/m °C	0.052	0.064	0.086
	Btu in/ft ² h °F	0.35	0.44	0.60
R-Value Based on +10°C K factor	12 mm / 0.5 in	1.4	1.1	0.8
	25 mm / 1.0 in	2.9	2.3	1.7
	51 mm / 2.0 in	5.7	4.5	3.3

Refer to the ProBalsa Technical Manual for more detailed information.

Nominal Moisture Content:	12%	
Coefficient of linear expansion (ASTM D-696):		
Longitudinal	1.1 x 10 ⁻⁶ / °C	2 x 10 ⁻⁵ / °F
Radial	8.0 x 10 ⁻⁶ / °C	4.6 x 10 ⁻⁵ / °F
Tangential	12.0 x 10 ⁻⁶ / °C	6.8 x 10 ⁻⁵ / °F

*Shrinkage and swelling of wood due to moisture changes will overshadow thermal expansion

ProBalsa and ProBalsa Plus have proven to be successful in a variety of molding processes. ProBalsa core is widely used and found in marine craft, trucks, train interiors and other structural applications.

ProBalsa core materials are approved by all major marine classification societies including American Bureau of Shipping, Lloyd's Register of Shipping, and Det Norske Veritas and Gemanischer Lloyd. Our type approvals mean ProBalsa products are recognized and meet the physical and structural standards established by these classification societies.



Disclaimer: This document and the data contained herein are subject to revision. DIAB Inc. reserves the right to release replacement data. The data presented is derived from tests and experience. Calculations should be verified with physical tests. The data is furnished without liability to DIAB Inc. or its agents and does not constitute a warranty or representation in respect to the material or its use. DIAB Inc. assumes no liability for patent infringement either expressed or implied. Users of this document should check that they have the latest revision, which may be downloaded from the DIAB web site – www.diabgroup.com or by calling Technical Services at 972-228-7600.

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DATA SHEET

Divilette[®]

*High performance
core bonding adhesive
for sandwich construction*

Divilette®

CORE BONDING ADHESIVE

Divilette is a polyester-based bonding adhesive which contains lightweight microspheres and fillers. It has been specially developed for use with Divinycell® and Klegecell® core materials. Four grades are available:

- Divilette 600 - A low viscosity adhesive for use with Divinycell and Klegecell GSW.
- Divilette SQ & NQ G1 - Medium viscosity adhesives primarily used for butt joints.
- Divilette NQ G1 HV - A high viscosity adhesive for use in more advanced constructions.

All four grades of Divilette are characterised by their low density, low exotherm and good strain properties and are type approved by Det Norske Veritas.

Physical properties of Divilette Core Bonding Adhesives

Property	Test Method	Temp. °C	Unit	600	SQ	NQ G1	NQ G1 HV
Density	ISO 2811	+23	kg/m ³	550-650	600-700	600-700	600-700
Viscosity	ISO 2555 ASTM D 1824	+23	cpx10 ³	40-55	>350	120-170	>600
Gel time	ASTM D 2471	+23	min.	25-45	25-45	45-70	25-45
Peak exotherm, 1 mm	ASTM D 2471	+23	°C	-	-	-	-
Peak exotherm, 3 mm	ASTM D 2471	+23	°C	<50	<50	<50	<70
Peak exotherm, 5 mm	ASTM D 2471	+23	°C	<100	<70	<70	<90
Tensile Strength (ISO)	ISO 527	-10	MPa	>8	>8	>12	>8
	ISO 527	+23	MPa	>4	>4	>10	>6
	ISO 527	+50	MPa	>2	>2	>7	>3
Tensile Modulus (ISO)	ISO 527	-10	MPa	1100*	1300*	1200*	900*
	ISO 527	+23	MPa	200-350	250-400	500-800	250-550
	ISO 527	+50	MPa	25*	25*	200*	100*
Tensile Strain (ISO)	ISO 527	-10	%	>1.3	>1.3	>2	>2
	ISO 527	+23	%	>4	>4	>4	>6
	ISO 527	+50	%	>10	>10	>7	>15
Water resistance*	Residual tensile strength after immersion in salt water	+23	%	80	80	80	80
Linear Shrinkage*	ASTM D 2566	+23	%	1.2	1.2	1.2	1.2
Water Absorption*	ISO 62 Meth.1	+23	mg	80	80	120	120
HDT*	ISO 75	-	°C	50	50	60	50
Amount of MEKP (50%)	-	+23	%	1.5	1.5	1.5	1.5
Colour	-	-	-	Blue	White	White	Yellow

* = Typical values

Divilette should be stored indoors in its original packaging at a temperature not exceeding 30°C. The storage life of Divilette is three months when stored in its original packaging under ambient indoor storage conditions. Operating temperature is -50°C to +80°C. Please note that the properties of Divilette will change with temperature.

This data sheet may be subject to revision and changes due to development and changes of the material. The data is derived from tests and experience. The data is average data and should be treated as such. Calculations should be verified by actual tests. The data is furnished without liability for the company and does not constitute a warranty or representation in respect of the material or its use. The company reserves the right to release new data sheets in replacement. Customers should check that they have the latest issue, see www.diabgroup.com.

DIAB develops and sells products and services based on advanced polymer and composite technologies.

*Over thirty years of experience together with continuous research and development
has made us an international market leader, with Divinycell / Klegecell being the prime element
in multi-functional sandwich constructions.*

Our philosophy is to supply our customers with structural cores for sandwich construction of the highest quality.

*We strive for excellence - not only with our materials
but also in regard to our technical assistance and documentation.*

*Our long term involvement in sandwich structures enables us to provide strong support to our customers
whenever and wherever needed.*

APPROVED BY



DET NORSKE VERITAS, OSLO
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TESSUTI IN FIBRA DI VETRO

GLASS FABRICS

ARTICOLO		fili x cm		titolo		spessore	peso			armatura	
		ordito	trama	ordito	trama		ordito	trama	totale		
ARTICLE		threads x cm		linear density		thickness	weight			weave	
		warp	weft	warp	weft		warp	weft	total		
		(UNI EN 1049-2)		(tex)		(mm) ± 15%	(gr/mq) ± 4%			(UNI 8099)	
						(UNI EN ISO 5084)	(UNI 5114-82)				
EE	24	22	22	5,5	5,5	0,035	12	12	24	Tela	Plain
EE	39	22	12,6	5,5	22	0,05	12	27	39	Tela	Plain
EE	48	24	19	11	11	0,05	27	21	48	Tela	Plain
EE	106	24	23	22	22	0,08	54	51	105	Rasoturco	Crowsfoot satin
EE	130	11	8	68	68	0,11	75	55	130	Tela	Plain
EE	165	12	11,5	68	68	0,12	83	80	163	Tela	Plain
EE	166	12	11,5	68	68	0,12	83	80	163	Batavia 2/2	Twill 2/2
EE	164	22	10	68	11	0,1	150	14	164	Rasoturco	Crowsfoot satin
EE	190	22	10	68	34	0,13	152	38	190	Rasoturco	Crowsfoot satin
EE	200	8	6,5	136	136	0,19	110	90	200	Tela	Plain
EE	201	17	12	68	68	0,16	118	82	200	Tela	Plain
EE	245	7	3	320	68	0,18	226	21	247	Tela	Plain
EE	280	7	6,5	68x3	204	0,26	145	135	280	Tela	Plain
EE	300	23	21	68	68	0,19	157	143	300	Raso da 8	8H Satin
EE	320	5	5	320	320	0,27	160	160	320	Tela	Plain
EE	380	6	6	320	320	0,29	192	183	375	Batavia 2/2	Twill 2/2
EE	425	5,5	6,3	136x5	68	0,26	382	43	425	Tela	Plain
EE	450	23,5	20,3	102	102	0,31	250	210	460	Raso da 8	8H Satin
EE	600	4,9	5	600	600	0,42	295	305	600	Rasoturco	Crowsfoot satin
EE	770	3,2	3,2	1200	1200	0,57	385	385	770	Spina da 4	Twill 3/1
RR	250	3,8	5	640	34	0,25	243	17	260	TELA	PLAIN
RR	500	6	2,9	800	68	0,45	480	20	500	TELA	PLAIN

Tutti i prodotti possono essere forniti impregnati coi vari sistemi di resina SEAL

All products can be supplied impregnated with the different SEAL resin systems

E = vetro E - R = vetro S

E = E glass - R = S glass



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TESSUTI ARAMIDICI PER COMPOSITI

ARAMID FABRICS FOR COMPOSITES

ARTICOLO	fili x cm		titolo		spessore	peso			resistenza a trazione		armatura		
	ordito	trama	ordito	trama		ordito	trama	totale	ordito	trama			
ARTICLE	threads x cm		linear density		thickness	weight			tensile strength		weave		
	warp	weft	warp	weft		warp	weft	total	warp	weft			
			(dTex)		(mm) ± 15%	(gr/mq) ± 4%			(DaN/cm)				
	(UNI EN 1049-2)				(UNI EN ISO 5084)	(UNI 5114-82)			(UNI EN 29073-3)		(UNI 8099)		
KEVLAR® 49 - DuPont													
STYLE	120*	13	13	215	215	0,08	30	30	61	39	39	tela	plain
STYLE	220*	9,5	9,5	420	420	0,12	40	40	80	51	51	tela	plain
STYLE	115	13,3	13,3	420	420	0,15	58	58	115	73	73	tela	plain
STYLE	181*	20	20	420	420	0,23	84	84	168	114	114	raso da 8	8 H satin
STYLE	281*	6,7	6,7	1270	1270	0,25	86.5	86.5	173	114	114	tela	plain
STYLE	285*	6,7	6,7	1270	1270	0,25	86.5	86.5	173	114	114	raso turco	crowsfoot satin
STYLE	282	6,7	6,7	1270	1270	0,25	86,5	86,5	173	114	114	batavia 2/2	twill 2/2
STYLE	143*	39	8	420	220	0,30	163	33	196	220	23	raso turco	crowsfoot satin
STYLE	243*	15	7	1270	420	0,30	190	30	220	256	39	raso turco	crowsfoot satin
STYLE	328*	6,7	6,7	1580	1580	0,33	111	111	223	142	142	tela	plain
STYLE	335	6,7	6,7	1580	1580	0,33	111	111	223	142	142	raso turco	crowsfoot satin
STYLE	279	4,4	4,3	3160	3160	0,32	139	136	275	160	160	batavia 2/2	twill 2/2
STYLE	900	6,7	6,7	2400	2400	0,40	163	163	326	200	200	raso da 5	5 H satin
STYLE	1050*	11	11	1580	1580	0,46	178	178	356	240	240	panama 4/4	basket 4/4
STYLE	380	15,5	2	2400	215	0,40	375	5	380	--	--	oxford 2/1	oxford 2/1
STYLE	1350	9,3	9,3	2400	2400	0,68	225	225	450	240	240	panama 4/4	basket 4/4
STYLE	1033*	7,85	7,85	3160	3160	0,62	260	260	520	300	290	panama 4/4	basket 4/4

TRATTAMENTI DI FINITURA : Tutti i prodotti possono essere forniti con trattamento di lavaggio.

FINISH TREATMENT : All fabrics can be supplied with scoured finish.

* Articolo conforme alle specifiche AMS 3902 B (Materiali per impieghi nel settore aerospaziale).

*Article that meet the AMS 3902 B Specifications (Aerospace Material Specifications)

Tutti i prodotti possono essere forniti impregnati coi vari sistemi di resina SEAL

All products can be supplied impregnated with the different SEAL resin systems



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TESSUTI IN FIBRA DI CARBONIO

CARBON FABRICS

ARTICOLO		fili x cm		fibra		spessore	peso			armatura	
		ordito	trama	ordito	trama		ordito	trama	totale		
ARTICLE		threads x cm		fibre		thickness	weight			weave	
		warp	weft	warp	weft		warp	weft	total		
				(tex)		(mm) ± 15%	(g/mq) ± 4%				
		(UNI EN 1049-2)				(UNI EN ISO 5084)	(UNI 5114-82)			(UNI 8099)	
CC	90	7,0	7,0	HS 1K	HS 1K	0,12	47	47	94	tela	plain
CC	105	11,8	3,0	HS 1K	HS 1K	0,13	80	20	100	tela	plain
CC	120	9,0	9,0	HS 1K	HS 1K	0,14	61	61	122	tela	plain
CC	160	4,0	4,0	HS 3K	HS 3K	0,22	80	80	160	tela	plain
CC	171	7,0	3,5	HS 3K	HS 1K	0,15	140	24	164	tela	plain
CC	166J	5,0	3,1	HS 3K	HM 55J 6K	0,22	100	66	166	tela	plain
CC	201	4,9	4,9	HS 3K	HS 3K	0,25	97	97	194	tela	plain
CC	205	4,9	4,9	HS 3K	HS 3K	0,25	97	97	194	batavia 2/2	twill 2/2
CC	202	5,1	5,1	HS 3K	HS 3K	0,25	102	102	204	tela	plain
CC	206	5,1	5,1	HS 3K	HS 3K	0,25	102	102	204	batavia 2/2	twill 2/2
CC	218	16,5	16,5	HS 1K	HS 1K	0,20	109	109	218	raso da 8	8 H satin
CC	220	5,5	5,5	HS 3K	HS 3K	0,25	110	110	220	tela	plain
CC	240	1,5	1,5	HS 12K	HS 12K	0,23	120	120	240	tela	plain
CC	241	1,5	1,5	HS 12K	HS 12K	0,23	120	120	240	batavia 2/2	twill 2/2
CC	245	6,0	6,0	HS 3K	HS 3K	0,28	120	120	240	batavia 2/2	twill 2/2
CC	250	8,7	3,5	HS 3K	HS 3K	0,26	176	74	250	spina da 4	twill 3/1
CC	281	3,5	3,5	HS 6K	HS 6K	0,30	140	140	280	raso da 5	5 H satin
CC	282	7,0	7,0	HS 3K	HS 3K	0,28	140	140	280	batavia 4/4	twill 4/4
CC	283	1,7	1,8	HS 12K	HS 12K	0,25	140	140	280	batavia 2/2	twill 2/2

Tutti i prodotti possono essere forniti impregnati coi vari sistemi di resina SEAL

All products can be supplied impregnated with the different SEAL resin systems



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TESSUTI IN FIBRA DI CARBONIO

CARBON FABRICS

ARTICOLO		fili x cm		fibra		spessore	peso			armatura	
		ordito	trama	ordito	trama		ordito	trama	totale		
ARTICLE		threads x cm		fibre		thickness	weight			weave	
		warp	weft	warp	weft		warp	weft	total		
		(UNI EN 1049-2)		(tex)		(mm) ± 15%	(g/mq) ± 4%			(UNI 8099)	
						(UNI EN ISO 5084)	(UNI 5114-82)				
CC	284	7,0	7,0	HS 3K	HS 3K	0,30	140	140	280	batavia 2/2	twill 2/2
CC	285	1,7	1,8	HS 12K	HS 12K	0,34	136	144	280	tela	plain
CC	288	3,5	3,5	HS 6K	HS 6K	0,32	140	140	280	raso turco	crowsfoot satin
CC	289	7,0	7,0	HS 3K	HS 3K	0,33	140	140	280	raso da 5	5 H satin
CC	292	4,5	5,3	HS 3K	HS 6K	0,34	90	210	300	tela	plain
CC	301	3,7	3,7	HS 6K	HS 6K	0,33	150	150	300	batavia 2/2	twill 2/2
CC	302	3,7	3,7	HS 6K	HS 6K	0,37	150	150	300	tela	plain
CC	370	4,6	4,6	HS 6K	HS 6K	0,36	184	184	368	raso da 5	5 H satin
CC	371	4,6	4,6	HS 6K	HS 6K	0,36	184	184	368	raso turco	crowsfoot satin
CC	380	9,5	9,5	HS 3K	HS 3K	0,37	190	190	380	raso da 8	8 H satin
CC	381	2,3	2,3	HS 12K	HS 12K	0,42	190	190	380	batavia 2/2	twill 2/2
CC	420	2,5	2,6	HS 12K	HS 12K	0,38	204	212	416	batavia 2/2	twill 2/2
CC	450	5,6	5,6	HS 6K	HS 6K	0,43	225	225	450	batavia 4/4	twill 4/4
CC	600	3,8	3,8	HS 12K	HS 12K	0,60	300	300	600	batavia 2/2	twill 2/2
CC	700	4,2	4,2	HS 12K	HS 12K	0,65	336	336	672	batavia 2/2	twill 2/2
CC	950	5,7	5,7	HS 12K	HS 12K	0,83	460	460	920	raso da 8	8 H satin
CPA*	206	5,1	7,3	3K(C)	3K(C)-334(PES)	0,28	100	90(C)-15(PES)	205	batavia 2/2	twill 2/2
CPB*	480	3,0	6,0	12K(C)	12K(C)-334(PES)	0,60	240	240(C)-5(PES)	485	tela	plain

*C=carbonio, PA=poliestere rosso; PB= poliestere blu

*C=carbon, PA=red polyester, PB=bleu polyester

Tutti i prodotti possono essere forniti impregnati coi vari sistemi di resina SEAL

All products can be supplied impregnated with the different SEAL resin systems



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TESSUTI in Dyneema® (PE alto modulo)

Dyneema® FABRICS (high modulus PE)

ARTICOLO	fili x cm		titolo		peso			spessore	armatura		
	ordito	trama	ordito	trama	ordito	trama	totale				
ARTICLE	threads x cm		linear density		weight			thickness	weave		
	warp	weft	warp	weft	warp	weft	total				
			(dtex)		(gr/mq) ± 4%			(mm) ± 15%			
	(UNI EN 1049-2)				(UNI 5114-82)			(UNI EN ISO 5084)	(UNI 8099)		
Dyneema® SK60											
Style	568	4,4	4,4	1760	1760	83	83	166		tela	plain
Style	545	7	7	1330	1330	95	95	190		raso turco	crowsfoot satin
Dyneema® SK65											
Style	580	19	18,5	220	220	43	41	84	0,18	tela	plain
Style	510	5,5	5,5	1320	1320	75	75	150	10,27	batavia 2/2	twill 2/2
Dyneema® SK66											
Style	507	16,5	16,5	440	440	75	75	150	0,26	spina 3/1	twill 3/1
Style	512	8,3	8,7	1760	1760	160	165	325		tela	plain

Tutti i prodotti possono essere forniti accoppiati con film termoplastici 12 µm, 30 µm, 60 µm

All products can be supplied coupled with termoplastic films 12 µm, 30 µm, 60 µm



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SAATILAR®
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NASTRI PER COMPOSITI - TAPES FOR COMPOSITES

ARTICOLO	fili x cm		fibra		spessore	peso totale	armatura		
	ordito	trama	ordito	trama					
ARTICLE	threads x cm		fibre		thickness	total weight	weave		
	warp	weft	warp	weft					
			(tex)		(mm) ± 15%	(g/mq) ± 4%			
	(UNI EN 1049-2)				(UNI EN ISO 5084)	(UNI 5114-82)	(UNI 8099)		
nastri in tessuto ibrido hybrid fabric tapes									
NCK	285	5,0	5,0	6K (C)	161 (A)	0,35	285	REPS 2/2	REPS 2/2
nastri in tessuto di vetro glass fabric tapes									
NE	1034	4,2	4,5	2400 (E)	68 (E)	0,58	1034	REPS 2/2	REPS 2/2
NEE	200	7,0	16,0	136 (E)	68 (E)	0,20	203	ETAMINE/6	ETAMINE/6
nastri in tessuto aramidico aramid fabric tapes									
NK	281	6,7	7,0	127 (A)	127 (A)	0,25	175	REPS 2/2	REPS 2/2
NK	200	5,0	7,0	158 (A)	158 (A)	0,26	200	REPS 2/2	REPS 2/2
nastri in tessuto di carbonio carbon fabric tapes									
NC	201	4,9	4,9	3K (C)	3K (C)	0,28	194	REPS 2/2	REPS 2/2
nastri UD in carbonio carbon UD tapes									
NCU	200	10,0	6,0	3K (C)	5,5 (PES)	0,19	205	REPS 2/2	REPS 2/2
NCU	215	5,0	5,0	6K (C)	34 (E)	0,21	225	REPS 2/2	REPS 2/2
NCU	300	3,6	6,2	12K (C)	5,5 (PES)	0,28	294	REPS 2/2	REPS 2/2
NCU	301	7,1	6,0	6K (C)	5,5 (PES)	0,26	300	REPS 2/2	REPS 2/2
NCU	305	7,2	3,0	6K (C)	5,5 (PES)	0,28	305	REPS 2/2	REPS 2/2
NCU	370	16,0	8,0	6K (C) - 34 (E)	34 (E)	0,35	374	REPS 2/2	REPS 2/2
NCU	380	4,6	6,1	12K (C)	5,5 (PES)	0,35	387	REPS 2/2	REPS 2/2
NCU	500	6,2	6,5	12K (C)	5,5 (PES)	0,48	500	REPS 2/2	REPS 2/2
NCU	501	12,5	10,0	12K (C) - 34 (E)	34 (E)	0,48	538	REPS 2/2	REPS 2/2
NCU	1000	13,3	5,0	12K (C)	68 (E)	0,99	1000	REPS 2/2	REPS 2/2

C: Carbonio - A: Aramidico - E: vetro PES - Poliestere

C: Carbon - A: Aramide - E: E glass - PES: Polyester

I nastri vengono forniti nelle seguenti larghezze standard: 50, 75, 100, 120 mm.

Standard widths: 50, 75, 100, 120 mm are available in stock.

Larghezze speciali nella gamma 30 , 120 mm disponibili su richiesta.

Special widths in the range 30 , 120 mm upon request.

TESSUTI IBRIDI

HYBRID FABRICS

ARTICOLO		fili x cm		fibra		spessore	peso			armatura	
		ordito	trama	ordito	trama		ordito	trama	totale		
ARTICLE		threads x cm		fibre		thickness	weight			weave	
		warp	weft	warp	weft		warp	weft	total		
		(UNI EN 1049-2)		(tex)		(mm) ± 15%	(gr/mq) ± 4%			(UNI 8099)	
						(UNI EN ISO 5084)	(UNI 5114 -82)				
CK	149	7,0	3,9	3K (C)	21,5 (A)	0,16	142	9	151	tela	plain
CK	160	5,0	4,1	3K (C) - 158 (A)	3K (C) - 158 (A)	0,23	66 (C) - 26 (A)	26 (C) - 42 (A)	160	tela	plain
CK	190	5,0	5,0	3K (C) - 158 (A)	3K (C) - 158 (A)	0,25	69 (C) - 27 (A)	34 (C) - 54 (A)	185	tela	plain
CK	189	5,0	6,6	3K (C)	127(A)	0,19	100	86	186	tela	plain
CK	191	5,2	5,2	3K (C) - 158 (A)	3K (C) - 158 (A)	0,24	53 (C) - 42 (A)	53 (C) - 42 (A)	190	batavia 2/2	twill 2/2
CK	204	6,3	6,3	3K (C) - 127 (A)	3K (C) - 127 (A)	0,26	64 (C) - 41 (A)	64 (C) - 41 (A)	208	spina da 4	twill 3/1
CK	220	7,0	6,3	3K (C)	127 (A)	0,26	142	81	223	spina da 4	twill 3/1
CK	439	4,2	4,2	12K (C)	240 (A)	0,50	335	100	435	panama 2/2	basket 2/2
CKK	180	5,0	5,0	3K (C) - 158 (A)	3K (C) - 158 (A)	0,25	34 (C) - 54 (A)	34 (C) - 54 (A)	175	tela	plain
CKK	181	5,0	5,0	3K (C) - 158 (A)	3K (C) - 158 (A)	0,25	34 (C) - 54 (A)	34 (C) - 54 (A)	175	batavia 2/2	twill 2/2
CKK	205	6,3	6,3	3K (C) - 127 (A)	3K (C) - 127 (A)	0,27	42 (C) - 54 (A)	42 (C) - 54 (A)	192	tela	plain
CKK	206	6,3	6,3	3K (C) - 127 (A)	3K (C) - 127 (A)	0,27	42 (C) - 54 (A)	42 (C) - 54 (A)	192	batavia 2/2	twill 2/2
CKK	240	6,7	6,7	3K (C) - 158 (A)	3K (C) - 158 (A)	0,35	45 (C) - 73 (A)	45 (C) - 73 (A)	240	batavia 2/2	twill 2/2
EA	390 S	4,5	4,7	600 (E) - 240 (A)	600 (E) - 240 (A)	0,38	135 (E) - 54 (A)	141 (E) - 56 (A)	386	spina da 4	twill 3/1
EA	390 M *	4,5	4,7	600 (E) - 240 (A)	600 (E) - 240 (A)	0,60	135 (E) - 54 (A)	141 (E) - 56 (A)	386 (tessuto) 630 (totale)	spina da 8 (doppia)	twill 7/1 (double)
GK	60	12,9	12,6	34 (E)	21,5 (A)	0,07	44	28	72	tela	plain
GK	300	4,1	6,0	320 (E) - 333 (A)	320 (E) - 333 (A)	0,31	96 (E) - 33 (A)	106 (E) - 56 (A)	292	tela	plain
GK	465	5,0	5,0	600 (E) - 333 (A)	600 (E) - 333 (A)	0,48	150 (E) - 83 (A)	150 (E) - 83 (A)	466	tela	plain
PE	260	6,0	6,0	340 (E) - 176 (D)	176 (D)	0,32	96 (E) - 53 (D)	106D	255	tela	plain
PG	280	6,0	6,0	320 (E) - 176 (D)	320 (E) - 176 (D)	0,37	94 (E) - 55 (D)	94 (E) - 55 (D)	298	tela	plain

C: Carbonio - A: Aramidico - E: vetro E - D: polietilene HT (Dyneema) * accoppiato a un matt di vetro da 225 g/sqm

C: Carbon - A: Aramide - E: E glass - D: HT polyethylene (Dyneema) * stitched to a chopped strand matt

Tutti i prodotti possono essere forniti impregnati coi vari sistemi di resina SEAL

All products can be supplied impregnated with the different SEAL resin systems



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TEXIPREG®
TEXINDUSTRIA®

TESSUTI IBRIDI UNIDIREZIONALI

UNIDIRECTIONAL HYBRID FABRICS

ARTICOLO		fili x cm		fibra		spessore	peso			armatura	
		ordito	trama	ordito	trama		ordito	trama	totale		
ARTICLE		threads x cm		fibre		thickness	weight			weave	
		warp	weft	warp	weft		warp	weft	total		
		(UNI EN 1049-2)		(tex)		(mm) ± 15%	(gr/mq) ± 4%			(UNI 8099)	
						(UNI EN ISO 5084)	(UNI 5114-82)				
CG	125	5,0	7,0	3K (C)	34 (E)	0,14	100	25	125	tela	plain
CG	137	4,0	2,8	3K (C)	200 (E)	0,17	80	56	136	tela	plain
CG	149	7,0	3,9	3K (C)	34 (E)	0,16	142	14	156	tela	plain
CG	170	7,0	4,3	3K (C)	68 (E)	0,19	142	30	172	tela	plain
CG	202	10,8	6,3	3K (C) - 34 (E)	68 (E)	0,17	110 (C) - 18 (E)	44	172	spina da 4	twill 3/1
CG	175	8,5	6,9	3K (C)	11 (E)	0,19	170	7	177	tela	plain
CG	190	7,0	6,3	3K (C)	68 (E)	0,20	142	43	185	raso turco	crowsfoot satin
CG	200	5,0	5,0	3K (C)	200 (E)	0,20	100	100	200	tela	plain
CG	205	8,5	4,3	3K (C)	68 (E)	0,22	174	30	204	tela	plain
CG	210	3,6	3,6	3K (C) - 320 (E)	3K (C) - 320 (E)	0,26	18 (C) - 87 (E)	18 (C) - 87 (E)	209	tela	plain
CG	215	5,0	5,0	6K (C)	34 (E)	0,21	200	17	217	tela	plain
CG	330	3,5	2,5	12K (C)	200 (E)	0,35	280	50	330	tela	plain
CG	399	4,2	2,8	12K (C)	200 (E)	0,45	344	56	400	tela	plain
CG	550	5,6	2,5	12K (C)	200 (E)	0,51	460	60	520	tela	plain
CG	600	6,5	2,5	12K (C)	200 (E)	0,60	525	51	576	tela	plain
KG	195	7,3	6,8	240 (A)	34 (E)	0,24	175	30	205	tela	plain
KG	300	11,6	4,0	240 (A)	34 (E)	0,33	281	14	295	tela	plain

C: Carbonio - A: Aramidico - E: vetro E

C: Carbon - A: Aramide - E: E glass

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TESSUTI MULTIASSIALI

MULTIAXIAL FABRICS

ARTICOLO		pesi in ogni asse (gr/mq) ± 5%					peso totale	spessore	materiale	
ARTICLE		weights in each axis (gr/mq) ± 5%					total weight	thickness	material	
		CSM	0°	-45°	90°	+45°	(gr/mq) ± 5% (UNI 5114-82)	(mm) ± 15% (UNI EN ISO 5084)		
-45° / +45° Biaxial										
CBX	300			150		150	300	0,30	CARBONIO	CARBON
CBX	400			200		200	400	0,45	CARBONIO	CARBON
CBX	600			300		300	600	0,60	CARBONIO	CARBON
CEBX	180			20(C)+70(G)		20(C)+70(G)	180	0,20	CARBONIO/VETRO	CARBON/GLASS
EBX	300			150		150	300	0,30	VETRO	GLASS
EBX	400			200		200	400	0,43	VETRO	GLASS
EBX	440			220		220	440	0,43	VETRO	GLASS
EBX	600			300		300	600	0,60	VETRO	GLASS
EBX	800			400		400	800	0,70	VETRO	GLASS
EBX	900			450		450	900	0,75	VETRO	GLASS
KEBX	390			43(A)+152(G)		43(A)+152(G)	390	0,40	ARAMIDICA/VETRO	ARAMID/GLASS
KEBX	390 M250	250		43(A)+152(G)		43(A)+152(G)	640	0,53	ARAMIDICA/VETRO	ARAMID/GLASS
KBX	450			225		225	450	0,55	ARAMIDICA	ARAMID
0° / -45° / +45° Triaxial										
ETLX	600		224	188		188	600	0,56	VETRO	GLASS
ETLX	900		252	324		324	900	0,79	VETRO	GLASS
ETLX	900 M300	300	252	324		324	1200	0,90	VETRO	GLASS
-45° / 90° / +45° Triaxial										
CTXT	900			297	296	297	900	0,79	CARBONIO	CARBON
ETXT	825			272	281	272	825	0,70	VETRO	GLASS
KTXT	360			119	122	119	360	0,45	ARAMIDICA	ARAMID
0°/-45°/90°/+45° Quadriaxial										
EQX	640 M100	100	130	170	170	170	740	0,58	VETRO	GLASS
EQX	1160		232	313	302	313	1160	0,97	VETRO	GLASS
KQX	360		90	90	90	90	360	0,55	ARAMIDICA	ARAMID

Legatura in fibra poliestere / Altezza standard: 1270 mm

Stitch polyester yarn / Standard width: 1270 mm

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TEXIPREG®
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UNIDIREZIONALI ALTA RESISTENZA

UNIDIRECTIONAL HIGH RESISTANCE

ARTICOLO				altezza	peso secco			resina	peso	spessore	trazione			flessione		I.L.S.S.	
ARTICLE				width	fibra	supporto	tot.	in peso	totale	ply	resistenza	modulo	allungamento	resistenza	modulo		
				width	dry weight		resin	total	weight	thickness	strength	modulus	strain	strength	modulus		
				(cm)	fiber	scrim	tot.	content	(g/mq)	(mm) ± 15%	(MPa)	(GPa)	(%)	(MPa)	(GPa)	(MPa)	
					(UNI 5114-82)			(% ± 3)	(g/mq)	(UNI 5114-82)	(UNI EN ISO 5084)	(ASTM D 3039-76)			(ASTM D 790-90)		(ASTM D 2344-84)
carbonio alta resistenza / high resistance carbon fibre																	
HS		35		EU 336	60	35		35	45	64	0,06	1880	102	1,3	2070	90	85
HS		70	EE24	REM	60	70	24	94	39	154	0,12	1635	121	1,3	1800	110	72
HS		110		EU 334	60	110		110	32	162	0,12	1920	135	1,4	2110	130	89
HS		95	EE24	REM	60	95	24	119	39	195	0,14	1700	126	1,4	1870	115	75
HS		110	EE24	REM	60	110	24	134	38	216	0,15	1750	120	1,4	1925	116	74
HS		150		REM	60	150		150	34	227	0,16	1960	133	1,4	2160	130	89
HS		120	EE24	REM	60	120	24	144	39	236	0,17	1800	130	1,4	1980	115	75
HS		120	EE24	REMC	60	120	24	144	39	236	0,18	1780	128	1,4	1958	115	72
HS		120	EE39	REM	60	120	39	159	36	248	0,18	1700	122	1,4	1870	110	70
HS		150	EE24	REM	60	150	24	174	35	268	0,19	1830	132	1,4	2010	118,8	70
HS		180		REM	60	180		180	37	286	0,20	1950	120	1,4	2145	135	90
HS		160	EE24	REM	60	160	24	184	38	297	0,21	1835	132	1,4	2020	120	75
HS		160	EE39	REM	60	160	39	199	36	311	0,23	1680	125	1,4	1848	110	71
HS		180	EE48	REM	60	180	48	228	37	362	0,26	1700	125	1,4	1870	115	72
HS		220	EE24	REM	60	220	24	244	37	387	0,26	1800	135	1,4	1980	120	73
HS		240	EE24	REM	60	240	24	264	38	426	0,33	1970	160	1,4	2165	145	80
HS		300		ET 442	60	300		300	38	484	0,33	2000	120	1,4	2200	135	85
HS		300		REM	60	300		300	38	484	0,33	1965	120	1,4	2160	108	85



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UNIDIREZIONALI ALTO MODULO

UNIDIRECTIONAL H MODULUS

ARTICOLO					altezza	peso secco			resina	peso	spessore	trazione			flessione		I.L.S.S.
ARTICLE					width	fibra	supporto	tot.	in peso	totale	ply	resistenza	modulo	allungamento	resistenza	modulo	
						dry weight			resin	total	thickness	tensile			flexural		
					(cm)	fiber	scrim	tot.	content	weight		strength	modulus	strain	strength	modulus	
						(g/mq) ± 4 %			(% ± 3)	(g/mq)	(mm) ± 15%	(MPa)	(GPa)	(%)	(MPa)	(GPa)	(MPa)
						(UNI 5114-82)				(UNI 5114-82)	(UNI EN ISO 5084)	(ASTM D 3039-76)			(ASTM D 790-90)		(ASTM D 2344-84)
carbonio alto modulo / high modulus carbon fibre																	
HM		90	HS 20 T	REM	60	90	20	110	34	167	0,13	1050	190	0,6	2070	165	75
HM		100		EU 334	60	100		100	36	156	0,11	1250	205	0,6	1600	190	78
HM		100	EE24	EU 336	60	100	24	124	43	218	0,14	1150	200	0,6	1850	175	67
HM		115		EU 334	60	115		115	28	160	0,12	1350	235	0,6	1485	200	76
HM		115	EE24	EU 336	60	115	24	139	40	232	0,17	1160	205	0,6	1685	180	69
HM		115	EE39	EU 336	60	115	39	154	36	241	0,18	1100	195	0,6	2110	170	67
HM		150		EU 334	60	150		150	26	203	0,16	1200	240	0,6	1370	205	75
HM		150		ET 442	60	150		150	32	221	0,16	1900	225	0,6	1750	205	75
HM		150	EE48	EU 336	60	150	48	198	36	309	0,23	1190	210	0,6	1850	180	70
carbonio altissimo modulo / very high modulus carbon fibre																	
HM	55J	90	IM 20 T	REM	46	90	20	110	37	175	0,13	1650	260	0,7	1815	220	54
HM	55J	100		EU 334	46	100		100	26	135	0,12	2200	320	0,7	2160	290	60
HM	55J	100	IM 20 T	REM	46	100	20	120	22	154	0,11	1700	265	0,7	2020	225	50
HM	55J	115		EU 334	46	115		115	33	172	0,11	1900	302	0,7	2090	265	65
HM	64	125		EU 334	60	125		125	30	179	0,13	1380	320	0,3	2150	310	73
HM	80	145		EU 334	46	145		145	28	201	0,15	1500	470	0,3	1650	375	62
HM	64	150		EU 334	60	150		150	30	214	0,15	1460	385	0,4	2155	315	70
HM	55J	150		ET 442	46	150		150	37	238	0,16	2100	315	0,7	2310	270	68
HM	64	300		REM	60	300		300	36	469	0,32	1100	330	0,3	2130	310	70



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TEXIPREG®

TEXIPREG® Sistemi di resine per compositi
TEXIPREG® Resin systems for composites

RESINA	CICLO DI RETICOLAZIONE				Tg	durata		Caratteristiche	applicazioni	auto estinguenza
	pressione	temperatura	tempo	post-cura		a 23°C	a -18 °C			
RESIN	CURING CYCLE				Tg	shelf life		Main features	applications	self extinguish
	pressure	temperature	time	post-curing		at 23°C	at -18 °C			
	(bar)	(°C)			(°C)	(giorni)	(mesi)			
	(bar)	(°C)			(°C)	(days)	(months)			
ET222 epoxy	2 - 7	125	30'	no	130	7	12	polimerizza a bassa temperatura, buona finitura estetica	sistema bassa temperatura di uso generale	
		80	7 h	no	90			low curing temperature, good surface finish	general purpose low curing temperature systems	
		60	14 h	no	70					
ET 223 epoxy	vacuum - 7	125	40'	no	130	21	12	tenacizzata, polimerizza a media temperatura	automotivo, articoli sportivi, nautica, industriale	
		85	14 h	no	110			toughened, medium curing temperature	automotive, sporting goods,marine, industrial	
REM epoxy	2 - 7	125	60'	no	120	30	12	sistema di uso generale	per uso generale	
				no				general purpose system	wide range of application	
ER 432 epoxy	2 - 7	125	60'	no	110	30	12	resina tenacizzata	automotivo, articoli sportivi, nautica, industriale	
				no				toughened resin	automotive, sporting goods,marine, industrial	
ET 443 epoxy	2 - 7	125	60'	no	145	30	12	buona finitura superficiale	automotivo, sport, nautica	FMVSS 302
				no				good surface finish	automotive, sport, marine	FMVSS 302
EF 451 epoxy	2 - 7	150	120	no	160	30	12	resistente al fuoco	parti per interni settore automotive e aerospaziale	ABD0031 Issue A FAR 25.853
				no				fire resistant	interior parts for automotive and aerospace	ABD0031 Issue A FAR 25.853
EU 336 epoxy	2 - 7	125	60'	no	130	30	12	per UD in carbonio	articoli sportivi, industriale	
				no				for carbon UD	sporting goods, industrial	
EU 334 epoxy	2 - 7	125	60'	no	120	30	12	per UD in carbonio alto modulo (HM)	articoli sportivi, industriale	
				no				for carbon UD high modulus (HM)	sporting goods, industrial	
REF T epoxy	2 - 7	180	2h	no	180	21	12	alta Tg	applicazione automobilistiche, sport, medicale	
	2 - 7	150	8h	no richiesta required				high Tg system	automotive, sport, health devices	
ES 253 epoxy	7	60	6h	richiesta	190	5	12	alta Tg, buona finitura superficiale	sistema per stampi	
				required				high Tg, good surface finish	tooling system	
FF 562 phenolic	2 - 5	135	75'	no	190	30	12	autoestinguente	parti per interni settore automotive e aerospaziale	ABD0031 Issue A FAR 25.853
		150	60'	no				self-extinguish	interior parts for automotive and aerospace	ABD0031 Issue A FAR 25.853
EC551 epoxy-cyanate ester	1 - 3	140	1 h	richiesta	300	30	12	alta Tg	applicazione automobilistiche, sport, medicale	ABD0031 Issue A FAR 25.853
				required				high Tg system	automotive, sport, health devices	ABD0031 Issue A FAR 25.853
CE662 cyanate ester	1 - 3	125	2 h	richiesta	370	60	12	alta Tg	applicazione automobilistiche, sport, medicale, aerospaziale	ABD0031 Issue A FAR 25.853
		140	1 h	required				high Tg system	automotive, sport, health devices, aerospace	ABD0031 Issue A FAR 25.853



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TEXIPREG®

DIAB Sandwich

the ideal concept for marine applications



ROYAL DENSHIP, 125 CLASSIC

The Royal Denship 125 Classic motor yacht is inspired by true greatness, her lines, her spirit dates back to a period in the past century when the elegant and unique was truly appreciated. However, she is today built in modern composite materials to produce an exceptional yacht.

The DIAB sandwich concept is ideally suited to fulfil the requirements for such a vessel. The freedom of design and superior surface finish is easily achieved when building in a sandwich structure. Other benefits when using Divinycell H-grade as core material in the sandwich construction are excellent acoustical and thermal insulation, high strength and stiffness and low maintenance costs. Also the lowered weight of the hull structure will mean increased speed and range compared with a conventional metallic structure.

Loa:	38.1 m
Width:	7.8 m
Draft:	1.9 m
Range:	4000 miles
Speed:	14 knots

Face material:	Glass fibre/ Polyester
Core material:	Divinycell® H-grade in different densities
Core bonding adhesive:	Divilette SQ

Manufacturing process:	Wet lay-up, One-off on frame work
Manufacturer:	Royal Denship
Production supervision:	DIAB Technologies



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DIAB Sandwich

the ideal concept for marine applications



BÅTBYGGARNE AB, RACE BOAT B28

The B28 has proven very successful both in the race boat- and pleasure boat version. The B28 has won several championships in offshore racing.

The construction materials make the boat extremely light, stiff and strong. These features and the unique design, makes it possible to achieve the very good performances both in the rough and the flat water conditions these boats run in.

The designer, Ocke Mannerfelt, relies on the DIAB sandwich concept for all his boat designs.

Loa: 8.65 m
Width: 3.1 m
Weight: 1.3 - 1.6 ton
Speed: 93 knots

Face material: Multiaxial glass fibre / Vinylester
Core material: Divinycell® H 160, H 80, H 60

Manufacturing process: Wet lay-up with vacuum bagged core

Manufacturer: Båtbygarne AB

Design: Ocke Mannerfelt Design



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MATHIES VERFT AS, SKAW PILOT II

Skaw Pilot II is a Pilot boat built by Mathies Verft AS in Denmark. She is built throughout in a sandwich construction with DIAB core materials. The much lower weight of the sandwich structure means that the stability and seakeeping of the ship is much improved which is very important for this kind of pilot boat.

The sandwich with Divinycell H-grade core material will in addition to the low structural weight provide integrated functions like thermal and acoustical insulation, excellent surface finish and good operating economy.

Loa:	15.5 m
Beam:	4.95 m
Draught:	1.15 m
Displ:	17 ton
Main engines:	2 x 535 bhp
Speed:	23 knots
Core material:	Divinycell® H-grade
Sandwich weight:	8.9 ton
Manufacturer:	Mathies Verft AS, Aalborg, DK
Design:	Murray, Cormack (South), GB



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TENCARA, SPIRIT OF NORWAY

“Spirit of Norway” is one of the fastest and best handling UIM Class 1 offshore racing boats competing in this spectacular racing series. It won the world championship in 1998.

These offshore racing boats race both inshore and offshore. Handling at high speed in smooth and rough seas is a very important matter. To be able to do this, the construction must be very strong, stiff and as in all racing; very light.

Nearly all boats competing in offshore racing rely on sandwich technology and core materials from DIAB.

Loa: 13.4 m
Width: 3.57 m
Weight: 4.57 ton
Speed: 136+ knots

Face material: Carbon fibre / Epoxy
Core material: Divinycell® H 180, H 130

Manufacturing process: Vacuum bagged laminates and core (one-off on male mould)

Manufacturer: Tencara

Design: Michael Peters Yacht Design



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BRØDRENE Aa MARIN, M.Y. MOONRAKER

M.Y. Moonraker is an exceptional mega yacht built by Brdr. Aa in Norway. She provides all the comforts of a yacht while having the top speed of a racing boat.

Moonraker is built throughout in a sandwich construction with DIAB core materials to be able to obtain the exceptionally low weight necessary to reach the top speed specified. The sandwich with Divinycell H-grade core material provides integrated functions like thermal and acoustical insulation, excellent surface finish as well as a low structural weight.

Loa:	35 m
Beam:	7.1 m
Draught:	1.4 m
Displ:	88 ton
Main engines:	2 x 3480 bhp + 1 x gas turbine 4600 bhp
Speed:	66.7 knots

Core material:	Divinycell® H-grade
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Sandwich weight:	22.5 ton
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Manufacturer:	Brdr. Aa Marine AS, Norway
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Design:	Mulder Design NL
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UMOE MANDAL A/S, MISSILE TORPEDO BOAT / FAST PATROL BOAT

This unique design features stealth technology, very high speed in rough and smooth waters and the ability to withstand shocks from mine-explosions.

The vessel is based on SES technology, which lifts the entire boat out of the water so that the draft is only approx. 0.9 m, which reduces resistance, draft and structural response when exposed to mine-explosions.

Loa: 46.8 m
Width: 13.5 m
Weight: 350 ton
Speed: 55+ knots

Face material: Glass fibre / Vinylester
Core material: Divinycell® HD and H qualities

Manufacturing process: Wet lay-up one-off construction

Manufacturer: Umoe Mandal A/S



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MUNDAL BÅTBYGGERI, FISHING VESSEL MV "BLUEFIN"

MV "Bluefin" is one of several fishing boats built in DIAB sandwich materials. This boat benefits from exceptional low maintenance cost, large and open fish hold (less stiffeners etc), very good insulation due to the excellent thermal properties of the core materials, increased stability, very good hydrodynamics and fuel efficiency due to the design freedom of the sandwich one-off construction method.

Loa:	21.3 m
Lpp:	19.9 m
Beam:	7.5 m
Depth :	6.8 m (moulded sh.deck)
Fish hold:	150 m ³
Face material:	Glass fibre / Polyester resin
Core material:	Divinycell® H 100, H 80, H 60
Manufacturing process:	Wet lay-up one-off construction
Manufacturer:	Mundal båtbyggeri



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STOREBRO FAST PATROL BOAT 90E

The fast patrol boat 90E manufactured by Swede Ship Marine AB is a fast assault boat for use in the amphibious battalions of the Swedish Marines. It is mainly used as a command and control or medical platform.

By building the boat in a sandwich construction it was possible to keep the weight so low that it can use only half the propulsion system of its slightly larger sister boats which are manufactured in aluminium. The very harsh structural requirement on the boat from the ability to beach the craft was met by the use of the highly ductile HD-material in the bottom. The design is very successful with over 50 boats built until today.

Loa:	11.9 m
Lwl:	10.9 m
Width:	2.9 m
Weight:	9.5 ton (fully loaded)
Speed:	35+ knots

Face material:	Glass fibre / Vinylester
Core material:	Divinycell® HD 180 bottom and H 60 topside
Core bonding adhesive:	Divilette NQ G1

Manufacturing process:	Wet lay-up with vacuum bagged core
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Manufacturer:	Swede Ship Marine AB
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KARLSKRONAVARVET, VISBY CLASS CORVETTE

The surface combatant YS2000, or Visby class corvette, for the Swedish Navy is manufactured by the Karlskrona shipyard. It is an innovative new stealth design that takes a quantum leap in naval ship design. By building the boat in a sandwich construction with DIAB core materials it was possible to achieve a number of harsh requirements that the stealth concept demanded, non-magnetic, flat surfaces, thermal and acoustical insulation in addition to the inherent low weight.

The very harsh structural requirement on the boat from the ability to withstand underwater mine explosions was met by the use of the highly ductile HD-material in the bottom. The boat is also built using an innovative modular technique where prefabricated core panels up to 16*3 m are delivered directly to the yard from DIAB ready to be used in the infusion process.

The design is very successful with 6 boats ordered until today, there is also an option for another 6. The first, HMS Visby, was launched in June 2000 and one boat a year is expected to follow.

Loa:	73 m
Lwl:	61.5 m
Width:	10.4 m
Weight:	600 ton (approx.)
Speed:	35+ knots
Face material:	Carbon fibre / Vinylester
Core material:	Divinycell® throughout with HD-grade in the bottom and H-grade topside in different densities from 60 to 250 kg/m ³
Core bonding adhesive:	Divilette NQ G1 and Divilette NQ G1 HV
Manufacturing process:	Vacuum assisted infusion technique, modular built
Manufacturer:	Karlskronavarvet, Kockums AB



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HJØRUNGAVAAG VERKSTED AS, M.S. TORGHATTEN

M.S. Torghatten is a car ferry built and operated in Norway. She has a novel design with superstructure and bowgates in a sandwich construction with DIAB core materials. The much lower weight of the sandwich structure topside means that the stability of the ship is much improved which can be used for a higher paying load.

The sandwich with Divinycell H-grade core material will in addition to the low structural weight provide integrated functions like thermal and acoustical insulation, excellent surface finish and low maintenance costs.

Core material:	Divinycell® H-grade
Description of sections	Sandwich weight
Wheelhouse:	2310 kg
Deckshouse on boatdeck:	2340 kg
Boatdeck:	9420 kg
Platform deck:	2160 kg
Bowgates (2 pcs):	4280 kg
Total sandwich weight:	20510 kg
(Total steel/alu weight:	48600 kg)
Manufacturer:	Hjorungavaag Verksted AS, Norway
Design:	Lund, Mohr & Giaever - Enger AS



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NAVY SANDWICH APPLICATIONS IN HISTORICAL VIEW

MINESWEEPER M33 VIKSTEN, 1974



Displacement: 120 ton
Length: 25.3m
Width: 6.6 m
Depth: 2.5 m
Speed: 11 knots
Crew: 11

Face material: GRP
Core material: Divinycell® H-grade

MCMV LANDSORT, 1984



Displacement: 360 ton
Length: 48 m
Width: 9.5 m
Depth: 2.3 m
Speed: 15 knots
Crew: 30

Face material: GRP
Core material: Divinycell® H-grade

Manufactured: 7 Swedish Navy
4 Singapore Navy

MCMV 36 STYRSÖ, 1995



Displacement: 205 ton
Length: 36 m
Width: 8.0 m
Depth: 2.0 m
Speed: 14 knots
Crew: 18

Face material: GRP
Core material: Divinycell® H-grade

Manufactured: 4



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STANDARDFLEX, (SF 300) FLYVEFISKEN, 1985



Displacement: 300 ton
Length: 54 m
Width: 9 m
Depth: 2.5 m
Speed: 30 knots
Crew: 29

Face material: GRP
Core material: Divinycell® H-grade

Manufactured: 14

MINEHUNTER OKSÖY, 1994



Displacement: 375 ton
Length: 55 m
Width: 13.5 m
Depth: 2 m
Speed: 25 knots
Crew: 37

Face material: GRP
Core material: Divinycell® H-grade

Manufactured: 4

MINESWEEPER ALTA, 1996



Displacement: 375 ton
Length: 55 m
Width: 13.5 m
Depth: 2.0 m
Speed: 25 knots
Crew: 37

Face material: GRP
Core material: Divinycell® H-grade

Manufactured: 5



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TEST VESSEL HMS SMYGE



Displacement: 140 ton
Length: 30 m
Width: 11.4 m
Depth: 1.9 m
Speed: 40 knots
Crew: 14
Facematerial: Carbon
Corematerial: Divinycell® H-grade
Manufactured: 1

CORVETTE VISBY, 2000



Displacement: 620 ton
Length: 72 m
Width: 10.4 m
Depth: 2.5 m
Speed: 35 knots
Face material: Carbon
Core material: Divinycell® H + HD grade
Manufactured: 1 (+5)



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DIAB SANDWICH

the ideal concept for marine applications



SWEDE SHIP MARINE AB, SSM SEISMIC VESSEL

This vessel is a catamaran especially designed for operation in shallow waters and is operational until 0.6 m depth of water, all systems can be run with the hull of the boat drained.

The ship is especially focused on being able to trail heavy streamer cables and gun-arrays when surveying gas and oil fields and analysing geological conditions and soil structures. The ship is also used as a work platform at static measurements, maintenance and transportation of equipment.

The entire hull construction including sprouts, tanks, deck, superstructure, interior, air duct and tube systems is built in DIAB sandwich construction providing high strength and stiffness, low weight and a minimum of maintenance. The work deck is designed as a plane work platform of 140 m² which enables positioning of heavy equipment according to the demands without consideration to underneath stiffening and sprouts, max load per m², 3000 kgs. The ship is built in accordance with "Det Norske Veritas", light craft rules, A1.

Length:	20.3 m
Width:	7.2 m
Max displacement without cargo:	70 ton
Depth :	0.5 m
Total sandwich weight:	9900 kg
Face material:	Glass fibre / Polyester
Core material:	Divinycell® H-grade in different densities
Core bonding adhesive:	Divilette SQ
Manufacturing process:	Wet lay-up with vacuum bagged core
Manufacturer:	Swede Ship Marine AB



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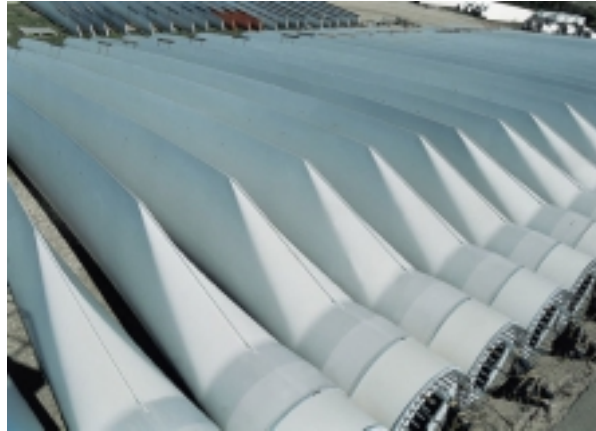
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Products In Action

DIAB Sandwich

the ideal concept for wind power applications



LM GLASFIBER A/S, ROTOR BLADES

LM Glasfiber A/S is one of the leading blade manufacturers in the world and produces rotor blades ranging in length from 13.4 up to 38.8 metres. The rotor blades are often a combination of sandwich and single skin construction.

One such an example is the 23-meter blades of the Micon 600/48 which are manufactured in female moulds using a common hand lay-up technique. Sandwich technology enables weight reductions while maintaining sufficient stiffness of the blade structure. The chosen material together with the manufacturing method results in products of good quality a high surface finish. The core material is delivered to LM Glasfiber A/S in kits; components which are custom made to fit perfectly into the moulds.

Laminates:	Glass fibre / Polyester
Core material:	Divinycell® H60, H100 delivered in kits
Manufacturing method:	Hand lay-up in female mould
Manufacturer:	LM Glasfiber A/S
Design:	LM Glasfiber A/S



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VESTAS V52 850 kW

Vestas is one of the leading rotor blade producers in the world, their rotor blades are part sandwich and part single skin constructions. Sandwich technology is used to optimise stiffness and strength with regards to weight.

The Vestas rotor blades are produced using a rather sophisticated method with epoxy/glass fibre prepregs together with Divinycell HPS 80 material in a female mould. The laminates are cured at elevated temperature and pressure. The use of a prepreg system guaranties high and even quality laminates, and together with a Divinycell core material a light, strong and stiff wing construction is achieved.

DIAB developed a new core quality to be used together with epoxy prepregs, the Divinycell HPS grade maintain its high mechanical properties and has high dimensional stability at elevated temperatures. The high modulus of the Divinycell HPS grade helps to prevent local buckling failure of the laminates.

Core material:	Divinycell® HPS 80, delivered in kits
Laminates:	Multiaxial glass/epoxy
Manufacturing method:	Prepregs in female mould under elevated temperature and pressure
Manufacturer:	Vestas
Design:	Vestas



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MICON 600/48 CABIN HOUSE

Micon is one of the leading windturbine manufacturers on the global market. Micon relies on sub-suppliers to produce the various components in a windmill such as the rotor blades and cabin house. The Micon 600/48 is an example of medium size Micon wind turbine with a nominal effect of 600 kW and a rotor diameter of 48 meter. The tower height varies from 46-70 meter.

The cabin house of the Micon 600/48 is a sandwich construction and is produced by several different sub suppliers. The cabin is manufactured with traditional hand lay-up of laminates and core material in a female mould. By using sandwich technology, a construction with high strength to weight ratio is achieved. Apart from minimising maintenance work, sandwich further enables a freedom of design which is not always possible with conventional materials.

Laminates:	Glass fibre / Polyester
Core material:	Divynycell® H45, H60 delivered in kits
Manufacturing method:	Hand lay-up in female mould
Manufacturer:	Bach, SI plast and Technofibre
Design:	NEG Micon
Structural analysis:	DIAB Technologies



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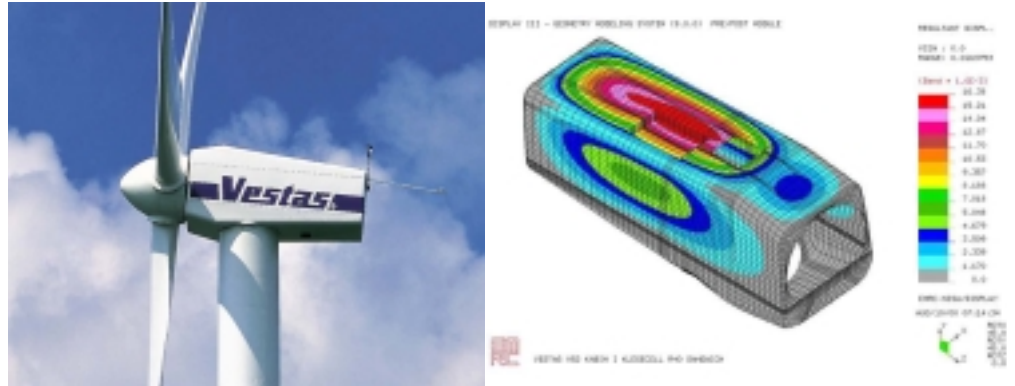
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DIAB Sandwich

the ideal concept for wind power applications



VESTAS V52 WIND TURBINE CABIN HOUSE

Vestas is one of the leaders in wind turbine technology producing windmills with capacity ranging from 600 kW up to 2.0 MW. One such an example is the Vestas V52-850 kW which was developed as an all-round type of turbine, able to operate in remote and demanding areas. The cabin house of the V52-850 kW is a pure sandwich construction where all the benefits of sandwich technology such as sound insulation, freedom of design, good surface finish and high strength to weight ratio are put together to generate a state of the art wind turbine cabin house.

The V52 cabin house is typically mounted on the tower 44 to 65 meters above ground and thus, exposed to high wind pressures. The purpose of the cabin house is to provide cover for the turbine, which is mounted directly onto the tower. The cabin also acts as a service platform for maintenance work. The V52 cabin is manufactured using a resin infusion method where the Klegecell core is provided with a groove pattern which helps to distribute the resin throughout the structure.

Cabin House

Core material:

Klegecell® R40, delivered in kits

Laminates:

Woven Roving, Chopped Strand Mat and
Unifilo / Polyester

Manufacturing Method:

Resin infusion in female mould

Manufacturer:

Jupiter Plast A/S

Design:

Jupiter Plast A/S

Structural Analysis:

DIAB Technologies



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DIAB Sandwich

the ideal concept for transport applications



ADTRANZ, REGIO-SHUTTLE

The Regio-Shuttle manufactured by Adtranz is an innovative solution for regional transport. It is an intelligent solution where the low-floor concept in combination with the sandwich design of covering panels creates a spacious and comfortable interior. The front, sides and roof of the train is all made in a sandwich construction with DIAB core materials that provide integrated functions like thermal and acoustical insulation as well as an excellent surface finish.

The front is made with a Divinycell H80 core material to live up to the very tough impact requirements. The roof is on the other hand made in Klegecell SR 65 to be able to cope with up to 90 °C surface temperature.

Length:	25.5 m
Width:	2.9 m
Height:	3.7 m
Passengers:	up to 334
Speed:	120 km/h

Front section

Face material:	Glass fibre / Fibre retarded polyester
Core material:	Divinycell® H 80, thermoformed and delivered in kits
Manufacturing process:	VARIM (Vacuum Assisted Resin Infusion Moulding)
Manufacturer:	LM Glasfiber A/S

Covering panels

Face material:	Glass fibre / Fire retarded polyester
Core material:	Klegecell® SR 65, delivered in kits
Manufacturing process:	VARTM (Vacuum Assisted Resin Transfer Moulding)
Manufacturer:	Jupiter Plast A/S

Structural design:	DIAB Technologies
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DIAB Sandwich

the ideal concept for transport applications



GARDERMOBANEN & SIGNATURE

Modern high-speed trains must be built with light-weight materials to use as little energy as possible. This is very important for these types of train that accelerate and decelerate frequently.

The fronts of these trains must be light, aerodynamical and be able to resist very high impact loads from animals that occasionally are hit by the trains at high speed.

More than 50 fronts have been built for the Gardemobanen and the Signature type trains.

Loa:	4.0 m
Width:	3.0 m
Height:	3.0 m
Weight:	0.7 tons (composite part)
Face material:	Glass fibre / Phenolic resin
Core material:	ProBalsa
Manufacturing process:	Vacuum assisted resin infusion
Manufacturer:	Adtranz/ABB/Brdr. Aa



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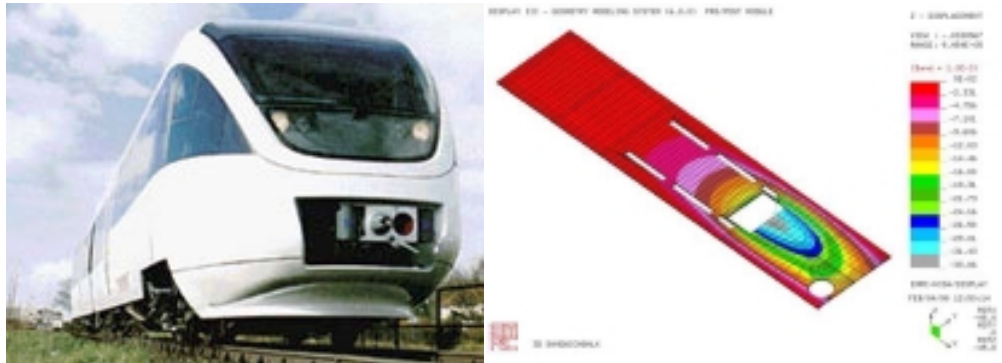
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the ideal concept for transport applications



BOMBARDIER TALENT

The Talent family of multiple units is a new generation of diesel and electrical train sets. Designed specifically to meet the passengers' needs, all trains include large low-floor sections and low-floor entries.

The streamlined exterior and interior design of the Talent marked a turning point in the quality of regional and suburban rail services in Germany. Developed for optimum life-cycle costs, the lightweight steel/composite construction offers operating companies considerable economic advantages. At present, more than half a dozen varieties of the Talent are available, more than 179 train sets have already been ordered by various state-owned and privately-owned railways.

It is an intelligent solution where the low-floor concept in combination with the sandwich design of covering panels creates a spacious and comfortable interior. The front, sides and roof of the train is all made in a sandwich construction that provide integrated functions like thermal and acoustical insulation as well as an excellent surface finish.

The roof is made with a Divynycell H60 core material in an innovative environmentally friendly closed manufacturing process. The result is a self-supporting roof section optimised for both low weight and excellent surface finish.

Length:	48.3 m
Width:	2.9 m
Height:	3.7 m
Passengers:	up to 283
Speed:	120 km/h
Roof section	
Face material:	Glass fibre / Fibre retarded polyester
Core material:	Divynycell® H 60 delivered in kits
Manufacturing process:	VARIM (Vacuum Assisted Resin Infusion Moulding)
Manufacturer:	LM Glasfiber A/S
Structural design:	DIAB Technologies



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ADTRANZ, GTW 2/6

The GTW 2/6 manufactured by a consortium led by Adtranz is an innovative solution for regional transport. It is an intelligent solution with modular sections that can be adapted to suit customer demands.

The front is a structural part made in a sandwich construction with DIAB core materials that provide integrated functions like thermal and acoustical insulation as well as an excellent surface finish. To be able to withstand the high structural requirements on the front, Divinycell H-grade core material was chosen. Divinycell H-grade has the mechanical properties that can live up to both the very tough impact requirements and long term statical loads.

Length:	38.0 m
Width:	3.0 m
Height:	4.3 m
Passengers:	up to 234
Speed:	120 km/h

Front section

Face material:	Glass fibre / Fibre retarded polyester
Core material:	Divinycell® H 80, H 100 and H 160

Manufacturing process: Wet lay-up

Manufacturer: FVK Dessau

Structural design: DIAB Technologies



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ADTRANZ, VT 612 REGIO-SWINGER

The Regio-swinger manufactured by Adtranz is a tilting train for regional transport at high speed. The tilting technology cut journey times while improving passenger comfort.

The front of the train is made in a sandwich construction with DIAB core materials which provide integrated functions like thermal and acoustical insulation as well as an excellent surface finish.

The front is manufactured with epoxy/glass fibre skins on each side of a Divinycell HD 100 core material. This produces a lightweight yet extremely tough sandwich which lives up to the very tough impact requirements on the front cab. The Divinycell HD 100 core material has excellent impact properties with a high strain at break while retaining a high shear modulus making it an ideal core material for front cabs.

Train configuration:	Two-car unit
Passengers:	146
Speed:	160 km/h
Front section	
Face material:	Glass fibre / Epoxy pre-preg
Core material:	Divinycell® HD 100, thermoformed
Manufacturing process:	Pre-preg
Manufacturer:	Comtas GmbH



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OMNINOVA BUS

A new bus concept built by Nova Composites in Bengtsfors, Sweden, in cooperation with TWR.

The bus is built in two versions, the Multirider and the Maxirider. It is made as a multipurpose vehicle for both passengers and goods transport. The interior is readily altered due to a very low flat floor and the integrated rails on which the seats run.

The floor is fabricated from Divinycell H60 using a resin infusion process with closed moulds. The sandwich floor and composite chassis result in a very light bus, which is very fuel efficient and therefore reduces environmental impact.

Face material:	Glass fibre / Polyester
Core material:	Divinycell® H 60
Manufacturing process:	Infusion (Shell mould system)
Manufacturer:	Lear Corporation



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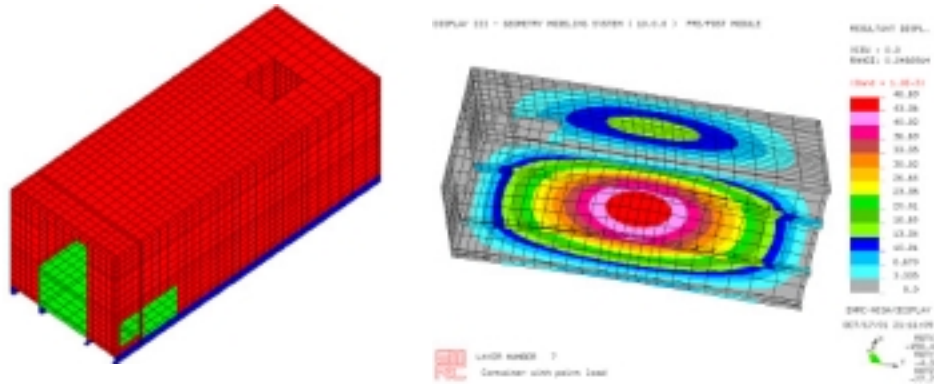
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20 FEET MILITARY CONTAINER

This is a multi-purpose unit. The unit is designed for easily transportations both on trucks and in airplanes. There are also high requirements on sound and thermal insulation. The container is built on a standard “roller bed frame” (roll on roll off container). On that frame an upper steel frame is added. This frame is designed to stand the global loads on the container for example the load from several similar containers piled on the container.

Walls, roof and floor are built of self-carrying sandwich panels. The sandwich panels are designed to transfer local loads to the steel frame. During the design of the container FE tools have been used to evaluate the structural response for a heavily loaded container under acceleration loads and to predict the interaction between the steel frame and the sandwich panels.

The sandwich panels are manufactured using a resin infusion method where the Divinycell core is provided with a groove pattern that distributes the resin throughout the structure.

Length:	6.0 m
Height:	2.3 m
Width:	2.4 m
Face material:	GRP / Plywood
Core material:	Divinycell H 60, 40 mm
Manufacturing process:	Resin infusion
Manufacturer:	A-L Mekanik AB
Structural Design:	DIAB Technologies



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13 m³ FIRE-FIGHTING VEHICLE TANK

The water tanks for fire-fighting vehicles have earlier been produced in single skin design. In order to save weight and achieve a stiffer construction the structure is now replaced with a sandwich design. An additional benefit using sandwich design is the insulation properties that increase the exposure time during winter conditions when temperatures are below 0°C. During the design of the tank, calculations for the panels were used to evaluate the structural response during operation and for extreme retardations such as during a crash. Considerations to inserts, joints, lead-throughs and fasteners to the truck frame were taken during the design work.

All panels were made in sandwich construction except for the inner bulkheads which were made of single skin laminates.

The manufacturing company was also aided in starting up their manufacturing unit utilizing an infusion technology.

The sandwich panels were manufactured using a resin infusion method where the Divinycell core is provided with an optimized groove pattern that distributes the resin throughout the structure.

Length: 6.4 m
Height: 2.1 m
Width: 2.5 m
Volume: 13 m³

Face material: GRP, CSM and 0/90 Biaxial combination
Core material: Divinycell H 60

Manufacturing process: Resin infusion
Manufacturer: FOSIEPLAST AB, Malmö, Sweden

Structural design and manufacturing techniques: DIAB Technologies



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Infusion was done on one quarter of the tank at a time. The picture is taken when a half-hour remains until it is filled. 400 kgs of vinylester was used during the infusion.

NORWEGIAN MARINE, COMPOST TANK

At Norwegian Marine, Eikefjord, Norway a cylindrical tank has been manufactured with infusion technology in co-operation with DIAB Technologies. Some of the benefits gained by this technology are a rapid decrease in emissions, a clean and nice working environment and a good glass content in the laminates.

The tank shall compost material in an accelerated way. The acceleration of this "compostation" is achieved through good isolation and a constant rotation of the tank. The tank is only supported on two wheels, which will rotate the tank. To get both a high stiffness and a good isolation at the same time a sandwich with a Divinycell core was a perfect solution.

DIAB Technologies supported Norwegian Marine with manufacturing technique, design and material specifications.

Length:	18 m
Diameter:	3 m
Face material:	Glass fibre/ Vinylester
Core material:	Divinycell® H80, H100
Manufacturing process:	Infusion
Manufacturer:	Norwegian Marine
Structural Design:	DIAB Technologies



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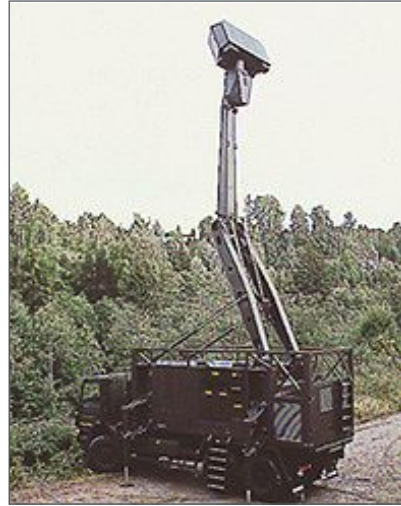
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GIRAFFE, AIR-WARNING RADAR UNIT

For many years, Divinycell has been used in the production of military shelters. DIAB Sverige AB is at the moment sandwich panel supplier for two different types of communication units, for which the Swedish electronics giant, Ericsson is involved. Manufacturer of the units is Botnia Production AB in Örnsköldsvik, Sweden.

One of the applications is the "Giraffe" (pictured above), a mobile air warning radar unit which features a total of 35 very complex panels per shelter. The core thicknesses vary from 10 -104 mm with both high and low densities being used.

There is also a smaller version of the "Giraffe" called "Arthur" for Artillery Hunting Radar. For this application, DIAB technologies were also involved in the strength calculations.

Another shelter series currently in production is the 2611. This is an electronically shielded multi-purpose unit, which is designed to blend into the surrounding environment. For the 2611 shelter, DIAB has produced sandwich panels with both GRP and aluminium skins. To date, over 100 shelters have been produced.

Face material:	GRP/ Aluminum
Core material:	Divinycell® ranges from H45 to H160
Manufacturing process:	Vacuum bonding
Manufacturer:	Botnia Production AB
Structural design:	DIAB Technologies



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DECOR SET, GOTHENBURG OPERA HOUSE

Free Span	19.0 m
Height:	9.8 m
Depth:	5.0 m
Surface area	150 m ²
Assemble/disassemble time:	< 30 min
Total weight:	950 kg

DIAB has been involved in the production of a sandwich vault construction that is a part of the décor set for the musical "Les Misérables" played at the Gothenburg Opera House. The vault construction that spans the whole width of the stage consists of two ellipse-shaped beams carrying 13 frame elements. The frame elements are covered with a cloth to give the construction the appearance of a brick vault. One of the design criteria was that the complete décor set had to be disassembled after each performance. In order to be able to handle a décor component of such large dimensions as those of the vault, low weight is of uttermost importance. Thus, FE-analysis of both beam and frame elements were used to optimise the construction. Both beam and frame elements are made utilising sandwich technology with Divinycell core materials to obtain the lowest possible weight.

Beams

Core:	Divinycell® H45, delivered in kits
Face:	Uniaxial Carbon, Biaxial Glas / Epoxy
Manufacturing method:	Hand lay-up

Frame elements

Core:	Divinycell® H45
Skins:	GRP Pecolit
Manufacturing method:	Vacuum assisted bonding, components delivered ready to assemble

Director:

Vernon Mound

Set Designer:

Tim Hatley

Design:

Ingmar Carlsson, Gothenburg Opera House

Manufacturer:

West Coast Composite

Structural Design:

DIAB Technologies



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LNG STORAGE TANK INSULATION - PYONGTAEK TERMINAL, KOREA

The LNG (Liquefied Natural Gas) receiving terminal owned and operated by Korea Gas has ten 100.000 kl storage tanks, all with bottom and wall insulation consisting of Klegecell and Divinycell foam according to the Technigaz Membrane System.

The insulation system is made up of 180 mm foam insulation with plywood adhered to both sides. Since the panels are used for both bottom and wall insulation as a load bearing component the foam must accommodate for all the mechanical stresses from the liquid and the thermal stresses from the temperature difference.

Insulation material: Divinycell® Grade 1 and Grade 2

Tank design: SN Technigaz



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