

Always at the core of your solution



LIFTING YOUR SUBSEA SOLUTION



High-performance buoyancy foams and sandwich
core solutions for subsea and offshore applications

ALWAYS AT THE CORE OF YOUR SOLUTION

Diab was founded in Sweden in 1950. Ever since the beginning, and throughout our steady development into a global company, we have been dedicated to constant innovation and promoting a widespread adoption of structural core materials.

Our products and solutions have been used in applications for marine, industry, subsea, aerospace and wind energy for decades, and are qualified according to relevant industry standards. With a complete range of high-performance core materials, numerous finishing options and kit operations in combination with engineering services and expertise, we present presumably the widest and most valuable offering in the sandwich composite industry.

BEST SOLUTION FOR EVERY SUBSEA CHALLENGE

The waters of our oceans are demanding, setting high standards on the materials used in a wide range of applications, from sea level to seabed. Security and functionality are crucial to avoiding unwanted, costly disruptions and operational interruptions. We know that strength, buoyancy, and insulation, with high quality and long service life, are essential product features for any application.

Diab's product range and know-how in this area enable us to provide total material and application solutions to our customers worldwide. We offer Divinycell HCP and Divinycell H for low to medium depths, and syntactic foam when going below 700 meters. Our materials are used in applications like ROVs, submarines, AUVs, subsea buoyancy units, diving bells, and impact protection structures.

All our materials provide high performance concerning strength, buoyancy, and insulation. The low density with high uplift capacity, combined with impact resistance and shaping possibilities, makes our solutions a cost-efficient choice for buoyancy units and sandwich structures.

SUSTAINABILITY IS IN OUR CORE

Today, sustainability is not an option. It is mandatory. And at Diab, we work hard to make a difference on the significant issues that matter to us all. We are firmly committed to making your solution more sustainable in every way. Therefore, we are on an ambitious journey towards net zero emissions. With our structural core materials, you can boost energy efficiency, reduce emissions, conserve natural resources, and create a longer life cycle for your product.

We have also made sustainability one of our top business priorities. For instance, we are the world's first composite materials company to set science-based targets approved by the SBTi (Science-Based Targets initiative), which have been renewed for a new five-year period. That means we have a documented plan for reducing the carbon footprint in line with what is defined in the Paris Agreement to keep the planet below 1.5 degrees overheating.

In addition, we have been awarded a gold medal by EcoVadis, one of the world's foremost sustainability rating standards. This prestigious recognition places us among the top 5% of companies evaluated globally by EcoVadis, highlighting our comprehensive commitment to sustainability across environmental, social, and governance dimensions.



FOSSIL-FREE PVC

As proof of our commitment, we have started to use fossil-free plastics in the core foam. Our manufacturing site in Laholm, Sweden, has obtained ISCC PLUS certification, which means we can offer mass balanced PVC in our Advanced kits.

By purchasing mass balanced material, you acquire a sustainability declaration from the supplier stating the amount of mass balanced feedstock produced in their processing unit to represent the amount in every specific supply you receive.

The ISCC PLUS certification guarantees full traceability throughout the mass balanced material supply chain to the finished kit at our processing unit, including a sustainability declaration upon delivery.

THE COST-EFFICIENT CHOICE FOR BUOYANCY UNITS AND SANDWICH STRUCTURES

Diab's high-performance buoyancy foam and core materials are utilized across a wide range of applications, supporting both traditional sectors, such as defense and oil and gas, as well as emerging areas, including offshore renewables. Still, composite materials are expanding into other subsea applications, where high-quality buoyancy, strength and long lifetime are essential.

THE IDEAL MATERIAL FOR SUBSEA

Our closed-cell PVC foams are lightweight yet incredibly strong, offering a high buoyancy-to-weight ratio, excellent impact resistance, and long-term durability. These qualities make them ideal for use in flotation units of remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs and UUVs), submarines, diving bells, and energy devices such as tidal and wave power systems. Designed to perform in conditions ranging from the surface to 700 meters of depth, they offer high, consistent uplift and exceptional chemical resistance.

Also, lower depth buoyancy, such as floatation units or moorings, benefits from our low-density foam. The light weight does not compromise the toughness

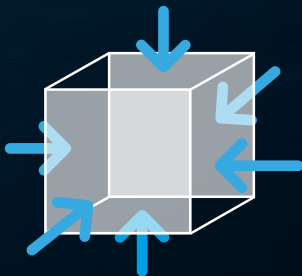
of the product. PVC foam cores are chemical resistant, can handle high impact and offer long-term creep resistance, improved thermal/acoustic insulation and excellent transmittance. In addition, they are easy to machine, making shaping easier and more efficient.

Understanding buoyancy requirements

Pressure is applied from all directions in a subsea environment. A closed cellular foam will not absorb water to a relevant degree, any buoyancy loss is the result of the hydrostatic creep acting over time resulting in a small volumetric loss. Buoyancy loss in syntactic foam that exceeds its depth rating occurs due to water ingress through micro cracks in the matrix material.

What impacts buoyancy?

- Specific density & volume
- Exposure time
- Water density
- Safety factors chosen
- Service depth
- Water temperature
- Cycling or static use
- Surface treatment

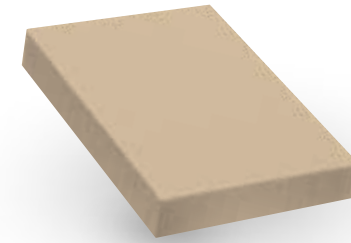


SELECTING THE RIGHT MATERIAL

When selecting a suitable buoyancy foam, you must consider several factors to achieve the best result. These include what purpose your application has, how deep it must be able to descend, for how long it will be underwater, the level of safety required and, of course, the cost of the material.

Composite excel at crafting complex shapes, enhancing hydrodynamics and stealth capabilities while adapting to round surfaces effortlessly. They allow for part consolidation, reducing manufacturing costs and time by avoiding riveting or joining smaller components. Moreover, being non corrosive they contribute to minimum maintenance cost, making them a favourable choice over traditional metals in subsea construction.

Our technical experts will guide you in choosing the most suitable buoyancy foam.



DIVINYCELL HCP

Divinycell HCP is developed to meet the demands for high performance in subsea applications. It's a low-density cross-linked PVC foam with closed cells, providing high strength and buoyancy performance due to its unique material formulation. 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. The low density with high uplift capacity makes it an ideal and cost-efficient choice in subsea applications.

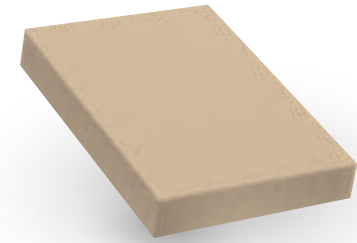
Moreover, due to its material composition, HCP can be easily machined into almost any shape, enabling designers a high level of design freedom. HCP has an excellent track record and has been used in subsea applications for over 50 years as buoyancy or high-performance FRP Sandwich core.

Each block is pressure tested and qualified for HCP rating, and each delivery is accompanied by a batch and test certificate.

With its excellent hydraulic compressive strength and high buoyancy to weight properties, it is used widely, for example, in ROVs, larger and smaller submarines, AUVs, flotation units, diving bells and marine impact-protection structures at depths down to 700 meters. Diab provides Divinycell HCP in blocks or ready-shaped parts.

SUPPLY CAPABILITIES

The full range of Diab's materials can be delivered with various grades of customization. All materials can be provided in standard blocks. Our CNC machining capacity enables parts build to print production like full ROV buoyancy units. We can also provide ready-painted parts.



DIVINYCELL H

Divinycell H is an all-purpose grade with an excellent strength-to-weight ratio. It's widely used in multiple on shore industries and in lower depth environment. It has a proven track record in virtually every application area where sandwich composites or lower depth buoyancy are used.

Its excellent strength-to-weight ratio enables solutions with very low environmental impact, and it is compatible with almost all commonly used resin and manufacturing systems.

Divinycell H is a closed-cell PVC foam with low resin and water absorption that provides a wide range of mechanical performance, enabling optimised structural designs.

Diab provides Divinycell H in blocks or ready-shaped parts. Typically used in renewable energy solutions such as wave and tidal power generation.



Ready-shaped parts

TESTING CAPABILITIES

Comprehensive testing is the only way to ensure product reliability and long-term performance. To ensure performance, all materials are readily tested according to certified standard procedures. Every Divinycell HCP block is individually pressure tested, and a certificate follows each delivery.

DIAB ENGINEERING SERVICES MAKE THE MOST OF YOUR APPLICATION

Diab Engineering Services is our powerful team of engineers, product specialists and process specialists, ready to team up with you to realise the total value of composites and buoyancy applications. We are here to support you with selecting the suitable material for your application and essential guidance on different manufacturing processes.

Composite Consulting Group (CCG) provides specialised composite technology and engineering services to improve your product further.

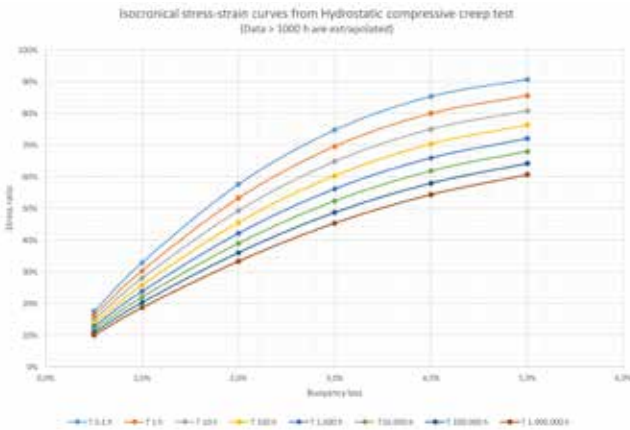
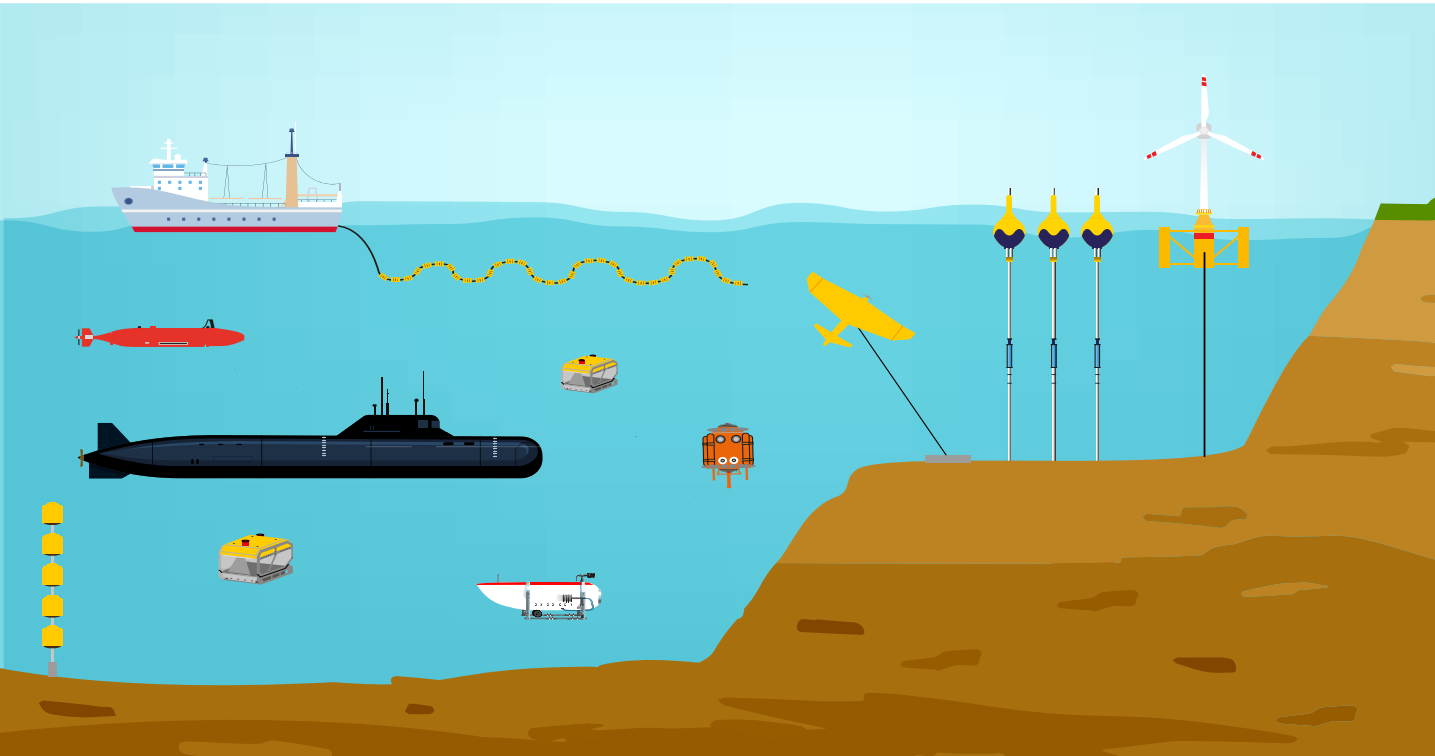


DEEP SEA SOLUTIONS

For depths below 700 meters all the way down to seabed we can provide built to print buoyancy solutions in Syntactic Foam. This through Subsea Composite Solutions, a part of Diab. Find out more at www.scsolutions.no.

Our product range and know-how enable us to provide total material and application solutions to our customers worldwide. Diab's Divinycell HCP can be used in applications like ROVs, submarines, AUVs, subsea buoyancy units,

diving bells, and impact protection structures. Divinycell H is an all-purpose grade with an excellent strength-to-weight ratio. It's widely used in renewable energy solution applications or buoyancy units for lower depth.



The diagram shows the buoyancy loss at different loading scenarios and time of operation. With our extensive testing data and long experience we will evaluate each specific case of use for selecting the right buoyancy grade.

Material	Density kg/m³	Buoyancy kg/m³	Typical service depth (meters)													
			30	40	55	70	100	150	230	300	380	450	540	630	730	830
H60	60	965														
H80	80	945														
H100	100	925														
H130	130	895														
HCP30	200	825														
HCP50	250	775														
HCP70	310	715														
HCP90	380	645														
HCP100	410	615														

Typical values and service depth for each PVC buoyancy foams, not to be considered as specification. Every application and operating condition is unique. Material selection and calculation should be performed per individual condition.

PROOF OF OUR EXPERIENCES

We are privileged to have participated in partnership with some of the world’s leading companies in the marine industry. Here we list a small selection of our subsea customer cases, you can always find many more on our website. Defence applications and similar are generally confidential, talk to us about our experiences in these areas.

DWTEK FLAGSHIP ROV “THE INVESTIGATOR”

DWTEK is Taiwan’s first marine inspection equipment manufacturer and supplier. To develop their flagship ROV, “the Investigator”, they needed technical expertise, support, and suitable materials. Diab supplied both knowledge and Divinycell HCP buoyancy units for the construction. The vessel has outstanding payload capacity and works according to all requirements.

THE HDW CLASS 214 SUBMARINE BY THYSSENKRUPP MARINE SYSTEMS

ThyssenKrupp Marine Systems has, from the proven design of previous submarines in the family, developed the HDW Class 214 submarine. The new sub is well-equipped to perform various missions, ranging from operations in coastal waters to ocean-going patrols. This submarine is a cost-effective weapon system thanks to its modular design and high degree of automation. It is tough to detect and, thus, the unbeatable solution for future-orientated navies.

SAAB DOUBLE EAGLE ROV

The Double Eagle ROV family is well-proven and used by global navies. Diab’s well-proven PVC foam Divinycell HCP provides buoyancy to the MKII and MKIII ROVs with a 500-meter depth rating. Each foam block is tested for hydrostatic pressure to ensure safe and reliable MCM operations. Divinycell HCP family is capable of designs down to 700 meters. The buoyancy foam is supplied in machined and ready-painted modules to be installed on the vehicle.

ARGUS ROV FOR SUBSEA MISSIONS

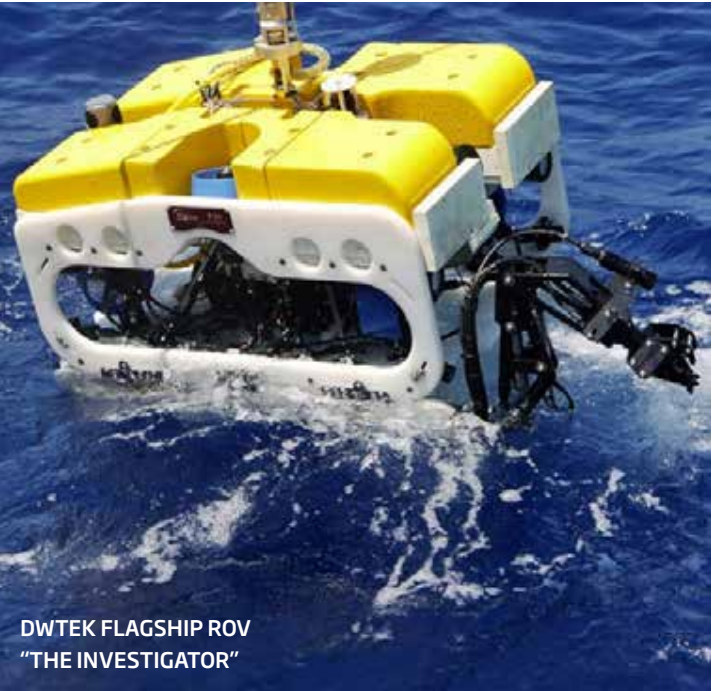
Argus designs and manufactures its range of ROVs for subsea missions like surveys, repairs, maintenance, laying cables and pollution control. Divinycell HCP offers high buoyancy uplift per weight under long-term loading conditions, to ensure a sustained operation.

MINESTO TIDAL STREAM & OCEAN CURRENT ENERGY

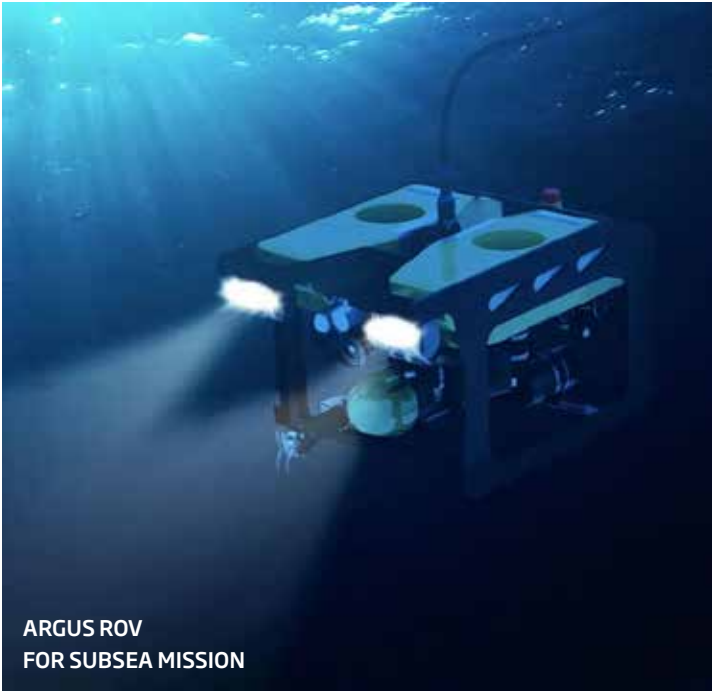
Minesto’s Deep Green technology generates electricity from low-flow predictable tidal streams and ocean currents by a unique and patented principle similar to a stunt kite flying in the wind. The wing uses the hydrodynamic lift force the underwater current creates to move the kite. A light and strong FRP structure with a CNC-kitted Divinycell foam core withstands the forces generated when the kite circulates underwater at high speed.

CORPOWER OCEAN WAVE ENERGY CONVERTER

CorPower Ocean and Diab has constructed its first commercial-scale Wave Energy Converter (WEC). Using sustainable materials is particularly important in this application, as the WEC will be exposed to significant fatigue, slamming, and impact loads. The hull’s sandwich structure involves Diab’s unique Divinycell H-grade material, providing many benefits, including high strength, durability, impact resistance, and lightweight and buoyancy performance. Diab provided structural engineering support to ensure the correct selection of core materials and laminates.



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THE HDW CLASS 214 SUBMARINE BY
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MINESTO TIDAL STREAM
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DOUBLE EAGLE ROV



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